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Development of a new standardised braille reading test

Author: *Graeme Douglas*
Rory Cobb

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Preface

This report was prepared using funding provided by the Department for Education under grant agreement with NatSIP, the National Sensory Impairment Partnership:

Contact:
Lindsey Jane Rousseau, NatSIP Facilitator
T: 07711 030711
E: lindsey.rousseau@natsip.org.uk
W: www.natsip.org.uk

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1. Summary

This report sets out a rationale and proposal for the development of a new standardised reading test to accurately assess children's braille reading ability. The proposal is to develop a braille version of the York Assessment of Reading for Comprehension (YARC). This builds upon research carried out in the 1990s by a team from the University of Birmingham who developed the braille version of the Neale Analysis of Reading Ability (NARA) (Greaney et al, 1998).

The proposed research will involve the assessment of 200 children and young people who read braille. This will give educators a valuable understanding of braille literacy development and teaching. Output of the proposed research will be a 'YARC braille assessment handbook'. The supplementary handbook (to be used in conjunction with the YARC) will contain norm tables allowing teachers to assess the reading age of children who read braille, and better understand and support their literacy development.

2. Introduction and context

This project was funded by the DfE through NatSIP and the RNIB. The projected aimed to produce a costed plan for developing a new standardised reading test to accurately assess children's braille literacy for comparison against print and braille reading norms, based on the York Assessment of Reading for Comprehension (YARC) published by GL Assessment. Specifically, the proposal focuses upon the YARC Passage Reading Test.

Before developing details of how this could be done, it is important to answer the questions:

- Why do we need a new standardised reading test to accurately assess children's braille literacy?
- What currently exists?
- Why should this development be based upon the YARC?

2.1 Why do we need a new standardised reading test?

Reading assessment serves several functions. It is useful for checking a child's learning progress, as well as the relative success of teaching interventions. It is useful for the identification, diagnosis and understanding of reading difficulties. Importantly, it can help educators design educational interventions in response to a given child's reading ability. This can be important at every stage of a child's educational career – for example, requests for formal examination accommodations (e.g. extra time allocation) may need evidence about reading speed.

This is also true of children who are blind and read braille. There are, however, particular benefits and challenges of developing an assessment of braille reading. Firstly, it is well established that there are differences in the processes of reading thorough print and through braille (e.g. Wormsley and D'Andrea, 1997). These differences include the nature of the modality of reading (which means that reading through touch is slower than sight reading and follows a more linear process) and the nature of the braille code (which means there are particular aspects of the code that must be taught, and particular errors that occur with particular consequences, e.g. cell reversal errors). Therefore, it is important to have a test that allows teachers to compare a blind child's reading performance not only with print readers but also with other braille readers of the same age.

Secondly, the majority of children who read braille are based in mainstream schools and in very many cases they are the only child who reads braille in that particular school. Therefore, helping teachers to interpret reading performance becomes much harder because they have no or few braille peers with whom to compare results. For this reason, there are real benefits for a teacher if they can draw upon information about the expected reading performance of this disparate population

2.2 What currently exists?

Significant work has been previously carried out in developing standardised braille reading tests. The most important and relevant work is the development of the braille version of the Neale Analysis of Reading Ability (NARA) (Greaney et al, 1998). This work offered an assessment of (contracted) braille reading ability standardised on the UK and Ireland population. While that work is now dated (discussed below), the work offers:

1. a rationale for the choice and design of the assessment itself, and
2. a methodological approach to how this work can be done.

In terms of the assessment choice, the NARA describes itself as a comprehensive assessment of reading ability aimed for use with children aged 6 to 12 years. The test is designed to assess oral reading ability in terms of reading rate, accuracy and comprehension, as well as to be a diagnostic assessment tool. The test was developed in the 1950s and there have been progressive editions and re-standardisations up until the late 1990s. It has been widely used in education and research in English-speaking countries and is still available for purchase.

The NARA was designed to assess the reading of fully sighted children between the ages of six and twelve. It consists of six passages of increasing difficulty. The child reads each passage aloud in turn and the test administrator notes reading errors, responses to standard comprehension questions and time taken. The test is complete when the child has either read all six passages, or finds it too difficult to continue (determined by the number of reading errors made). There are two parallel versions of the test (known as forms one and two) which permit the same child to be re-tested without recognising the previous test and thereby invalidating the score. The child's scores are converted into reading ages for accuracy, comprehension and speed.

