Individual Styles In Learning To Spell: Improving Spelling In Children With Literacy Difficulties And All Children In Mainstream Schools

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EXECUTIVE SUMMARY

INDIVIDUAL STYLES IN LEARNING TO SPELL: IMPROVING SPELLING IN CHILDREN WITH LITERACY DIFFICULTIES AND ALLCHILDREN IN MAINSTEAM SCHOOLS

A concern for increased standards in literacy and spelling is commonly expressed and is focused upon by the government's Literacy Strategy. This research shows that children's rates of acquiring spellings can be much enhanced by simply applied individual learning strategies used within their usual English and spelling programmes.

- There has been much research on the cognitive and literacy development of children but this has not been matched by related and carefully controlled study of how they might learn word level literacy skills more effectively.

- This research indicates the links between effective teaching of spelling and children's individual development and styles of learning.

- It studied six 6-8 year old children with dyslexic features in rigorous individual programmes, and in a group comparison of children with dyslexic features with children with moderate learning difficulties and those with no difficulties (12 children in each group).

- In a one year field trial in mainstream schools, individual strategies for learning spellings were quite easily found for all children, most having no learning difficulties, and used in their usual English and spelling education.

- These individual strategies approximately doubled all children's rates of learning spellings.

- Such individualisation of learning demands little teacher time and does not add to, or alter, usual class teaching and practice. There is no emphasis on one teaching method.

- Recommendations are made for: extending field trials regarding numbers and geography; recognising the value of individual strategies for learning, extending and measuring their effectiveness in teaching employed by the National Literacy Strategy; viewing the methods across the development of children and in other learning fields; further investigation of differences between children with dyslexic features and those with moderate learning difficulties; and establishing an institute to evaluate teaching methods.

- It is hoped that an inexpensive guide establishing individual learning strategies can be made readily available, which will complement multi-sensory teaching materials.

BACKGROUND

There is an increasing understanding and awareness of the thinking and development involved in reading and spelling skills, and the relationship of this development with children who fail in literacy, such as children with dyslexic features. Along with this understanding, there is growing concern about the poor literacy development of children in this country as compared to their European counterparts. Connections are now being made between poor literacy development and employability, as well as crime rates. In this context, it could be expected that thorough

research would have been undertaken to examine in detail how to improve these skills in children and, in particular, those who are failing.

There have been many studies where the authors suggest that their method of teaching children experiencing difficulties is effective. However, very few studies examine the individual learning strategies and cognitive development of both children experiencing difficulty and children experiencing no difficulty, and compare the effectiveness of different teaching methods. There are less studies of spelling than reading. For these reasons, this research is innovative.

This study builds on earlier research and develops our understanding of the processes involved in acquiring word level literacy. This is a key area of difficulty for many children, and can greatly influence educational, vocational and life progress. The study is based upon the current understanding of literacy development, and investigates the relationship between individual learning strategies and effective methods of learning to spell for all children..

THE FIVE STAGES OF THE RESEARCH: METHODS AND FINDINGS.

- Stage 1. This produced a detailed picture of the cognitive and literacy profiles and development of children without literacy difficulties in order to have detailed data to compare the Stage 2 children against.

- Stage 2. Extensive cognitive profiling was undertaken in order to select six children, aged 6 to 8 years, with learning difficulties. They were then taught spellings in ten different ways for 18 months. The aim was to investigate the link between the children's thinking patterns and the methods by which they learned new spellings most effectively. 4 were found to have dyslexic features and 2 to have moderate learning difficulties. Results highlighted the interrelationship between the learning style of those with dyslexic features, their cognitive profile and the successful teaching of literacy skills. Building on the strengths of individual styles in learning spellings was also effective with those with moderate learning difficulties.

- Stage 3. A group experimental approach was adopted in order to test whether the single case findings could be replicated and generalised, and if there were differences between groups in terms of their cognitive development and their learning styles. The spelling age matched groups comprised children with dyslexic features, children with moderate learning difficulties and children with no difficulties (control group). There were 12 children in each group, average ages 8, 11 and 6 years respectively. The results supported some of the findings from the previous Stage. Results were not statistically significant, possibly because of small numbers and insufficiently defined groups in terms of their cognitive development and learning difficulties. The children with dyslexic features learned the greatest number of word spellings when using Neurolinguistic Programming, a visual learning method; this appeared to tap into their visual strengths and reduce their reliance on their phonological weaknesses. It was found that children with dyslexic features with visual and phonological weaknesses progressed less well than those with just phonological difficulties, being additionally handicapped in their learning. The children experiencing no difficulties, while benefiting from the visual method, also did well in the Onset-Rime phonic method that relies on phonological skills. They showed little difference in learning with visual and phonic methods. The children with moderate learning difficulties benefited from visual and phonic approaches; it was believed that they would learn at an equal but slow rate, regardless of the teaching method. This Stage found both quantifiably and qualitatively different learning

styles in these three groups, indicating that cognitive makeup closely guides effective teaching.

- Stage 4. This followed through 8 children from the group of children with dyslexic features of Stage 3 for another 15 months. They continued to use their best learning method, found in Stage 2, to examine whether the children were able, through using these methods, to continue to increase their spelling levels above those expected normally. All but two made gains almost 50% greater than would be expected over a period of 15 months.

- Stage 5. Findings were examined over a much broader band of children in mainstream schools. 3 schools were involved, with 60 children from Years 2 and 3. The children's best learning methods for spellings were discovered after an input of approximately 80 minutes in total over 3 weeks from their teacher, classroom assistant or parent. The children were then encouraged to use their best method whenever they had to learn spellings in their usual schoolwork. There was no additional input. Half the children used their method over the 10 months of the field trial, half just over the last 5 months. The aim was to compare the spelling improvements of the two groups. After 5 months, the rate of increase in spelling age of the group using the individual methods approximately doubled, while the others increased at a usual "chronological rate". The difference was found to be highly significant. The second group showed similar improvement to the first in the latter 5 months when they also used their individual methods.

- The final part of the research was to develop the pack used in Stage 5 by any teacher, classroom assistant or parent in order to discover the individual child's best learning method, for anyone to use in the future

CONCLUSIONS

Each Stage of this research has looked at the individual styles of learning of differing individuals and groups of children largely ranging in age from 6 to 8 years. The research has shown the value of individualising the learning styles of children, whether they be children with learning problems or normally developing children.

This research has highlighted the effects of attending to the variations in learning styles in individual children and shown how productive, not only for children with dyslexic features, but all children alike, this focus can be. In one of the schools from Stage 5, for example, the teacher has found the individualisation so helpful amongst the children included in the research that he has instigated the use of this approach for all children. The teacher recently reported that, not only has he found a difference in the children's successes with spellings, but parents have also commented on the value of this method. Only a small amount of time (approximately 80 minutes) need be invested by the teacher, assistant or parent in finding an individual's effective learning method to reap educational rewards for all children. These approaches to individual learning styles may be able to be adopted in different areas of learning, such as reading, mathematics, foreign languages, study skills, etc., and might be fruitfully investigated further.

RECOMMENDATIONS

- Making inexpensive guides to establish individual learning methods available to all, which will complement multi-sensory teaching materials.

- Extending field trials over larger numbers and other geographical areas.

- Recognising the value of individual strategies for learning, extending and measuring their effectiveness in teaching methods employed by the National Literacy Strategy.

- Viewing individual styles of learning and their interaction with cognitive and literacy development over the ages of 3 years to adulthood.

- Investigating further the learning and development of children with dyslexic features and moderate learning difficulties, children without learning difficulties, and other S.E.N. groups.

- Using the individualised learning methods on other materials.

- Contrasting sex differences.

- Establishing an Institute to evaluate teaching and learning methods.

KEY IMPLICATIONS FOR TEACHERS

- The research gives a simple way to find an individual child's best strategy to learn any spellings.

- It can be used for any child.

- Finding this strategy takes little time from the teacher, an assistant, a parent or any adult.

- This individual strategy to learn spellings is used by the child in the usual curriculum, teaching programmes and teaching groups. There is no additional input once the child has been given the best learning strategy.

- The use of the individual strategy may be self-reinforcing for the child. It gives children a sense of self control and an ability to take more responsibility for their own learning.

- This simple use of individual learning strategies has been shown to approximately double the rate by which all children acquire spellings.

- Whilst the approach suits all children, it will be highly relevant to any children with difficulties in literacy.

CHAPTER 1:   INTRODUCTION

1:1   The development of literacy and dyslexia

Over the last decade, there has been considerable interest in the acquisition of literacy skills and many explanations of the process have been offered. Any study investigating difficulties in acquiring word level literacy skills must take account of the current evidence regarding the normal developmental process. This study focuses upon word level literacy, since it is the key area of difficulty and subsequent failure for children with dyslexic features, extending not only into written language but also study skills, general learning and educational success as a whole. However, it is important at this point to emphasise that this difficulty does not necessarily imply complete educational failure, since many dyslexics will use aspects of the English language such as syntax, meaning and subtlety in understanding, expression and form to aid their grasp of the language and its meaning.

One explanation of the process of word reading and spelling has been Coltheart's Dual Route Model (Coltheart et al 1993). This proposes that a word can be recognised or produced either through a whole word route, or via a grapheme-phoneme analysis (the phonic route). This explanation has been used to teach literacy through sight vocabulary and phonic methodology for children requiring special help. However, more recently this model has been criticised for implying literacy acquisition is so structured in its development. It also takes little account of what has more recently been recognised as fundamental to the process, namely phonology. Connectionist theories suggest a development of an interrelationship between orthographic and phonological knowledge built up through exposure and experience (Seidenberg, 1992, and Van Orden, Pennington and Stone, 1993).

Frith (1985) developed a model proposing that reading and spelling pass through logographic, alphabetic and orthographic stages. There are some parallels between the Dual Route Model and Frith's in the logographic stage, since it now appears that children do not initially use only visual recognition and production but instead early word skills are mediated through phonological skills (Ehri, 1992, and Adams, 1990). It is the development of the skill of phonological processing that enables the child to begin to read and, later, to spell successfully (Bryant and Bradley, 1985, Treiman et al, 1995, and Goswami and Bryant 1990). Frith's model remains highly influential.

