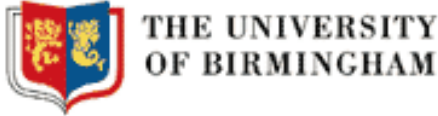


## DfES SEN Small Grants Programme TO45

**Project partners:  
University of Birmingham  
Royal National Institute of the Blind  
Linden Lodge School**



### **Case study – An investigation into the potential of embossed ‘dotted’ Moon as production method for children using Moon as a route to literacy**

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### **Executive Summary**

Dotted Moon is a useful and important resource to compliment the range of options available to those teaching and learning Moon. Observation of a variety of Moon readers (including those at early stages of literacy as well as more advanced readers) showed:

- All participants were able to decode dotted Moon characters, and engage in educational activities using dotted Moon at their developmental level.
- No conclusive evidence was found of any of the participants finding the dotted Moon harder (or easier) to decode than lined Moon.

While professionals involved in the teaching of Moon expressed some concern about the potential of dotted Moon, in particular about the quality of some of the characters, there was little evidence to support this from observations made of Moon readers.

The technical system used in the project combines an Enabling Technology braille embosser and Duxbury braille translation software. This set up could be improved further if it incorporated a Moon font to enable users to more easily edit Moon documents. Other technical systems allow the control of spacing and size of the embossed characters and these are also worthy of further investigation.

## **Overview of the project**

The project had four main strands: (a) a survey of professionals involved in the teaching Moon; (b) the collection of case studies of students using Moon (as well as their educational context); (c) the development of educational resources; and (d) the dissemination of the findings.

## **What is dotted Moon?**

Moon is a tactile code based on a simplified raised line version of the Roman print alphabet. It was invented in 1847 by Dr William Moon, and was widely promoted in Britain, Australia and the United States until it gradually lost ground to Braille. Moon had survived in the United Kingdom as a reading medium for those elderly blind who are unable to master Braille. Through work initiated at the University of Birmingham, in the early 1990s people began to explore the use of Moon with blind children who had traditionally found it difficult to use Braille – often including those who had learning difficulties or limited tactual sensitivity. There are a number of ways to produce traditional ‘lined’ Moon, although all of them have drawbacks.

*Dotted* Moon is produced using a braille embosser which creates Moon characters through various configurations of a five-by-five matrix of closely aligned dots. The characters are approximately equivalent to point 28 in size. The embosser is able to print on paper or plastic sheets (with or without adhesive backing). A picture of the dotted Moon alphabet is presented below.

**Figure. Photograph of the dotted Moon alphabet embossed on black plastic**

## **Survey of professionals teaching Moon**

Approximately 100 questionnaires have been sent out to those involved in teaching Moon. The questionnaire requested information on the following key areas - (1) reaction to (or experience with) dotted Moon, (2) resources needed to support teaching (not reported in this summary report), (3) types of equipment available for the production and distribution of dotted Moon. 25 ‘quality responses’ (ie providing useful data) were gathered.

### ***Respondents:***

The respondents were largely made up of classroom (11) and advisory (6) teachers. Others included teaching assistants with a particular interest in Moon (4). Most of the respondents supported children reading Moon (88%), two respondents supported adults. In the majority of cases this was either a single pupil or two pupils (64%), and over half had not worked with Moon prior to this current work.

64% of respondents were not familiar with dotted Moon prior to receiving the questionnaire, and only one respondent currently used dotted Moon in their teaching. Amongst them, the respondents had experience using a variety of lined Moon products in a variety of ways (eg: Moon story books, labels, Moon Velcro tiles, computer fonts and swell paper production, and computer touch tablets).

**Reaction to Moon - Durability of Dotted Moon:**

There was some concern about the durability of paper dotted Moon - 40% feeling it was not robust enough for their work, most of whom thought it was less robust than swell paper Moon (a common method of producing lined Moon). The majority (80%) felt plastic dotted Moon was robust enough for their work.