A key reason Greaney et al (1998) and previous researchers chose to develop a version of the NARA was primarily that NARA offers three reading scores, while other reading tests do not. Of particular note is the measurement of reading speed: given braille reading has generally been accepted to be slower than print-based reading it was recognised that reading speed was an important feature of a braille reading test.

However, the NARA is currently outdated in a number of ways. Firstly, the original print version has not been revised since 1997 and there appears to be no plan to do so in the future. This means that the standardised scores for sighted pupils are now quite old. In addition, the language and content contained within the test reading materials are now dated, affecting its relevance. For example, one of the test passages is about a circus lion tamer; this seemed reasonably familiar 20 years ago, but now in 2016 is probably alien to most children in the UK. Secondly, Greaney et al's 1998 braille version was based upon contracted (grade 2) English braille. Since then there have been developments in the braille code such as the use of capitalisation and the introduction of Unified English Braille (UEB). Nor does it encompass changes in braille teaching practices such as the increasing move towards the use of uncontracted (grade 1) braille in the early stages of braille learning.

In terms of the methodological approach, Greaney et al (1998) offer a detailed account of their approach to testing a sample of 317 children and young people who read braille, and the analysis approach they adopted to produce the standardised scores. This is very significant work to draw upon because it offers details of testing procedures, which are specific to braille including categorisation of braille reading errors. The lessons learnt from this work are extremely valuable and are drawn upon in more detail in the proposal that follows.

2.3 Why should this development be based upon the YARC?

The York Assessment of Reading for Comprehension (YARC) was first published by GL Assessment in 2009, and the second edition was published in 2011 (although the assessment material remained the same). The 2011 manual described how the assessment became established quickly and 'has been extensively used by teachers, learning support practitioners and academic researchers to assess children with typical developing skills and with a range of reading difficulties' (Snowling et al, 2011, pv.).

The YARC and the NARA are both published by GL Assessment. The YARC manual does not explicitly draw parallels between the YARC and NARA but core elements of both tests are extremely similar. Indeed, the NARA was used to establish concurrent validity during the development of the YARC (p99 of the YARC manual). Examples of key similarities between the NARA and 'Passage Reading' part of the YARC include:

- Two parallel sets of materials (Passages A and B).
- Three components to the test: decoding (reading accuracy), reading rate and reading comprehension.
- Similar test structure and test scoring approaches.
- Identical classification of the reading errors: mispronunciations, substitutions, refusals, additions, omissions and reversals.
- Similar target age ranges (YARC: 5-11:11 years, with norm ranges from 4:06 to 12:04; NARA 6-12 years, with norm ranges from 6:11 to 12:10)

There appear to be very few significant differences between the NARA and the YARC, and those that do exist are positive improvements:

- The YARC standardisation data (based upon a sample of 1,324 pupils from across the UK) was collected relatively recently.
- The YARC passages are recently designed and contemporary in content.
- The YARC passages do not have associated pictures. The NARA included pictures which pupils were asked to look at before they read each passage. For the braille version of the test a short description was read out by the assessor as an alternative. This modification to test procedure would not be required for the YARC.
- The test was developed by a highly regarded team then at the University of York, led by Professor Margaret Snowling.

3. Proposed approach

3.1 Introduction

The approach adopted by Greaney et al (1998) to develop a braille version of the NARA is relevant to this proposal and summarised here. A similar method was also adopted in some later work by the same research group in relation to children with low vision who were print readers (Douglas et al, 2002; Hill et al, 2005).

Greaney et al (1998) included 317 students aged 5–18 years in their study. This included 182 boys and 135 girls, and they were based in 46 schools and colleges throughout the UK and the Republic of Ireland. Based upon estimates at that time, the research team worked with approximately 40% of the school-aged population of braille readers. Importantly, there are now fewer specialist schools for visually impaired pupils compared the mid-1990s when the previous work was carried out. As a result the population of braille readers is likely to be more dispersed across mainstream schools.