There is considerable evidence (Brown and Ellis, 1994, Ellis, 1993, Frith, 1995, and Snowling, 1991) that children with dyslexic features have a phonological weakness at a cognitive level which interlinks with the development of the working memory, long term memory, learning and retrieval, all of which build up to produce the difficulties seen in adults with dyslexic features (Ellis, 1989, Cataldo and Ellis, 1988, and Thomson, 1984). As yet the problems with naming, word finding and accessing information are less well understood, but are typically weaker in children with dyslexic features (Snowling et al, 1988). There are no clear explanations so far for the visual weakness sometimes experienced by children with dyslexic features; however, these weaknesses may well compound language processing problems. These difficulties may become clarified through the study and training of children with dyslexic features to read and spell, since often in research the study of a "malfunctioning system" helps the understanding of the system itself.

1:2   Cognitive profiles

1:2:1   Abilities and discrepancy criteria

There has been an extensive history of identifying dyslexia within research, and especially within local authority educational practice, through viewing the discrepancy or underachievement between literacy skills (and especially reading and spelling) and ability levels. This mechanism has attracted much criticism due to political implications of defining learning difficulties through ability levels and concerns regarding the relationship between ability and literacy levels (Frederickson and Reason, 1995, Siegel, 1988, Stanovich, 1991, 1994, 1997). Alternative comparisons to ability such as listening comprehension have found difficulties as these are often handicapped in children with dyslexic features. There is some hope that phonological skills may demonstrate a clear cognitive weakness in children with dyslexic features (Frederickson and Reason, 1995) but this weakness may again be important if relative to their ability or general levels of development. The discrepancy criterion is responsible for generating samples of children and adults who have demonstrated clear cognitive weaknesses and difficulties in education in many research studies (Snowling, 1991). It is suggested that this measure should remain a part of any assessment package. Caution may need to be used with young children whose abilities may be measured quite reliably, but whose levels on reading and spelling will feature towards the lower floor of many tests and may consequently not be sufficiently sensitive or reliable.

1:2:2   Cognitive weaknesses

Phonological weaknesses have been demonstrated through many research papers; recent reviews include Brown and Ellis (1994), Ellis (1993) and Snowling (1991). Tests of phonological skills have included non-word repetition, rhyming, alliteration, syllable-tapping and phoneme substitution. Tests of fluency and naming include picture naming tests, naming speed, and semantic, rhyming and alliteration fluency tests, (Frederickson et al, 1996, and Fawcett and Nicholson, 1996). Children with dyslexic features typically show weaknesses in working verbal memory (Rugel, 1974) and measures such as digit spans have been widely used. Relationships between dyslexia and weaknesses in visual and motor skills are less certain but have commonly been reported. Tests used could include copying designs, timed copying of codes, visual discrimination, picture puzzles, memory for visual spans, tapping speeds, arm and leg co-ordination and balance. It was required that assessment in this study would provide a comprehensive measure of a child's ability, language skills, verbal reasoning, phonology, verbal memory, naming/accessing, verbal fluency, visual processing and motor skills. These measures would then build a profile within a child through comparisons between tests that could be judged via their standardised scores within the population. Such methods have their routes in psychological approaches termed as cognitive neuropsychology (eg, Temple and Marshall, 1983).

1:2:3   Literacy development

Word level measures of reading and spelling may prove insensitive for young children, especially for those with difficulties in literacy, as they are likely to demonstrate few achievements at the lower end of test materials. Reading generally develops earlier than spelling and may consequently show more sensitivity, and spelling measures could benefit from extension down into many simple words and letter knowledge as in the Helen Arkell Spelling

Test (1998),(HAST). Alphabet knowledge appears to be an important example of early literacy learning which correlates highly with later literacy development (Ehri and Wilce, 1988, Snowling, 1991). Prose reading and writing should offer a more realistic picture of language but suffer even more markedly from floor effects. Tests might endeavour to judge strategies employed in word level literacy by subjects, especially in the context of anticipated development from logographic to alphabetic strategies during the ages 4 to 7 years. Suitable tests might compare reading and spelling of exception words, phonically regular words and nonsense words requiring a whole-word approach, a phonic emphasis, and a phonic approach (Coltheart et al, 1983, Treiman and Hirsh-Pasek, 1985). The assumed links between types of words and strategies employed in reading or producing spellings can be tenuous due to issues raised earlier regarding Connectionist theories and phonology in early word recognition, and due to possibilities for using other strategies. For example, a young child may use analogies rather than phonic skills and word families across similar words (Goswami, 1990). Nonsense word reading has been felt to be a good indicator of dyslexia and to reflect weaknesses in phonological processing and competence in phonic skills in literacy (Rack et al, 1992).

1:2:4   Teaching strategies

There is a range of studies indicating that work in developing phonological skills in children at risk of dyslexia can reduce future limitations upon their literacy skills. Bryant and Bradley (1985) studied 65 children aged 5-6 years and found that phonological skills, as measured by a rhyming test, predicted literacy development. Training, especially within phonology and non-explicit links to early orthography, led to improved literacy progress. Further studies have demonstrated that explicit training in phonology and mastery of these skills, together with related experience of literacy, can much reduce literacy difficulties in children aged 5 to 7 years (Lundberg, 1994, Byrne and Fielding-Barnsley, 1993, Iversen and Tunmer, 1993).

Teaching children of 7 to 10 years with literacy difficulties can be especially effective with a basis in phonological division and training in orthographic skills (Snowling, 1996).

Olsen et al (1994) used computer based reinforcement to emphasise sub-syllable units in word level literacy. Hatcher Hulme and Ellis (1994) put forward a phonological linkage hypothesis emphasising the need for interaction between phonological training and experience of orthography.

There are many studies viewing teaching methods with children experiencing difficulties in literacy that suggest certain methods can be effective (eg Branwhite, 1983, Browne, 1990, Carlisle, 1987, Clay, 1985, Gregory et al, 1982, Lane, 1990, Lewis, 1982, Moore, 1988, Moseley, 1988, Van der Leij and Van Daal, 1987). There are some studies that compare teaching methods (Tizard et al, 1982, Hatcher et al, 1994, Hulme, 1981, Bradley, 1981, and Thomson, 1988). There are studies that view dyslexics from some particular criterion (Hornsby and Miles, 1980, Tyre and Young, 1983, Miles, 1983). There are very few studies that compare teaching methods and control methods, define dyslexics accurately, describe the cognitive profile of participants, and compare those with dyslexic features with other participants failing in literacy such as those with moderate learning difficulties. A few studies offering many of these features are Thomson (1988), De Partz (1986), Broom and Doctor (1994), and Brooks (1995). All but the first, are single case studies. The comparison between those with dyslexic features and those with moderate learning difficulties does seem particularly important in order to emphasise the need to identify such difficulties and extremes, and establish necessary teaching

strategies and training as well as funding within education. Again, such comparisons would clarify the theoretical models used to describe dyslexia and literacy development (Brooks 1995).

Remedial methods with children with dyslexic features have generally been based upon a clearly structured framework for phonics, and related orthography and rules governing word level literacy (Cowdery et al, 1983, 1984, 1985, Gillingham and Stillman, 1956, Hornsby and Sheer, 1980, and Miles, 1989). It might be argued that these approaches offer a phonic structure to subjects who would find it difficult to structure such frameworks without clear support.

These approaches may offer a generalisable rule-based system that can reduce memory and learning demands and emphasise children with dyslexic features' relative reasoning strengths.

These methods often contain a multi-sensory basis for reinforcing word recognition and production, such as Simultaneous Oral Spelling, which may allow weaker modalities to be supported by many available pathways. There are a range of methods that tap phonological elements of words and phonic similarities ranging from rhyming games to word families.

In contrast, there are methods that attempt to emphasise children with dyslexic features' strengths through visual cues such as Look-Cover-Write-Check, icons and visualisation.

Neuro-Linguistic Programming attempts to build visual skills and to tap the behaviours of successful readers and spellers (McLean, 1993, and Goedkoop, 1992). ARROW (Lane, 1990) uses a theory that the subject's own voice will benefit memory, learning and recall.

Fernald (1943), Hulme (1981) and Thomson (1991) have indicated the benefits of tracing and kinaesthetic cues to acquiring spelling.

1:2:5   The current study

The study will sample a range of teaching methods that represent those in use, and which also represent the range of modalities and strategies that might be attempted. The study will view the interaction between different teaching methods and the children's development and cognitive profile. Initial considerations are to show the importance of using teaching methods which build on strengths and weaknesses. What will be the implications for generalisation, or for constructing foundations from which higher skills can grow? The project centres on 6 to 8 year olds where remediation may positively affect the children's long-term literacy, educational and emotional well- being, and where children have not been exposed to long periods of intensive and defined specialist teaching methods that could have a significant impact upon results.

CHAPTER 2:   COMPILING DATA FOR COMPARISON - (STAGE 1)

2:1   Comparison data

Data were required in order to be able to compare the dyslexic featured single cases that were to be taught spellings, in terms of their abilities, cognitive skills and basic educational attainments, with peers who showed no difficulty in acquiring literacy skills. These data would allow a profile to be drawn up regarding each dyslexic featured individual's abilities, cognitive development, and language and number skills. This picture of their development and patterning in processing information would be compared with their responses to different methods and emphases within teaching techniques used in building spelling skills.

The data may be grouped into the following areas:

-Language including vocabulary, reasoning, understanding and memory.
-Visual skills including spatial reasoning, observation and perception and memory.
-Phonological skills.
-Motor skills.
-Sequencing skills.
-Literacy skills.
-Number skills.

There is an emphasis upon phonological skills due to their importance to the development of early literacy (Adams, 1990, Ehri, 1992, Goswami and Bryant, 1990) and to the problems found within dyslexics (Snowling, 1991). Visual skills require careful consideration due to the visual nature of literacy material, and the possibility of visual versus phonic routes to word level written language (Coltheart et al, 1983, Castles and Coltheart, 1993) and the likely extremes of such strategies in adult expert readers (Baron, 1979). It was important to establish measures appropriate to this early stage of language and literacy development. The numbers of original tests that needed to be evolved was less than had been anticipated when the project was first proposed, in large part, due to the recent publication of standardised tests for phonological skills. The tables of comparison data consequently show a range of published and original materials.