**Reaction to Moon - Readability of Dotted Moon:**

There was mixed opinion about how easy (plastic) dotted Moon was to read (the general ease of recognising and distinguishing between letters) – approximately half felt it was easier or the same in terms of readability as swell paper or lined plastic Moon. Of those concerned about dotted Moon, 6 (24%) thought it was *too hard*, or were unsure. Interestingly, 64% thought plastic dotted Moon was easier to read than paper dotted Moon (no respondents thought paper dotted Moon was easier than plastic). This may be related to concerns about the robustness (and possibly rigidity) of paper dotted Moon.

In terms of size of the characters, 9 (36%) thought the sample characters were too small for their students, and 14 (56%) thought it was about the right size for their students.

Respondents were asked to indicate which characters in the Moon alphabet were acceptable or unacceptable (or unsure). The table below summarises the results in similar letter groups.

**Table. Frequencies of professionals (N=25) identifying the dotted Moon characters as acceptable or unsure.**

Letter Group	Unacceptable	Unsure
A K V X	A – 3 K – 6 V – 2 X – 7	A – 6 K – 9 V – 1 X – 8
B F G J	None	B – 1 F – 1 G – 1 J – 1
C D U W	U – 1	U – 1
E L M Y	None	None

HO	H – 4 O – 1	H – 1
ITSR	None	None
PQ	None	P – 2 Q – 1
NZ	Z – 1	N – 2 Z – 3

Key areas of concern seemed to centre around particular letter groups - AKVX group in particular, HO group, and to a lesser extent the NZ group.

### ***Reaction to Moon – Transferability of dotted Moon***

A key issue for those teaching Moon readers is whether students are able to transfer across different media. To some extent teachers already grapple with this issue within lined Moon because there are a number of production methods (e.g. plastic tiles, thermoform, swell paper, and stamped paper). In terms of dotted Moon, there was uncertainty expressed by respondents – about one-third predicted that some students would transfer easily; similarly, one-third predicted that some would transfer with difficulty. Only three respondents predicted that some students would not be able to transfer.

### ***Available equipment***

In terms of dotted Moon production, and the potential of distributing dotted Moon electronically it is important to note that only 50% of respondents reported having a braille embosser available. Not surprisingly, those who did have a braille embosser available generally did not know whether it was capable of embossing dotted Moon. The data gathered regarding the brand of embosser also indicates that most would not be able to produce the dotted Moon under investigation in this project (using an Enabling Technology embosser). Nevertheless, some alternative Index embossers are able to produce a similar dotted Moon. This is discussed later.

### **Case study evidence**

#### ***Case studies approach to evaluation:***

Only a relatively small number of children currently read Moon in the UK (estimated as 100 at the project outset), and they are a very diverse group with a range of needs. Since the application of Moon as a route to literacy for children began in the early / mid 1990s, there has never been a rigorous evaluation of Moon resources other than by teacher acceptance. For all these reasons it was thought a case study approach which could be sensitive to the different needs, abilities, and contexts of the participants was important. Twelve participants were involved – all are engaged in education, seven

attending a special school (secondary school age), two attending a specialist FE college (17 and 18 years old), and three attending adult education courses.

Methods adopted were informal interviews with staff and students (where possible), observation of reading taking place, and the collection of video data evidence. The collection of video evidence has always been of difficulty in relation to tactual reading because the hand obscures the reading process being undertaken. In an attempt to better record this process the research team embossed samples of dotted Moon onto clear plastic film, placed this on a glass table top, and mounted a video camera (with appropriate lighting) under the table. This arrangement enabled video footage of children finger movements during reading activities. The picture below is taken from such an activity.

**Figure: Photograph of dotted Moon embossed on clear plastic taken from beneath. A right hand can be seen on the letter D. The Moon alphabet appears as a mirror image because of the camera position.**

### ***Overview of evidence by different types of Moon reader***

While it is difficult to categorise such a varied group, the following three broad groupings or 'routes' to Moon reading may be useful:

- Route 1 – Students who are functioning significantly below age related expectation in terms of academic attainment, and working within level one of the national curriculum. Moon is the only formal literacy code which has been adopted. Many of these individuals may also be experiencing other communication systems, e.g. objects of reference.
- Route 2 – Students who have had previous experience of braille but have failed to make significant progress and decisions have been made to use Moon. Therefore, they have some limited experience of literacy before starting Moon.
- Route 3 – Students who did read print before losing their sight (sometimes having tried and struggled with braille).