The following are keys aspects of their data collection approach:

- The NARA includes two forms, each including six passages of increasing difficulty (so a total of 12 passages). Each form also includes a practice passage. All passages were transcribed into Standard English Grade 2 (contracted) braille in a standard way.
- All assessors were researchers with qualifications in braille.
- Pilot trials included 10 visually impaired students who did not participate in the main study.
- All assessments were audio-recorded and a sample was subjected to inter-observer agreement analysis.
- The procedure described in the NARA print manual was followed – a relevant exception to this was that the time limit for recognising an individual word was extended from four to ten seconds (the YARC specifies five seconds).
- Each participant was assessed with both forms of the NARA. The order of presentation of the forms was counterbalanced across the students. Assessment always started with the practice passage, and then passage 1.
- Importantly, Greaney et al also developed a categorisation of reading errors/mis-cues similar to those offered by the NARA (and YARC) but defined in relation to braille: mispronunciations, substitutions, refusals, additions, omissions, and ‘braille errors’.
- As well as reading performance in the NARA, the following data was gathered: age at time of testing; school type; age at starting braille (allowing ‘time learning braille’ to the calculated); eye condition; visual acuity; hand and fingers used in reading; dominant hand left / right; other disabilities; sex.

The following are key aspects of their data analysis approach:

- In line with the aims of the assessment, data analysis primarily sought to describe the relationship between reading performance (accuracy, rate and comprehension) and children’s age.
- Regression analyses were used to find this relationship – specifically, how age predicted each of the dependent variables (accuracy, rate and comprehension). More detail of this technique is provided below under ‘Data analysis’.

Using the Greaney et al (1998) study procedure as the model, the following sections outline a proposed method for work with the YARC.

3.2 Materials

Like the NARA, the YARC includes two forms of the assessment (Form A and Form B). Each form includes seven passages of increasing difficulty ('beginner level', and then level 1 to level 6). So in total there are 14 passages. All passages would be transcribed into Universal English Braille (UEB) (contracted or 'grade 2' braille). An additional discussion about the use of contracted and uncontracted braille is presented later as a potential 'add-on' piece of research/analysis.

Over time and following sustained reading, traditional braille produced on paper can become flattened and more difficult to read. For a discussion about the impact of braille dot height see an article by Douglas et al (2009). Greaney et al (1998) were aware of this issue of braille quality and for the purpose of standardisation produced their braille on 'braillon thermoform' material (p27), which is a more robust plastic material (although it can have the disadvantage of the reading fingers sticking when they are damp or sweaty). No doubt the researchers also checked the quality of the braille before each assessment and replaced it if required. We would follow the same procedure here for all YARC passages.

3.3 Assessment procedure

A similar procedure to that offered by Greaney et al (1998) for the NARA will be followed. As with the previous research, the work with the YARC will benefit from pilot work to finalise the procedure and materials. Key points of note regarding the procedure are as follows:

- All assessments will be digitally audio-recorded and a sample subjected to inter-observer agreement analysis.
- The procedure described in the YARC print manual will be followed – the time limit for recognising an individual word will be extended to 10 seconds (the YARC specifies five seconds).
- Each participant will be assessed with both forms of the YARC (A and B). The order of presentation of the forms will be counterbalanced across the students. Assessment will always start with the 'beginner level', then passage 1, and so on.
- As well as reading performance in the YARC, other data would be gathered: age at time of testing; school type; age at starting braille (allowing 'time learning braille' to be calculated); eye condition; visual acuity; hand and fingers used in reading; dominant hand left / right; other disabilities; sex.

Nevertheless, there are two differences of presentation between the NARA and YARC which need further thought. These are:

1. the use of pictures in the NARA
2 the format of the 'beginner level' in the YARC:

An advantage of the YARC compared with the NARA is that it does not include pictures to accompany the passages. Therefore, there is no need to offer an alternative description of the pictures for braille readers as is the case for the NARA.

The 'beginner level' in the YARC has a slightly different format to the other passages in the assessment. The activity involves a six-line story in which there is turn-taking between assessor and pupil (i.e. the assessor reads one line, and then the pupil reads the next line, and so on). The print version of the YARC uses visual cues to indicate which parts the pupil should read (font size and a

star), and the manual provides some guidance for the teacher (e.g. “I would like you to read the sentences which start with a star”, p13). Although this will need some thought when designing the materials and finalising the procedure, we anticipate no difficulties.