2:2   Participants

The participants used in obtaining data for original tests were 25 children (mean age 6.4 (S.D 0.26) months)) from 2 primary schools and 1 first school in the L.E.A sector in West Surrey.

They were selected as being of average ability (within 1 S.D of the mean on the Wechsler Intelligence Scale for Children - Third Edition U.K on Vocabulary and Object Assembly) and as having average spelling levels (within one standard deviation of the mean on the British Ability Scales Spelling Test). This average performance and absence of marked difficulties or obstacles to education was confirmed from class teachers' opinions and "Year R." screening undertaken within Surrey L.E.A Schools.

2:3　Tests: original procedures

Detailed results are contained in the full Technical Report.

2:3:1　Visual tests

<u>Greek letters</u>

Nine Greek letters of 2cm. in height, were drawn onto small visiting cards using black ink. Two identical sets were made, one for demonstration purposes, the other for the child to use. The children were told that they would be shown these shapes for 10 seconds and then the shapes would be removed, after which they would be asked to display the shapes in the correct sequence. The Wechsler Intelligence Scale for Children (3rd Ed, 1992) digit span pattern was used so that the Greek letter cards had numbers on the reverse side and the letters used corresponded to the digit span numbers in the test. The number of shapes displayed also corresponded to the pattern in the digit span test. The rationale for this test was to access visual sequential memory.

2:3:2　Sequencing tests

<u>1) Days of the week</u>

Children were asked to recount the days of the week going forwards and backwards, ie, Sunday, Saturday, etc. Sequencing skills are often not as effective in a child with dyslexic features, (Miles, 1978).

2)　<u>Months of the year</u>

Likewise, children were asked to say the months of the year both going forwards and backwards.

3)　<u>Piaget sticks</u>

"Piaget's sticks", a collection of 10 graded lengths of wood, were presented to the children. Each stick had a cross section of 1cm. by 1cm. and ranged in length from 10cm. to 19cm. in 1cm. gradations. Three were initially used to demonstrate how they could be ordered in terms of their heights. Once this was understood by the children, they were given the complete array and asked to put them in order of height, and timed.

2:3:3　Literacy tests

1)　<u>Alphabet</u>

The children were given two alphabet-related tasks, in order to assess their understanding of the names and sounds of the letters, as vital building blocks for learning to read and spell. This seems an important early indicator of ease of learning for basic written information. They were given all 26 letters in a jumbled form (following the layout of the Qwerty keyboard) and asked to say the names of the letters, followed by the sounds of the letters.

2)　<u>Book up the right way</u>

A book was placed on the table the wrong way up for the child. The child was then asked to read from the book a short passage and observed for holding the book the correct way. 100% of the subjects held the book the correct way.

3)   Reading left to right

While the children were being checked for holding the book the correct way up, they were also observed for reading from left to right. Two children were unable to read any words presented but all the other children did read from left to right.

4)   Prose writing

A piece of prose writing was taken from each of the children's writing books. The piece was chosen for being "free writing" and an attempt was made for each piece used to be as close in date to all the other pieces. This was then analysed for the percentage of spelling errors made in the writing. The mean percentage of errors was 14% of words written with a standard deviation of 9%. This information will allow an objective comparison to be made between the prose writing of the "average" child, and one who is possibly delayed due to learning difficulties such as dyslexic features, and the risks they are prepared to take in their use of spelling vocabulary.

5)   Exception / Regular / Nonsense Words (E.R.N)

Lists were made of 10 words in these three categories from the Helen Arkell Spelling Test (1998). They were matched for levels of difficulty and spelling skills required. The 30 words were written on small visiting cards in a simple print 1cm high. The words were shuffled to offer a random order on each presentation. Children were asked to read and spell all the words.

2:4   Tests: published materials used

2:4:1   Language tests

Wechsler Intelligence Scale for Children III U.K. (1992). Vocabulary; Similarities; Comprehension; Information; Digit Span.

The Dyslexia Screening Test (DST) University of Sheffield (1994) (Pre-publication form - see Fawcett and Nicholson, 1996). Backward Span.

2:4:2   Visual tests

Wechsler Intelligence Scale for Children III U.K.(1992). Block Design; Object Assembly; Coding; Symbol Search;

British Ability Scales (1993). Recall of Designs.

2:4:3   Phonological tests

Phonological Assessment Battery (PhAB) University College London (1995). Pre-publication form - see Frederickson, Frith and Reason 1996). Alliteration; Rhyme; Fluency; Naming.

The Dyslexia Screening Test (1994). Verbal Fluency, Semantic Fluency; Phonemic Segments.

2:4:4   Tests of motor skills

McCarthy Scales of Children's Abilities (1972). Arm Co-ordination; Leg Co-ordination; Imitation; Draw-a-Design; Drawing a Child.

The Dyslexia Screening Test (1994). Beads; Postural Stability.

2:4:5   Sequencing tests

McCarthy Scales of Children's Abilities (1972). Xylophone.

2:4:6   Literacy tests

British Ability Scales (1993). Word Reading Test.

Neale Analysis of Reading Ability (Revised British Edition 1989).

Snowling Graded Nonword Reading Test (1995).
British Ability Scales (1983) Word Spelling Test.

Helen Arkell Spelling Test (1998).

The Dyslexia Screening Test (1994). One Minute Reading; Nonsense Passage; Two Minute Spelling; One Minute Writing.

2:4:7   Number tests

McCarthy Scales of Children's Abilities (1972). Counting and Sorting; Number.

Wechsler Intelligence Scale for Children III U.K. (1992). Arithmetic.

British Ability Scales (1983). Number.

2:4:8 Screening measure

Keystage 1 C.O.P.S (1995).

2:5   Observations on tests used to describe cognitive profiles

Cognitive tests and profiles were used:

> 1) To offer a level of development or ability that could be used as a gauge against other cognitive skills and attainments within each individual subject.

2) To describe strengths and weaknesses in cognitive skills especially in areas seen as relevant to literacy development.

3) To describe literacy and number development.

Test results were appraised in terms of consistencies shown between tests viewing similar areas and between different children. They were appraised in terms of being able to display significant differences. Appraisal was made largely through observation of differences, although correlational analysis was undertaken in order to highlight any areas of statistical interest. These observations seem appropriate to screening and assessment of cognitive features, and literacy and number skills, in children aged 6-7 years.

2:5:1 Language

The tests from the Wechsler Scale (WISC) seemed accurate and reliable. Vocabulary, Similarities and Comprehension offered good indications of overall language and verbal ability levels. Similarities may be especially sensitive to higher levels of reasoning within language. Information offered a useful index of acquired knowledge and learning.

2:5:2 Verbal memory

WISC Digit Span and Dyslexia Screening Test (DST) Digit Span seemed to offer closely related measures of working verbal memory.

2:5:3 Visual processing

WISC Object Assembly and Coding seemed reliable and discriminating in identifying children with weaknesses in visual processing such as memory, use of visual detail and form, and pencil skills. WISC Symbol Search seemed to offer limited useful discrimination, and Greek Letters was not sufficiently reliable or sensitive. BAS Recall of Designs and McCarthy Draw a Design appeared to suggest that all children's skills were well developed and were not discriminating.

2:5:4 Phonology

Phonological Assessment Battery (PhAB) Alliteration and Rhyme and DST Phonemic Segmentation tests seemed appropriately sensitive and discriminating for key areas linking to literacy development. The support of pictures did not seem necessary for the levels of phonology viewed with the PhAB Rhyming and Alliteration measures. There seemed to be limited relationships between PhAB and DST Fluency and Naming Tests. These tests may reflect the materials they are using (such as phonology or semantic categories) but did not seem to reliably describe a cognitive process.

2:5:5 Motor skills

All the children achieved well on the motor tests offered to them. They did not seem discriminating or relevant to the current study. It would seem likely that observation of motor skills may well prove a sufficient tool for most psychologists and teachers working with language and learning difficulties.

2:5:6 Sequencing

The recital of days in forward and reversed order seemed appropriate to the age group considered in this study. Most children could not relate months in a forward order at the age of 7 years. There seemed to be limited links between these tests and Piaget Sticks and McCarthy Xylophone, which appeared unreliable.

2:5:7 Literacy alphabet

Testing children's knowledge of alphabet names seemed a useful test of initial literacy learning. Alphabet sounds offered an indication of a particular curriculum and training, and progress within initial phonic skills in literacy. Holding a book suitably and reading in the correct direction did not appear helpful in discriminating children's reading behaviours and were achieved by all children that had begun to read.

2:5:8 Literacy reading

There appeared to be close relations between BAS Word Reading, ERN Reading, Snowling 1 Syllable Nonsense Words, DST Nonsense Passage, and DST One Minute Tests. The Neale Test seemed to be too advanced to be useful with 6 to 7 year olds with weaknesses in literacy.

2:5:9 Literacy writing

All children were able to write their names. Prose writing and related observations seemed unreliable measures of expressive written language. BAS Spelling proved too difficult to be discriminating. HAST, ERN and DST Spelling Tests seemed appropriately sensitive and to tap this aspect of the literacy curriculum of our children reliably. The DST Writing Test seemed less reliable.

2:5:10 Number

WISC Arithmetic appeared to be a sensitive and reliable instrument. It offered some translation into the mathematics curriculum such as counting, adding on to a number series, and initial number operations. BAS Number Skills did not appear to be discriminating. McCarthy Number was easy for all children.

2:6 Conclusion

A package for testing of cognitive and initial school skills might include WISC Vocabulary, Similarities, Comprehension, and Information; WISC Digit Span; WISC Object Assembly and Coding; PhAB Alliteration and Rhyme; Recital of Days; Reciting Alphabet Names; BAS Word Reading; HAST and ERN Spelling Tests; and WISC Arithmetic. The Digit Span, Phonemic

Segmentation and Spelling tests from DST could be added or substituted. It is unfortunate that many of these tests are restricted in their use to psychologists. It is proposed that suitable measures need to be evolved for use by teachers especially in terms of language and verbal ability, visual processing, and number skills.

The British Ability Scales were used for key cognitive and attainment measures but not in acquiring broader ability measures. It is expected that B.A.S. tests could be effectively used instead of WISC for language, verbal memory and non-verbal ability assessment. A further battery of educational psychologists' tests would have placed severe strains on research time and the tolerance of the children involved.