All of these routes to literacy were represented within the twelve students who participated in this the project. General findings are as follows:

- It was found that all participants were able to decode dotted Moon characters, and engage in educational activities using dotted Moon at their developmental level.
- No conclusive evidence was found of any of the participants finding the dotted Moon harder (or easier) than lined Moon.

Most notably, the concerns expressed by professionals in the survey appear not to be borne out when observing participant's reading.

**Example of participants from each reading route**

The following pictures (taken from video sequences) provide examples of the same student from each of the three reading routes *successfully* engaging with dotted Moon. In each case we have chosen example of pupils reading the letters which were highlighted by professionals as a characters of major concern in the survey (above). Also, pictures of parallel reading of lined Moon are presented (when available) to demonstrate relatively easy transfer between the two media.

**Type 1**

**Reading dotted Moon letters, including A and H (pictured underneath)**

**Reading lined Moon letters presented on Velcro tiles (including letters A and H)**

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**Type 2**

**Reading dotted Moon letters, words CAT and HAT (pictured underneath)**

**Reading dotted Moon letters, words CAT and HAT (pictured above)**

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### Type 3

Reading dotted Moon letters  
(pictured underneath)

Reading lined Moon letters  
(pictured underneath)

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### ***Analysis of reading performance***

In some cases the research team was able to collect (limited) reading performance data in terms of reading speed, comprehension and accuracy. In the case of all three there was no evidence to suggest that one media (dotted or lined Moon) was associated with better reading performance. The methods adopted did allow very precise analysis of reading accuracy, specifically reading errors associated with reading of Moon characters. The following categorise of reading error (on a character level) are initially proposed, although further analysis is required:

- 1. Perceptual errors – these are associated with the Moon code, and the process of perceiving each character. There are different types of these:**
  - ‘rotation/reversal errors’ in which the character is confused for another similar character which is in a different orientation or is the mirror image, e.g. Moon character M and E.
  - ‘salient features errors’ involve the reader missing (or over-emphasising) a salient feature of the character which leads them to read it as another character, e.g. Moon character I and L
  - ‘combination errors’ in which a combination of rotation/reversal and salient features occurs.
- 2. Top down errors – these are associated with prior knowledge of the reader which may result over generalisation. There are different types of these:**
  - ‘semantic, phonic, syntactic errors’ are the incorrect prediction of a character based upon semantic (e.g. predicting the wrong word), phonic (e.g. predicting the wrong sound, such as an incorrect vowel), or syntactic (e.g. predicting the wrong punctuation).
  - ‘braille errors’ are the confusion of braille and Moon codes if the reader has experience of both. This *may* be particularly true for dotted Moon (see below).
  - ‘visual memory errors’ are the confusion of print and Moon characters if the reader has experience of both, e.g. the Moon character W appears like a lower case print N.

These errors are likely to be associated with the code rather than specific media and this was confirmed through observation.

In terms of errors associated with specific media, very little evidence has been found to suggest that any errors are particular to dotted Moon. Potentially, top

down errors associated with braille are likely to only be apparent for dotted Moon (as both codes are made up of dots). We found evidence of these parallels being drawn by participants between braille and Moon, but no obvious reading errors. Perhaps a more significant observation was the emotional response evident in some participants in relation to dotted Moon and its negative association with braille (of which some did not have positive experiences).

The larger final report will explore very specific issues of reading errors in more detail, and this will be reflected in the designed resources. Such a micro-analysis of errors will prove useful to those teaching Moon.

### ***Production of dotted Moon***

#### **Technical issues**

The production of dotted Moon in the project was done using an Enabling Technology Juliet pro-embosser in conjunction with Duxbury Braille translation software version DBT Win 10.4 SR1 May 2002.

Of key importance is that this technical set-up worked. Nevertheless, the process is technically awkward, and the research team – with its reasonable technical competence – found the process initially quite difficult. The process has four key stages (plus an additional one-off embosser set-up):

1. prepare text;
2. translate text to Moon;
3. format Moon on-screen; and
4. emboss Moon.