A more significant difference between the NARA and YARC is that the latter recommends the use of the ‘Single Word Reading Test’ (SWRT) as a method of selecting the starting passage for the assessment that follows. The print NARA follows a different approach of selecting the starting passage (partly linked to performance in a practice passage) and the braille version of the NARA recommends all the passages are read in all assessments irrespective of pupil age or reading ability. As noted, for the braille version of the YARC we propose following this same procedure of using all passages for the purposes of the standardisation (and assessment administration more generally). In part, this means that the SWRT no longer serves a purpose for the braille version of this assessment. Nevertheless, we recommend that a braille version of the SWRT be administered for all the participants in the research because this short assessment may offer additional insight. For example, it will be helpful to know how and if SWRT correlates with the eventual braille reading performance on the passages. The words in the SWRT also serve as useful illustrations of the difference between contracted (grade 2) and uncontracted (grade 1) braille, which is discussed in a separate section below.

3.4 Population and sample

A recent survey carried out by RNIB provides useful insight into approximate numbers of braille users in England and Wales that are known to visual impairment teaching services (see Keil, 2016). The analysis gives an estimate of about 1,000 children and young people from birth to 25 years “who use (or in the case of EYFS [early years and foundation stage] children, are expected to use) braille as their sole or main literacy medium.” Of greater relevance to this research, the estimated figure for children and young people aged between 5 and 16 years is closer to 900. Given the relative sizes of Scotland, Northern Ireland and the Republic of Ireland, we would expect approximately a further 180 in these countries leading to a total of 1,080 braille users aged between 5 and 16 years in the UK and the Republic of Ireland.

The RNIB survey also gives a vital insight to where the young people are educated. Over three-quarters are described as being on the visual impairment teaching services caseload, and this gives a strong indication that they will be attending local schools rather than provision beyond the local authority (including specialist schools).

The RNIB analysis is extremely useful in the planning of this research for several overlapping reasons:

1. The population estimate is similar to that of 20 years ago when Greaney et al (1998) did their research providing further evidence that the need for braille assessment remains.
2. The educational placement of the children and young people who use braille is helpful for the planning of data collection for the purposes of assessment standardisation. Most likely, high proportions of the pupils will be based in mainstream schools and commonly the only braille user in a given school. Clusters of braille users in specialist schools and resource bases do exist but these are in the minority.
3. Through consultation with the report author (Sue Keil), the analysis will give an indication of the distribution of the population in relation to placement (in England and Wales at least), and this can be used as a point of reference when establishing a representative sample.
4. In terms of efficient recruitment of a sample, through consultation and collaboration with the report author (Sue Keil), the research team may be able to better target communication about

recruitment towards local authorities. This communication could be personalised to the responses the local authorities offered in the 2015 survey.

Greaney et al (1998) recruited a sample of 317 children and young people aged 5-18 years. Their recruitment and assessment strategy took place over approximately three years and most of the testing was carried out by three researchers (the three authors). Based upon the experience of that research (and later research linked to the NARA, print reading and low vision, see Douglas et al, 2002; Hill et al, 2005) it is proposed that more targeted quota-sampling would prove more efficient while maintaining statistical power. The aim would be to test the reading of approximately 200 to 220 braille users, relatively evenly distributed across the Year 1 (age 5) to Year 11 (age 16) age bands (or equivalent bands in the UK nations and the Republic of Ireland). This would give approximately 20 children and young people in each year group.

As with Greaney et al (1998) we would test children and young people beyond the age range of the original print test. The YARC is designed for pupils aged between 5 and 11 years. Nevertheless, research consistently shows that 'the reading scores obtained by braille readers are in general lower than the reading scores obtained by their sighted peers' (Greaney et al, 1998, p44). Greaney et al found this to be true for all three reading ability measures (accuracy, speed and comprehension), although the lag was particularly pronounced for reading speed. For this reason the YARC has utility for a greater age range of braille readers. It is also worth noting that the test will be useful up to the age of 16 when national examinations commonly take place because clear understanding of reading speed is helpful when applying for assessment accommodations.

3.5 Data collection

Each of the participants would be assessed following the assessment procedure outlined above. The proposed design for managing and staffing this data collection is based upon two strategies:

1. Traditional researcher-led assessment

   This follows a similar approach adopted in our previous work (Greaney et al, 1998; Douglas et al, 2002). Following the process of recruitment outlined in the previous section, services and schools would be asked to identify children and young people of the appropriate age who are braille users. Permission and consent would be sought from schools and parents in advance. A member of the project team trained and familiar with the assessment procedure would visit the relevant school and carry out the assessment. In previous research of this kind, teachers and parents have been very positive about being involved in this way because they benefit from what is learnt through the assessment process and outcome. We anticipate that this approach would be adopted in early parts of the project. The participants for assessment would be chosen based upon relative ease of travel as well as working in specialist schools and resource bases where a number of braille users were located. In parallel with this work, training materials would be developed which could be used for strategy (2).