CHAPTER 3:   DETAILED ANALYSIS OF THE COGNITIVE PROFILES AND RESPONSES TO DIFFERENT STRATEGIES FOR TEACHING SPELLING IN SIX INDIVIDUAL CHILDREN - (STAGE 2)

3:1   Method

3:1:1   Design

This study adopted a two-pronged approach to disclosing the effectiveness of differing teaching techniques. From a macro perspective the study adopted a between-programmes approach, examining whether there was any significant difference in success rates between the differing teaching programmes. Macro-examination of the relationship between the varying programmes will give a broad indication of the power or otherwise of the varying approaches to teaching children to spell.

Micro-examination, however, aims to reveal detailed relationships between the teaching techniques and the individual child's cognitive profile, this being a more "single case study" approach.   The research will therefore provide a comprehensive account of the gross performance and the detailed strengths of the various strategies adopted by teachers in schools with children with dyslexic features and those with no difficulties.

Previous work in this field (eg Frith, 1985) has proposed that classification of developmental disorders of spelling can be achieved according to the stage at which the development of literacy was arrested. This developmental model appears to be fruitful in that it offers links between underlying processing deficits and patterns of spelling performance. The hypothesis directing this research is the belief that teaching techniques must link in with the arrested spelling development if they are to be successful, and detailed cognitive profiling and presentation of techniques will reveal those connections. Cognitive neuro-psychological approaches used to study single cases with dyslexic difficulties have shown marked individual differences in spelling performances (Temple and Marshall, 1983, Coltheart et al, 1983, Snowling and Hulme, 1989). This research, therefore, is investigating the link between different interventions and the individual's literacy skills, and aims to demonstrate the interactions between literacy and cognitive skills. These interactions will then be followed by testing in group situations in order to confirm any generalisability of the findings.

3:1:2   Participants

The participants were chosen after a careful selection process took place in two primary schools in the L.E.A sector in West Surrey. Initially, teachers were approached, the aims of the research explained, and then they were asked whether they felt they had any children between the ages of six and seven and a half years who would be appropriate for the research. This approach produced 31 children who were then given the British Ability Scales (BAS) Spelling Test. If the child scored below the 55th centile level or the teacher was particularly concerned, the child was tested with the BAS Reading Test. If the child scored below the 50th centile on this reading test, he/she underwent extensive cognitive testing. 21 children were chosen to progress to the selection level. There were three stages to this testing, the first being The Wechsler Intelligence Scale for Children III U.K., (WISC), Vocabulary, Similarities, Object Assembly, and Block Design. If the child showed an uneven profile on these tests or scored above the 50th centile on them (showing at least an average intellectual development and potential for literacy skills), they

were then accepted onto the next tier of testing. This round of testing involved the use of WISC Coding and Digit Span as well as the Phonological Assessment Battery (PhAB) Rhyme and Alliteration, and BAS Recall of Designs. These tests viewed aspects of cognitive development that have been indicated to be important to literacy skills. A further spelling test was given with much sensitivity in initial spelling such as in writing letters and simple words which would be appropriate to young children with writing difficulties : the Helen Arkell Spelling Test (HAST).

This batch of testing reduced the number of appropriate children to ten who were then given their final round of tests in order to choose the most appropriate for the research. These tests were WISC Information, Comprehension, Picture Completion, Picture Arrangement, Arithmetic and Symbol Search; PhAB Naming, Fluency Alliteration and Fluency Rhyme; Bradley Test of Auditory Organisation; ERN. This cross section of tests was used in order to provide detailed information of each child's cognitive profile and stage of spelling and number development.

The published tests contained related materials and scoring sheets. The scoring sheets were used to develop subject booklets for ease of recording the quantity of data collected. All scores were recorded in the booklet along with any work the subject undertook.

The details of the original tests used can be found in Chapter 2.

From this battery of tests, seven children were picked as being the most appropriate participants, both for their profiles and the differing categories of learning difficulties that they represented. Also, within this group was one set of twins and one child to whom English was a second language. One of the twins was dropped from the study after teaching began as he was causing increasing concerns in school due to his behaviour and was also receiving help from several staff. It was felt the research work might place too many demands upon him.

3:1:3 Procedure

As far as possible, the research was conducted in a quiet room at the same time each day. The tests were conducted over a period of about 2 months with the children all undertaking the same tests over the same period. Since the children would have tired if they were asked to do too many tests at once, it was felt this was the most reasonable timing. In the case of the prose writing, school work was used that was written around the same time.

The tasks were always explained to the children, who were aware that the point of the work they were doing with the researcher was to find out which way of teaching helped them learn the spellings most effectively.

For individual test procedures see the test manuals and Chapter 2.

3:2   The interventions

The teaching strategies were employed within a "precision teaching" type framework. Words were presented, tested and taught on a carefully prescribed daily schedule. An initial knowledge of words was established at the beginning of teaching each set of spellings by testing the child's reading and spelling of all 20 words in each word set. On the subsequent two days, the child was tested on the first five spellings from the word set without teaching to give a baseline.

This was followed by each day teaching the words that were incorrectly spelt, aiming to achieve a target of four out of five correct over two consecutive days. If this target was not achieved in ten teaching sessions, the programme was ceased and another one started. If the target was achieved, then a baseline of ten word spellings was established over 2 days without any teaching. This set of ten words included the first five together with the next five from the word set.

The child was then taught the ten words for ten days or until the target of nine out of ten correct words was achieved. If this was the case, a baseline for twenty spellings was established by giving all the words for two days without teaching and the child again taught for ten sessions or until nineteen out of twenty correct spellings achieved.

Any child's programme was ceased if they had spent 10 days learning any group of spellings and had not reached the set target. Once the programme was finished, at whatever stage, a post teaching check of the 20 spellings was undertaken to see how much had been learned, along with a check of any progress in reading the 20 words achieved through the learning of the spellings. Then a check at six weeks and three months was performed to ascertain levels of medium and long term retention for the reading and spelling of the 20 words.

The words were selected as they occurred at high frequencies in the spoken language of five year olds (Raban 1988). Sets of words were balanced in terms of length, so that the first five words tended to be mainly three letters, with one four and one five letter word. Also they were matched for grammatical form (ie whether noun, verb, adjective, preposition, or adverb), orthographic regularity and imagibility (as Coltheart et al, 1983).

Materials and procedures were trialled prior to the main study beginning, which resulted in minor adjustments.

Ten matched lists of twenty spellings were formulated, and a pattern of ordering of strategies formed. The order was random other than certain criteria being adhered to. Look-say was always followed by Tracing, then Look-Cover-Write-Check, as each strategy expanded the previous one. Phonics was never to be next to Onset-Rime as this would confuse these phonological divisions of words. Own-Voice, Neurolinguistic Programming and Pictures could go anywhere. No Teaching was always the last programme to be presented to offer a level of learning without any teaching when the children were at their highest age.

For the Look-Say and Look-Cover-Write Check methods, the words were written on small blank playing cards with the letters being 5 mm high written in blue ink. The Pictures programme was undertaken using pictures developed from asking a sample of 7 year olds how they would illustrate the words. The pictures were drawn on small blank playing cards. The Tracing method involved the use of words written on blank reference cards approximately 8 mm in height, using

pink fabric paint so that the letters were raised above the card. More details of each method will be found in the Teaching Strategies section.

The same experimenter or teacher undertook all the teaching so as to ensure there was no contamination of results due to variations in presentation.

The teaching experience was positive for all the children and their teachers. It gave extra attention for a period of a few minutes each day to an area of difficulty, ie spelling. The child was able to sample a range of teaching/learning strategies and decide on the more effective ones, with less successful methods being soon discarded after brief trials on only 5 words.

3:3   Teaching strategies

General instructions for teaching spelling.

The words were read one at a time and the child was asked to write the word down. Responses were noted and a record of the correct number of spellings achieved was recorded on a daily record sheet in the individual file. The children were taught each word where an error was made. Each error was noted. There was an attempt to make each teaching experience for each word about ten seconds in duration.

3:3:1 Phonics

The child was shown the word using letters on a 1.5 x 2.5 cm. card. The teacher said each sound in the word in order, after which she repeated the whole word, eg "c-ar-t", "cart". Irregular sounds were offered as an actual sound eg "S - ide". The child was asked to sound out the individual sounds, as the teacher had just demonstrated, followed by saying the whole word. The word was removed from sight and the child was asked to write the word. Incorrect responses were pointed out.

3:3:2 Onset-Rime

The child was shown the whole word made up with letters. The teacher then showed how the word could be divided up, saying, "we can break up the word and listen to its sounds like this .....(eg d-ear). If you now put the two parts together the word is....(eg dear)". The child was then asked to say the sounds of the word and then the word. In this example the syllable dear has an onset d and a rime ear. the child would say, "d, ear, dear".

3:3:3 Simultaneous Oral Spelling

The word was written out on the white board in letters 8mm high while sounding out the individual letters (using letter names) individually. The child was then asked to write the word himself/herself, copying from the teacher's writing onto paper, saying each letter as it was written (using letter names). The child was then asked to name the word and check that the word had been correctly written by comparing it with the original the teacher wrote. Any mistakes were pointed out.

3:3:4 Look- Cover-Write-Check

The teacher presented the word written on a card, telling the child to look at it, and allowing ten seconds. After this time, the word was covered and the child told to write the word. The word was uncovered and the child told to check his/her spelling against the target presentation. If it was incorrect, the teacher pointed out the error.

3:3:5 Picture Association

The teacher would show a card with the word and picture representing the word to the child for 10 seconds. The association was discussed only on the first showing of the card, on subsequent occasions the association not being explained.

3:3:6 Neurolinguistic Programming (NLP)

The teacher first enabled the child to function in a visual mode, by talking to the child about the fact that each of us has a "camera" in our heads which allows us to remember things as if a picture had been taken of them. To help the child understand this, he/she was asked to imagine the window in his/her bedroom and, as the child did this, the teacher explained that he/she was able to imagine them because of the picture the child has in his head from his/her "camera". This also allowed the teacher to find out where the visual field was for each individual, by observing in which direction the eyes went when thinking about the window, thus indicating the visual field the child works in.

Having talked about the "camera", the child was asked to write down the spellings. The first incorrectly spelled word was written on a white board, in letters 8 mm high, which was placed in the correct visual field, or if it was not possible to discover this, the word was placed in the left to central visual field. Any memorable features about the word would be discussed, and the word withdrawn after 10 seconds. The child was asked to write the word down on paper.