A key source of this difficulty is Stage 3, i.e. the on-screen display of the translated Moon and its subsequent formatting (if required). The source of the problem is that the software does not make use of a Moon font and translated text is presented as Braille. It would be an extremely useful addition to the software if it were able to incorporate a Moon font. Even with such an addition, the process is complex and the project has demonstrated the need for a user-manual for those wanting to emboss dotted Moon. This is in preparation.

Another key issue raised in the project was the production of maths symbols (following the 'Staff Maths' conventions). The current software does not have this capability.

### **Production of dotted Moon – Linden Lodge School case study**

Linden Lodge School presents a fascinating case study of how a school has incorporated the new technology and the possibilities it affords into its working practice. There are three things highlighted in this summary report. Firstly, library and technical staff have an additional route for preparing teaching material for pupils when it is requested, and files can be saved for potential use at a later date. Secondly, the school has been able to accelerate and

broaden their library resources, and of particular note is the creation of reading scheme books in a variety of formats – normal print, large print, Braille, *and* dotted Moon. The use of dotted Moon on clear adhesive plastic has enabled the creation of ‘clear vision’ Moon books as well as ‘clear vision’ Braille books. Finally, the school network computers enables students to save their written work (using a word processor with speech package) to a shared disk from which the staff can emboss dotted Moon.

While dotted Moon has enabled the school to develop their support of Moon literacy considerably, the existence of an adequate Moon writing device is still an obvious missing component. Potentially, dotted Moon technology offers opportunities to develop a useful and much-needed writing device.

### **Distribution of dotted Moon files**

Dotted Moon has the potential for files to be distributed to users rather than hard copies. In principle, the user could access the file (e.g. from a website) and emboss the Moon locally using their own Braille embosser. This clearly has potential advantages for distributors (e.g. RNIB, NLB) who save on production and distribution costs, and the user who can emboss multiple copies at relatively little extra cost and can edit material if required.

Nevertheless, it would be premature to over-emphasise this method of distribution for a number of reasons. Firstly, the current technology used requires further improvement as described in previous sections. Secondly, it is likely that relatively few potential users have the adequate technology in place (as shown in the survey), and its purchase is extremely expensive.

In part, this leads to a discussion about standards. An alternative method of dotted Moon production is possible using some Index Braille embossers. Any distribution of dotted Moon files would ideally be in both standards.

### **Dotted Moon and lined Moon**

A note of caution here is in relation development of dotted Moon at the expense of other products. Most of the participants involved in the research successfully used dotted Moon, but this was only one resource of the many they used (including lined Moon products). One of the historical qualities of Moon has been the flexible ways in which professionals have used it when developing teaching resources. A key part of this has been the ability to manipulate the size of ‘lined’ Moon characters without losing the ‘whole’. Dotted Moon in its current format does not have this flexibility. Again work on versions of dotted Moon of different sizes on the Index embosser may be of relevance here.

### **Resources**

Materials which the team is developing fall into two categories. Firstly, the production of support materials for those teaching and preparing Moon materials. For example, the team are currently preparing detailed materials

describing how to set up hardware (the Enabling Technology embosser) and the software (the Duxbury braille translation application) necessary to produce dotted Moon. The current materials proved inadequate as described above.

Secondly, the production of teaching/assessment materials. The following materials being produced include - a Moon version of reading test materials, tracking activities, letter combination for embossing onto adhesive plastic and the production of Moon labels, preparation of dotted Moon version of the 'Journey to the Moon' reading scheme series. Attention will also be given to suggestions for material made by professionals made through the survey described above.

## **Dissemination**

Materials developed in the project will be distributed through the RNIB and University of Birmingham web sites in the form of a teacher's pack. Users will be able to download the materials and emboss or print locally.

A full report is being prepared by the project team for the RNIB. This will be disseminated through web sites, and possibly in other formats.

Project team members led a conference on Moon, 'Asking the right questions', on the 18<sup>th</sup> March 2003 in Nottingham. 50 people attended. Preliminary project findings were discussed with delegates. An additional workshop will be held at Linden Lodge School on the 23<sup>rd</sup> May 2003.

A 30 minute video has been created through the project (prepared on both VHS and CD/MPEG formats). Currently this is only available to the project team for teaching purposes, but permissions will be sought to use it (or an edited version) more broadly.

Additional papers will be prepared for academic and professional journals over the coming year.

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