2. Developing and harnessing a community of practitioner researchers

   In our work on print reading we included data collected by approximately 10 practitioners (all were trained teachers, but at the time all were training to be specialist teachers of visually impaired children). Each practitioner was trained in the assessment procedure, and each assessed approximately 10 children. Therefore, this strategy extended the reach of the research considerably. We propose following a similar strategy, although because of the dispersed nature of the braille reading population this will require a greater network of practitioners.

3.6 Data Analysis

We intend to follow the same approach of using regression analysis adopted in previous studies:

- In line with the aims of the assessment, data analysis primarily seeks to describe the relationship between braille reading performance as measured on the YARC (accuracy, rate and comprehension) and children's age.
- Regression analyses will be used to find this relationship – specifically, how age predicts each of the dependent variables (accuracy, rate and comprehension).
- More precisely, several reader characteristics (including age, time learning braille, additional disabilities) will also be included as predictors in step-wise multiple regression analyses for each of the dependent variables (accuracy, rate and comprehension). This method of modelling maximises the amount of variance explained in the analysis, and therefore maximises the confidence in the reading test providing meaningful reading ages.
- From the 'lines of best fit' produced by these regression analyses we will be able to create the 'raw score to reading age conversion tables' and include confidence intervals.

3.7 Contracted and uncontracted braille

Braille is a system for representing print that was invented by Louis Braille in 1829. The braille cell consists of raised dots arranged in a three by two matrix. Therefore, there are six potential dots in a braille character, and each has an associated number for reference. For example, dot 1 only (a) is the letter 'a'; dot 1 and 3 (b) is the letter 'b'.

Figure: The 'braille cell' and associated dot number

1 • • 4

2 • • 5

3 • • 6

In October 2011, the UKAAF (UK Association for Accessible Formats) decided to adopt Unified English Braille (UEB) as the official braille code in the United Kingdom. It did not differ greatly from the previous Standard English braille, but it meant that the UK was standardised with many other English speaking countries. UEB comprises the letters of the alphabet, punctuation, numbers and a large number of contractions and short form words.

The contractions include many common letter clusters (e.g. 'sh', 'ou', 'ing') and common words as short forms (e.g. 'and', 'with', 'this'). The use of contractions is complex because the meaning of a given braille character (and how it can be used) is context- and rule-dependent. In fact, the UEB Rules of Unified English Braille (2013) summarises the many contractions under nine headings (pp9-10).

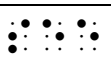
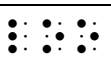
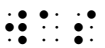
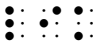
Nevertheless, when and how contractions are introduced during the teaching of braille is a point of some debate. In our previous review (McCall et al, 2011), one of the aims was to answer the question 'Should we start by teaching un-contracted or contracted braille?' We summarised the problem both in pedagogical and practical terms as follows:

> A current debate in literacy instruction for children who are blind revolves around whether reading and writing in braille is best introduced through uncontracted braille or contracted braille. Since the 1970s contracted braille has been commonly used in the UK as the medium of instruction for young braille readers. However, as increasing numbers of young children who use braille as their main medium for literacy receive their education in mainstream settings, their literacy skills are developed within the context of a national framework for the introduction of literacy with a predominant focus on the teaching of reading through print. It is argued by some teachers that the 'letter-for-letter' correspondence with print that uncontracted braille offers, allows greater opportunities for literacy learning alongside sighted children. Another argument is based around the fact that in mainstream settings, literacy instruction in braille is often delivered by a range of non-specialist professionals (e.g. mainstream class teachers or teaching assistants) who may have little or no experience of supporting a braille reader (Keil and Clunies-Ross, 2002). As such, it is argued that uncontracted braille allows for greater participation of non-specialists in the teaching process. (p25)

The review concluded that 'proof one way or another is elusive' (p32), but we did note that 'in the early stages of learning to read and write braille, both contracted and uncontracted approaches have much commonality' (p32).

While our review offered practical advice and reassurance regarding a range of approaches to teaching braille literacy, the open and pragmatic position we adopted is problematic when designing a reading test: i.e. the test needs to be contracted braille *or* uncontracted braille. The first eight words from the YARC 'Single Word Reading Test' (SWRT) offers a useful illustration of uncontracted and contracted braille, and the challenge it poses in terms of assessment design (see Table below).