3:3:7 Own Voice

Before starting the spelling, the child's voice was taped so as to get the child used to the sound of his/her own voice. After this the child was asked to write down the spellings. The spellings incorrectly spelt were taped, the child firstly saying the whole word then the individual letters (using the letter names), then the word repeated. The tape was rewound and the child listened to the recording of the word and the individual letters. The child wrote the word as he/she heard it said.

3:3:8 Look/Say

The teacher said the word and showed the word written on a card for 10 seconds. The child was encouraged to say the word and look at it for ten seconds before it was taken away.

3:3:9 Tracing

The child was shown the word on a card. The child was asked to trace the letters as if writing them, with the index finger of the preferred hand.

3:3:10 No Teaching

Correct and incorrect responses received no instruction. No Teaching was always given last in order that it would provide the most conservative comparison with the other teaching methods.

The child's correct responses to the spellings each day were plotted on a graph to give a visual representation of their learning under each teaching strategy. The rates of learning were compared by visual inspection. Differences between rates in learning were tested for significance using the Mann Analysis of Trend.

3:4   Single cases

Background information

S.B., JR, JT and NP all initially attended the same school. The school's policy on the introduction of learning to read and spell is to use the Spelling Made Easy, Multisensory Structured Spelling by Violet Brand. All children are exposed to this programme to introduce them to spelling. However, since the school noticed that these children were all showing signs of difficulty, they all received individual help on an ad hoc basis from the SENCO when time was permitting. This teacher used Alpha to Omega order to help the children, in particular Sequencing the Alphabet and Initial Sounds. In addition when she felt it appropriate, she also used Hear it, See it, Say it, Do it by Mary Atkinson, books 1 and 3. Their classroom teacher was also given some work for the children to do out of these books.

The other two children had both recently arrived at the school with literacy problems. The school allows teachers training in special needs to teach children experiencing difficulties, and these two children each were allocated a specialist training teacher who used methods to teach the children as they felt appropriate. Since the two children had recently arrived at the school, their past literacy experience was unknown.

The detail of one of the children will be offered in this report. If detail of the other children is required, please refer to the Technical Report.

3:4:1   SB

S.B is a boy whose date of birth is the 5th June 1988. He is the youngest of 4 children, being the only boy, and with an age gap of 5 years between him and the next sister. There is a family history of reading, writing, spelling and mathematical problems, one sister in particular having difficulties with all the skills.

The mother reported having no problems with the pregnancy or birth, S.B. being nearly 7 lbs at birth. He reached his developmental milestones at the expected ages and had no problems with his speech development. There is no significant family medical history, although his sisters do suffer from asthma and hay fever. Vision and hearing have been checked and found to be within normal ranges.

His mother reported that S.B is slow with jigsaws, runs oddly and was slow learning to catch a ball. However, his hobbies are playing football and cricket.
His mother's main worry was S.B.'s slowness with reading and writing development. He had literacy support from school for 1 year in which the programme being followed in the classroom

was backed up by the SENCO. At the time of writing (June 1997), this had stopped since it was felt to be no longer necessary.

SB's cognitive profile

S.B's abilities were mainly average. He showed a particular strength to a well above average level in one test concerned with verbal reasoning.

S.B seemed to display a particular relative weakness in motor skills, such as leg co-ordination and imitation and handwriting. He found difficulty in maintaining sequence within information.

S.B achieved well in most tests involving phonology such as alliteration, phonemic segmentation, naming and fluency.

S.B. showed an underachievement in comparison with his average abilities especially within spelling, prose reading and writing, and number skills. He may be acquiring a central alphabetic strategy in word literacy.

S.B.'s BAS Reading Age was significantly lower than expected from his WISC Verbal IQ (p=.011) and from his Full IQ (p=0.18). His BAS Number Age was significantly lower than his Verbal IQ (p=.023) and from his Full IQ (p=.048). Differences with his Performance IQ were not significant.

In summary, S.B. was of average ability, with an underachievement especially in expressive written language and number skills, which may link to relative weaknesses in motor and sequencing skills. His patterning showed elements of a specific learning difficulty especially based within motor skills and related attainments.

SB's learning

S.B. learned effectively using Picture Association, Onset-rime, and Look-Cover-Write-Check methods. These may be regarded as involving a reduced motor demand which was found, along with sequencing, to be weak in S.B. Onset-rime used an initial phonemic analysis. Picture Association may reinforce a visual-semantic strategy. Look-Cover-Write-Check included a writing or motor element but may have been effective due to the procedure encouraging accurate visual analysis since other strategies encouraging motor skills were ineffective. Effective methods seemed to encourage S.B.'s processing strengths.

There were indications that S.B. initially learned more slowly using the Phonic and NLP methods but both led to a rapid acceleration of learning and completion of learning. This might suggest that S.B. acquired two useful strategies for learning spellings that he was then able to generalise and apply. These methods might well allow S.B. to utilise his phonic/phonological and visual strengths.

S.B. showed limited learning with Simultaneous Oral Spelling and visual inspection of graphs suggested that Tracing was not effective. Both methods may be dependent on S.B.'s weaker motor skills and related motor/kinaesthetic codings.

S.B. had made marked progress in literacy skills over the 15 month period of teaching input. Reading and spelling had moved from a below-average to a low-average level for his age. He had shown a marked development in phonic and alphabetic strategies on the ERN test and some improvement in his reading and writing of exception words. He may be compensating for motor and sequencing weaknesses and using his intellectual capability to build upon his phonic/alphabetic strategies in word level literacy.

Progress in each child's literacy skills over the course of the study is shown in Appendix 3:7.

SB's learning under the 10 teaching strategies

Graphs of number of words spelled correctly on each teaching day against day given