Table: Print words with equivalent uncontracted and contracted braille (UEB). Contractions are in bold for illustration

Word	Uncontracted	Contracted	Comment
see			No contraction
look			No contraction
play			No contraction
was			Whole word contraction
like			Whole word contraction
this			Whole word contraction
next			No contraction
house			'ou' contraction
going			'ing' contraction
bell			No contraction

Clearly, the skill and knowledge of the assessor is crucial in interpreting and navigating the assessment. Knowledge is needed in relation to the braille code and the teaching of braille literacy, but also contextual knowledge of how a given child has been taught is vital. However, there is no satisfactory or simple solution to the dilemma of how to design the assessment given there appears to be inconsistent teaching practice in the UK.

In terms of this planned research, the most likely approach would be follow the methodology offered by Greaney et al (1998) who based their work on contracted braille. Nevertheless, this issue requires further planning and it may be that some additional work exploring the use of uncontracted braille with some of the earlier passages will be helpful. In part, this will depend upon the teaching approaches adopted across the population and this is not entirely clear at this time. The research will also give an opportunity to gather data in relation to this question.

4. Project output

The key output from the project will be a supplementary 'YARC braille assessment handbook'. This will provide instructions and procedures, score tables and a detailed explanation of the research and methodology. We also anticipate that the handbook will provide some detailed description of how the assessment tool should be used as part of an approach to teaching literacy through braille. This would draw upon Greaney et al's work and include some recommendations about interpretation of scores and diagnosis of reading difficulties (including error analysis). Importantly, we see that the braille manual is a supplement to the full 'YARC Test Manual.' Discussions about this project will be required with the publisher of the YARC (GL Assessment), but we anticipate that the braille manual would be a free, online download available for people who had purchased the full YARC assessment (indeed, the supplementary manual would have no use as an assessment tool without the full YARC print manual).

The material sold by the RNIB as part of the braille version of the NARA includes hardcopy braille produced on braille paper (in the form of a booklet). Importantly, unlike the previous Greaney et al research, this research does not propose the production of an assessment pack that contains hardcopy braille reading materials. Instead, online downloadable resources are recommended. This relies upon users of the assessment producing their own braille reading materials of appropriate quality, and maintaining and replacing that material as required. Instructions will be provided in relation to this, but the user would need to have access to braille transcription equipment (or a braille transcription service).

5. Project timeline and project partners

For the purposes of this briefing paper we do not offer details of the 'when' and 'who' of the proposed project. Nevertheless, we do present some summary points:

5.1 Timeline

We anticipate the project could be carried out over a period of two years. The aspect of the project that would take most of the time would be the data collection (i.e. the assessment of reading). The work would most likely fall into four overlapping strands of work:

1. Planning
2 Data collection – Researcher-led assessment
3. Data collection – Practitioner-led assessment
4. Analysis and report writing

5.2 Project partners.

We anticipate that the work would be led by a team at the University of Birmingham. However, we would plan to work with other academic research partners who would give us access to contacts and specialist teachers across the UK and Ireland. Additionally, contacts in the RNIB would be very important for the identification of braille users and schools. The work would also benefit from close working with practitioner partners who would be crucial in gaining access to participants and disseminating the work. This would include: VIEW (Vision Impairment: Education and Wellbeing) which is the professional membership association for Qualified Teachers of Children and Young People with Vision Impairment, local authority specialist teacher services (and the associated head of service network), and specialist schools and resource bases.

Finally, the project could benefit countries beyond the UK and Ireland, and therefore links with overseas partners may be useful. The introduction of UEB (Unified English Braille) has meant that the braille codes across many other English speaking countries are now standardised. This means that materials developed in the UK and Ireland have potential use in, for example, Australia, Canada, New Zealand and the USA.

6. Next steps

The project proposal will be discussed with GL Assessment with the intention of approaching funding bodies to finance the project. Key contacts for taking this work forward are Graeme Douglas (University of Birmingham) and Rory Cobb (RNIB).

Graeme Douglas,
Visual Impairment Centre for Teaching and Research (VICTAR),
Disability, Inclusion and Special Needs (DISN)
School of Education
University of Birmingham
g.g.a.douglas@bham.ac.uk

Rory Cobb
Principal Officer for Inclusive Education
Royal National Institute of Blind People (RNIB)
58-72 John Bright Street
Birmingham
Rory.Cobb@rnib.org.uk

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