Programme 1 Phonics
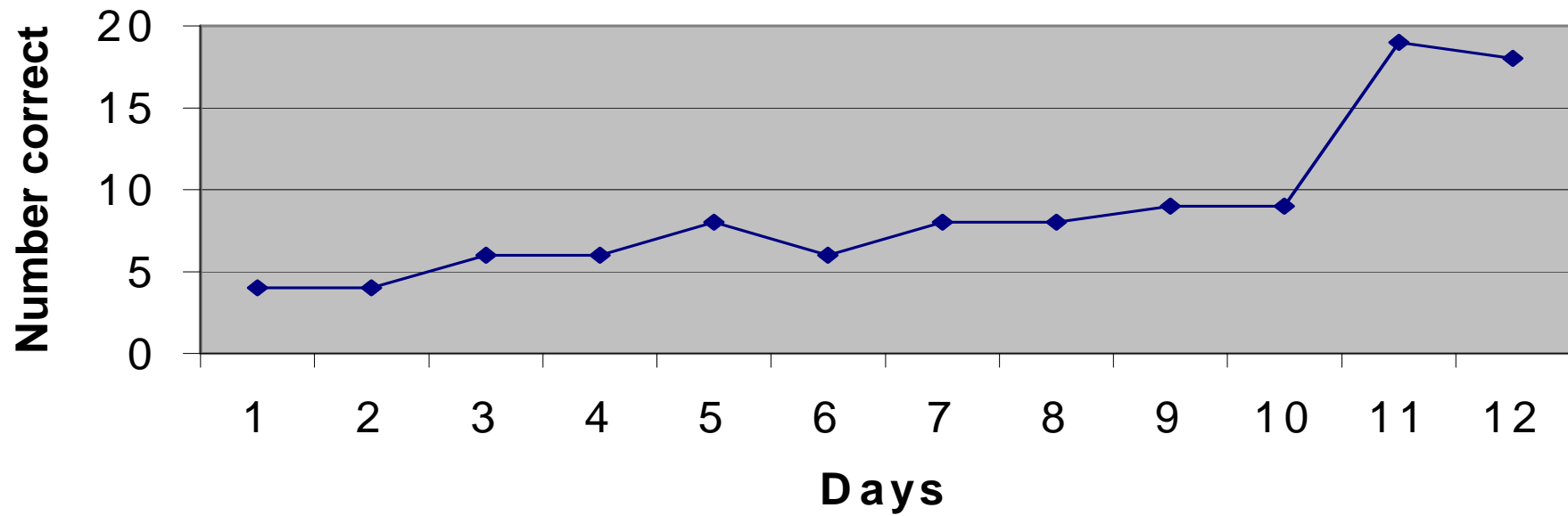
Programme 2 Look Say
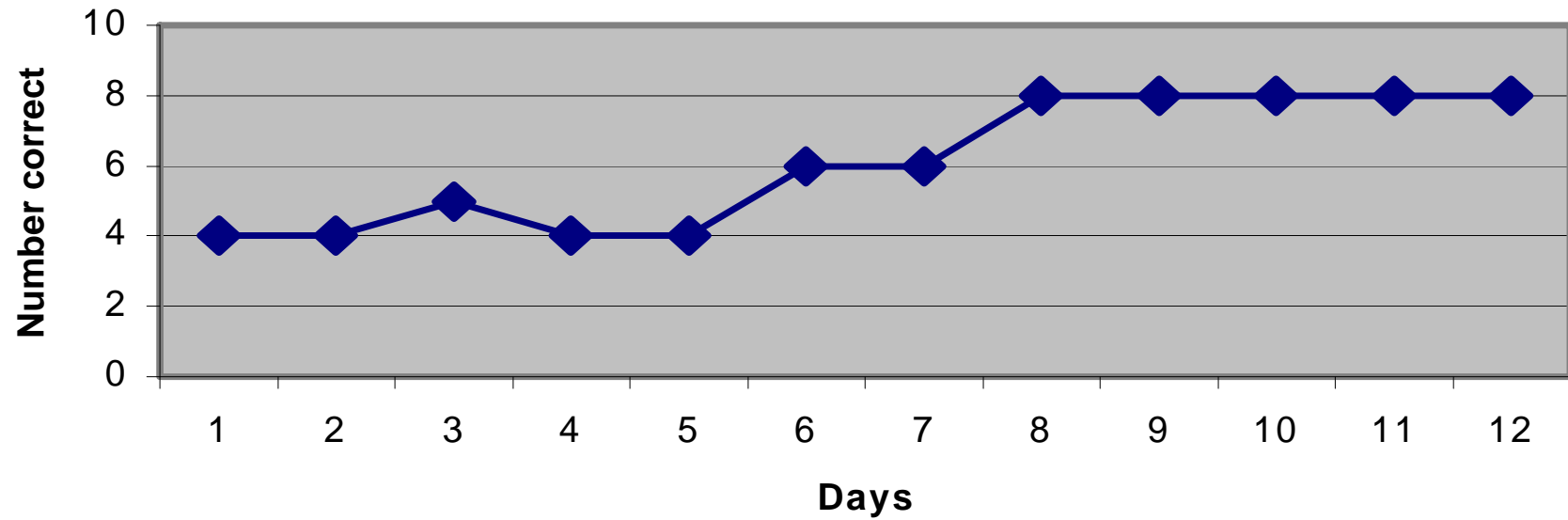
Programme 3 Tracing
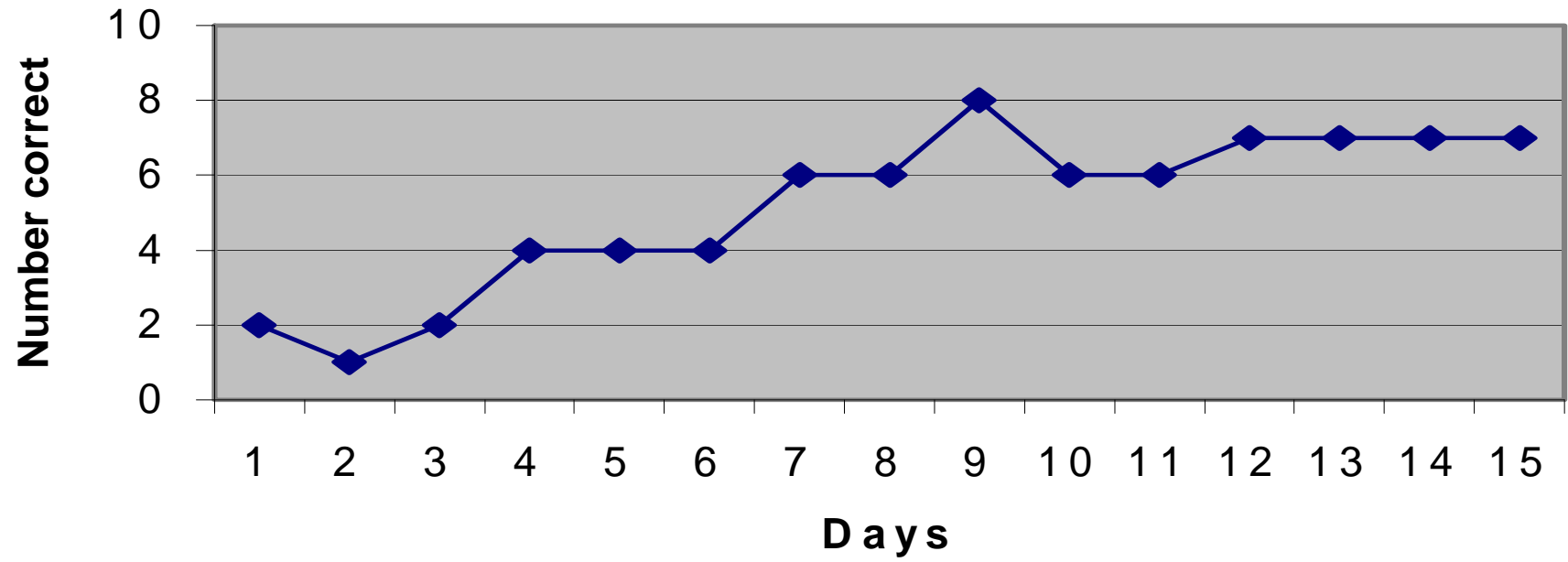
Programme 4 LCWC
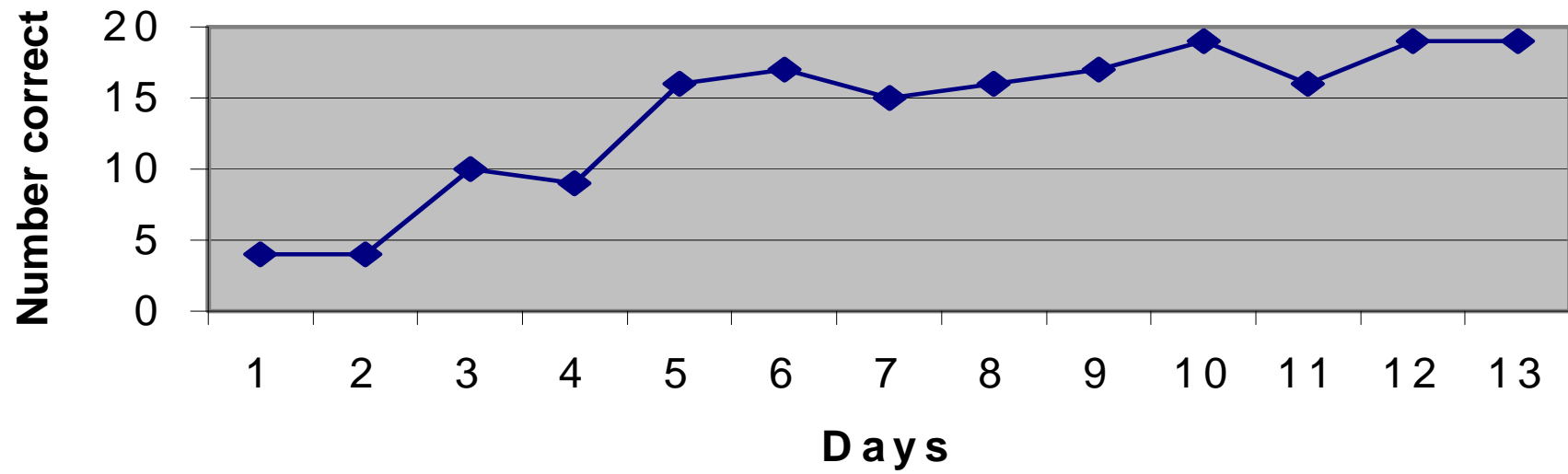
Programme 5 SOS
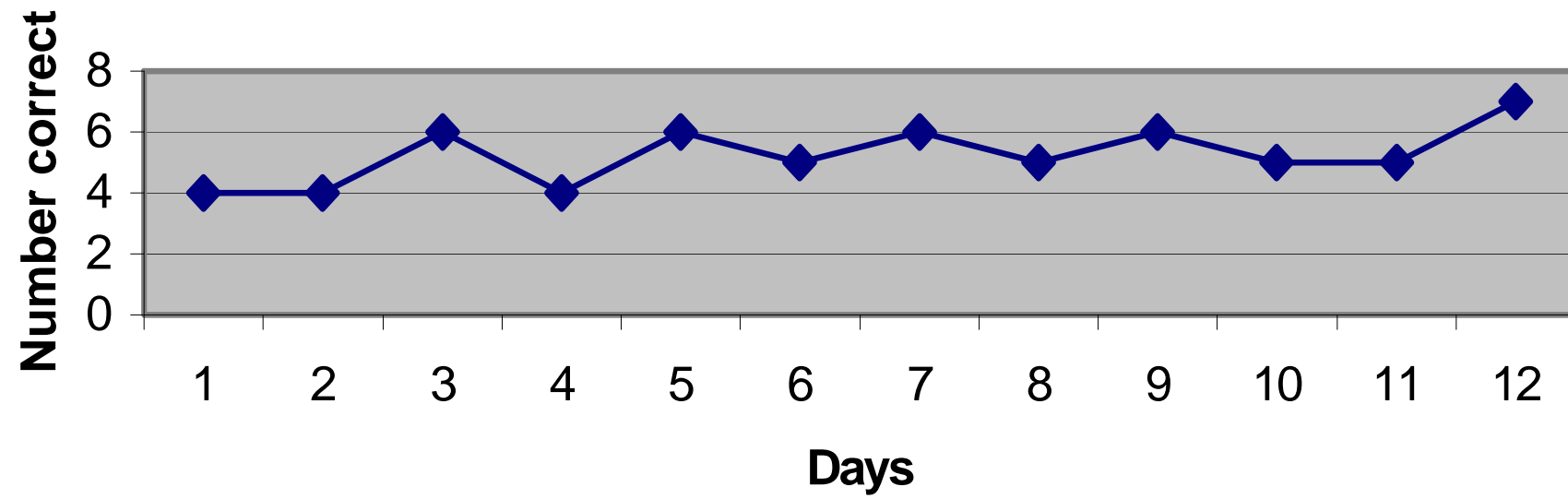
Programme 6 Onset Rime
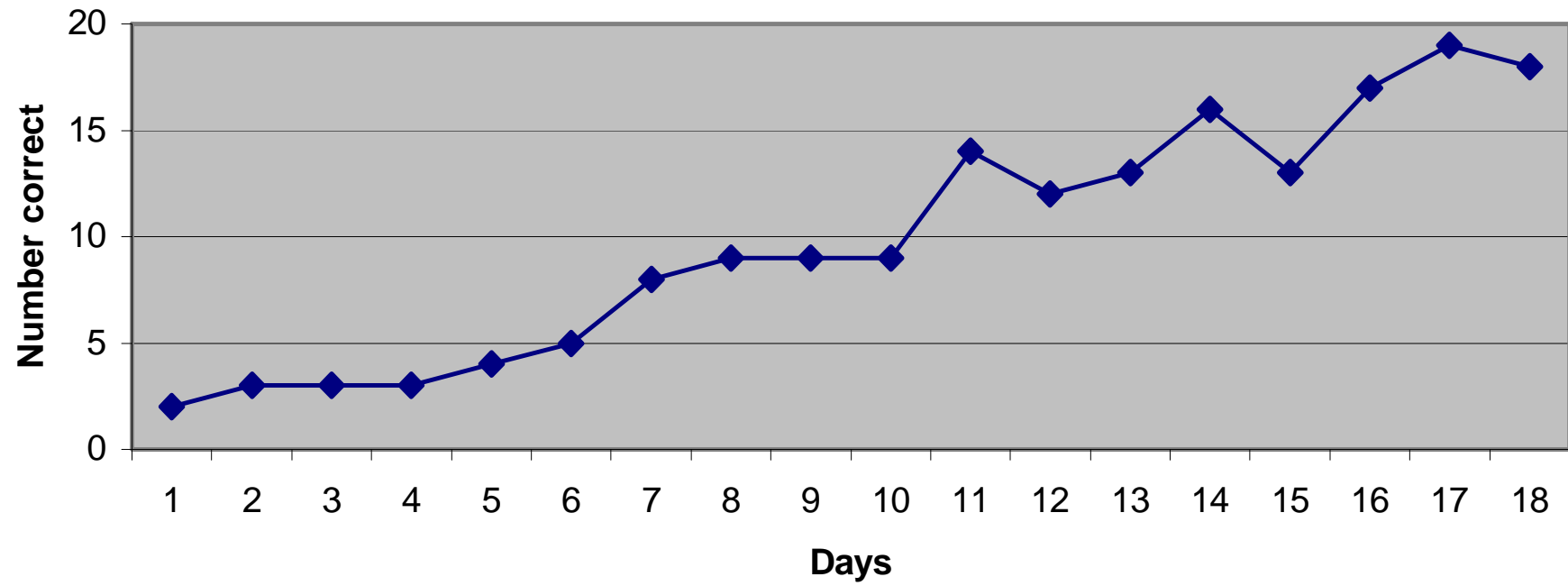
Programme 7 Picture Association
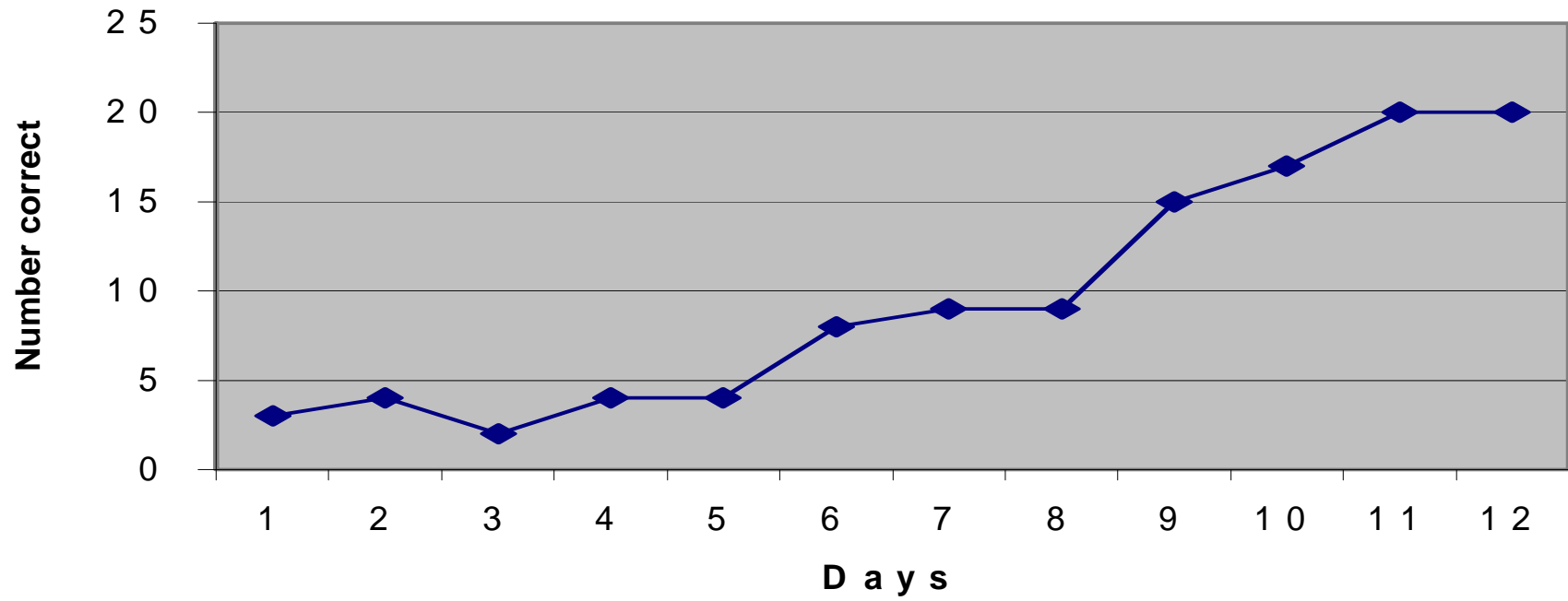
Programme 8 NLP
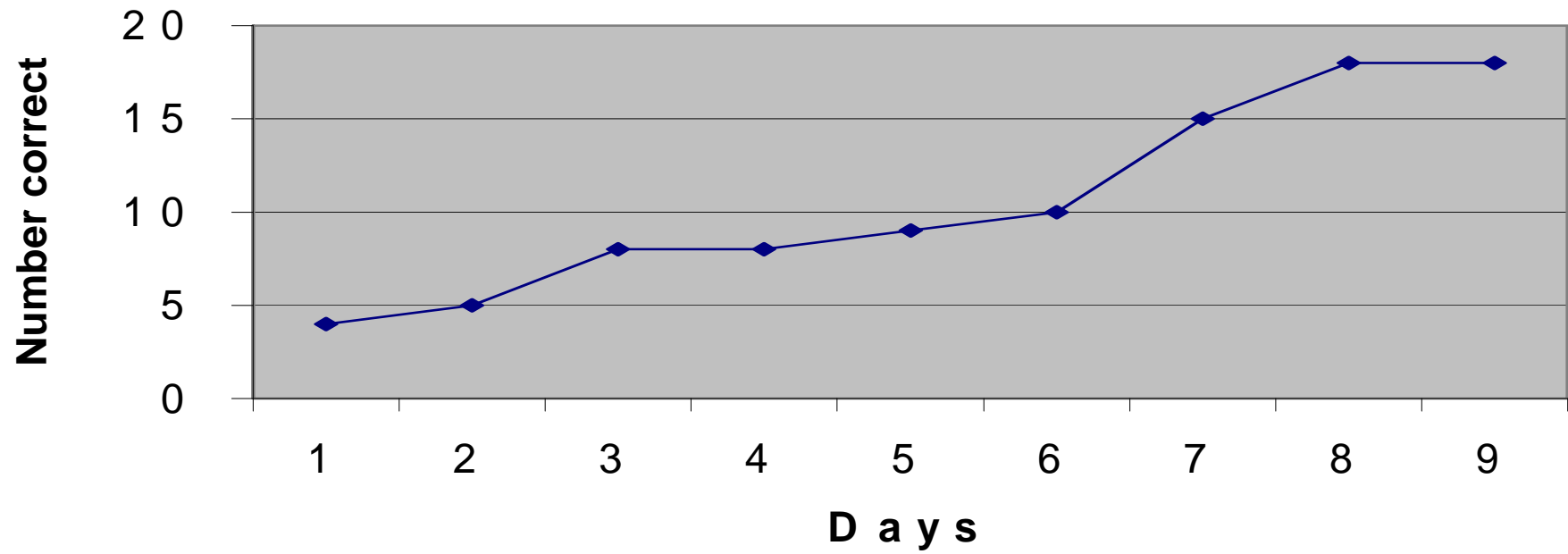
Programme 9 Own Voice
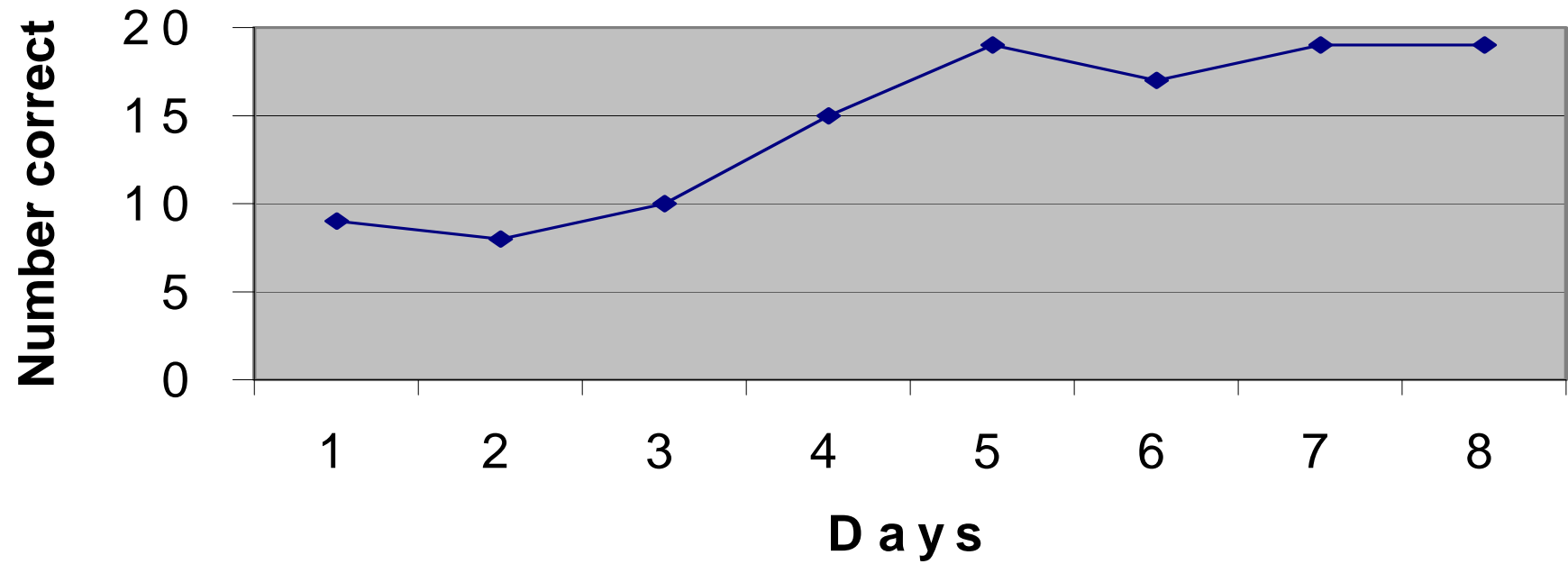
Programme 10 No Teaching

Y-axis: Number correct (6, 7, 8, 9)

X-axis: Days (1 2 3 4 5 6 7 8 9 10)
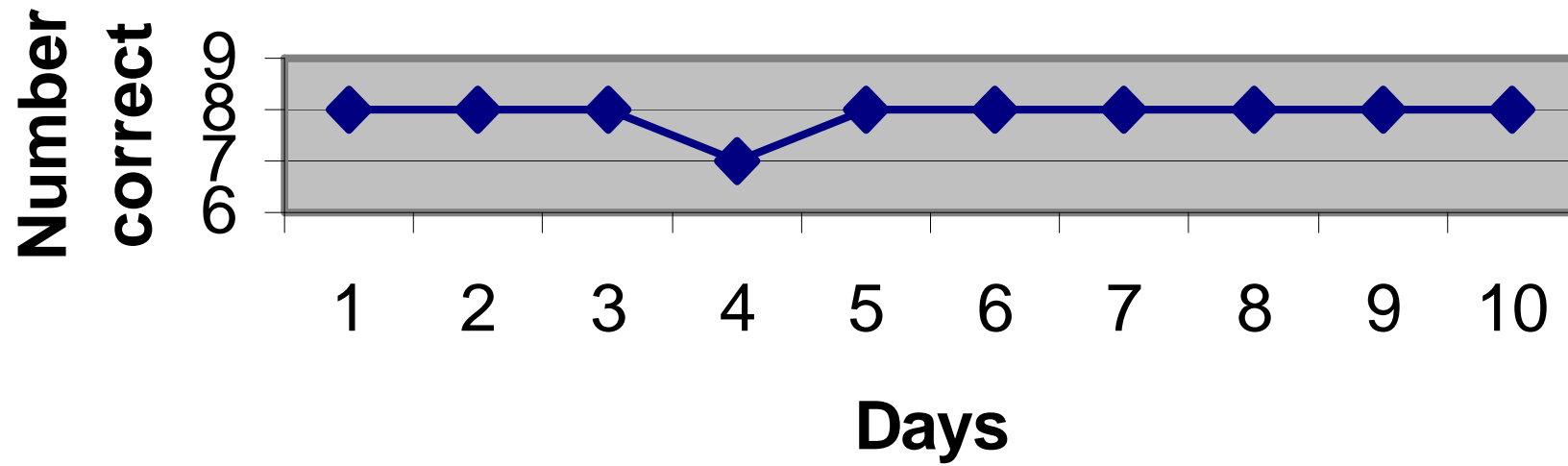
Table 1

S.B.: Significant differences between the learning of spellings achieved with each teaching strategy compared with each other using the Mann Test of Trend.

	OV	Pi	SOS	Ph	OR	LCWC	NLP	T	LS
NT	*	**	ns	**	**	**	**	**	ns
LS	ns	**	ns	ns	**	ns	**	ns	
T	ns	ns	*	ns	ns	*	**		
NLP	ns	ns	**	**	ns	ns			
LCWC	ns	ns	**	*	ns				
OR	ns	ns	**	ns					
Ph	ns	ns	**						
SOS	*	**							
Pi	ns								

ns	=	not significant difference
**	=	$p < 0.01$
*	=	$p < 0.05$

NT	=	No teaching
LS	=	Look say
T	=	Tracing
NLP	=	Neurolinguistic programming
LCWC	=	Look-Cover-Write-Check
OR	=	Onset-Rime
Ph	=	Phonics
SOS	=	Simultaneous Oral Spelling
Pi	=	Pictures
OV	=	Own Voice

3:4:2 CH

CH is a girl whose date of birth is the 10th April 1989. There is a family history of speech problems; and of reading, writing, spelling and mathematical delays. Motor development was normal but slow, along with speech development, and by the time CH went to school, CH was unable to communicate satisfactorily with the other children or teachers. No speech therapy was given.

CH's cognitive profile

CH showed average to low-average levels to many non-verbal abilities, and a relative strength in memory for visual designs. She showed marked weaknesses in tests concerned with visual search, and the use of visual form and detail.

CH's verbal abilities were largely low-average. She showed a strength in one test viewing verbal reasoning.

CH showed marked weaknesses in phonological skills including phonemic segmentation, alliteration, naming and fluency.

CH showed limitations to literacy development, and especially in terms of alphabetic sounds, word reading, nonsense word reading and spelling. She showed restrictions to orthographic and alphabetic approaches to reading and spelling. Literacy skills suggested a significant underachievement in comparison with her low-average abilities.

CH was making progress appropriate to her abilities in number skills.

C.H.'s BAS Reading Age was significantly lower than expected in comparison with her WISC Verbal IQ (p=.023), Performance IQ (p=.036) and Full IQ (p=.036).

In summary, CH was of average to low-average ability, with an underachievement in literacy skills, which may link to relative weaknesses in phonological skills and visual processing. Her patterning seemed typical of dyslexia or a specific learning difficulty.

CH's learning

Visual inspection of the graphs suggests that CH learned most effectively using Look-Cover-Write-Check. However, no teaching strategy was markedly successful or statistically better than no teaching.

CH continued to show marked learning difficulties. Her phonological skills remained markedly weak and may prove a particular obstacle to spelling. She may have used Look-Cover-Write-Check profitably in utilising her visual memory strengths. However, her key weaknesses mean that she requires much experience of phonology and the linkage of this work to reading and writing experience in order for even elementary word level literacy skills to become reliable.

3:4:3 CM

CM is a boy whose date of birth is the 3rd July 1989. There is a family history of speech, language and literacy problems within the family. Motor development was normal, while a speech problem was noted by the mother when CM was about 4 1/2 years old. The school are worried about C.M.'s progress, and are monitoring the situation; however, they report he is good at sequencing activities.

CM's cognitive profile

C.M.'s overall abilities were below average and ranged over a low-average to below-average span. He achieved less well in tests concerned with vocabulary, and the use of visual form and detail.

C.M.'s phonological skills were particularly weak in terms of alliteration, phonemic segmentation, naming and fluency.

CM showed limited literacy skills in his knowledge of letter names but especially in terms of his letter sounds and word recognition and production.

CM showed particular weaknesses in the development of number skills.
Motor skills seemed well developed.

C.M.'s BAS Reading Age was significantly lower than expected in comparison with his WISC Verbal IQ (p=.081). There were no significant differences with his Performance IQ or Full IQ.

In summary, CM was of below average ability, and may show some underachievement in writing, spelling and number skills. This may link to particular relative weaknesses in phonological skills. His patterning may show elements of dyslexia or a specific learning difficulty.

CM's learning

CM showed slow progress under any teaching strategies. His lower level abilities may have led to his responding best to clear simple strategies that were largely based in areas of relative processing strength. Visual inspection suggested that learning via Onset-rime, Simultaneous Oral Spelling and Look-Say may lead to some learning. Analysis of Trend showed no significant learning. It was felt that the processing strengths were largely subservient to the need for carefully differentiated and reinforced targets for this slower learner.

CM had limited literacy skills to the end of the study. He continued to show very limited phonological skills. CM would require phonological training as for C.H., and a special emphasis made upon a very carefully structured learning programme in early reading and writing vocabulary.

3:4:4 NP

NP is a boy whose date of birth is the 4th October 1989. He is the youngest subject in the research. He has one brother and comes from a large extended family who speak both Gujurati and English at home. His brother has had a problem with learning to spell but there is no other family history of literacy problems. NP was reported as having no history of speech problems and he has received no specific assistance in English as a second language.

NP's cognitive profile

N.P.'s abilities were below average. He showed relative strengths to about average levels in vocabulary, and visual memory and discrimination. He showed relative weaknesses in verbal reasoning and comprehension, and more sophisticated non-verbal reasoning.

NP showed strengths in drawing skills.

NP showed particular weaknesses in phonological skills including alliteration, phonemic segmentation and fluency.

NP showed limited development in literacy skills, and in orthographic and alphabetic approaches to word reading and spelling. He may demonstrate some underachievement in written language.

NP's number skills were consistent with his age and intellectual development.

NP's BAS Reading Age was significantly lower than expected in comparison with his WISC Verbal IQ (p=.081). There were no significant differences with his Performance IQ and Full IQ.

In summary, NP was of below average ability and has made a limited beginning to the development of literacy skills, which may be influenced by particular relative weaknesses in phonological skills. He may show elements of dyslexia or a specific learning difficulty.

NP's learning

NP was of marked concern early in his teaching programmes due to his slow progress and uncertain application. However he learned spellings effectively using NLP and showed significant learning with phonics. It would appear that NLP was able to tap his visual memory and discrimination strengths. Phonics may have given a detailed and structured means for learning that especially suited his lower abilities and restrictions to "higher level" reasoning. It was of interest to note that despite N.P.'s below average ability it was possible to establish clear learning and strategy preference in contrast to CM where this proved difficult.

NP found particular difficulty in learning with Picture Association and learning with Own Voice appeared limited on visual inspection of graphs. These methods may generally be less effective and would not tap N.P.'s relative strengths in processing. NP showed no clear ability to generalise the use of a strategy, such as NLP or Phonics.

NP made very limited advances in literacy skills over the course of this study. He showed limited initial whole-word or phonic approaches to reading words or spelling. His phonological skills were poor on re-test. It seems likely he would benefit from the use of NLP to develop a

whole word approach, and work upon a phonological linkage method might develop a more consistent use of phonological skills and initial phonic skills in written language.

NP seemed to largely demonstrate a learning difficulty that was independent of issues of English as a second language. The difficulty instead may be centrally based in slow overall levels of intellectual development. It is, however, likely that phonological skills may be made less consistent by his considerable experience of another system of language.

3:4:5 JR

JR is a boy whose birthday is the 19th June 1988, and he is a non-identical twin. There is a family history of delayed speech and literacy problems. There was no delay in milestones.

JR's cognitive profile

J.R showed many aspects of average verbal ability, especially in terms of his vocabulary, verbal reasoning and comprehension. He showed weaknesses in verbal memory, and in verbally-based knowledge and learning.

JR showed particular strengths to well above average levels in tests concerned with visual search and discrimination. He showed weaknesses in tests concerned with visual memory.

JR showed weakness in phonological skills in terms of rhyming and phonemic segmentation. His fluency and naming skills seemed satisfactory.

JR knew alphabet sounds and names. He showed an underachievement in reading tests, but satisfactory levels in spelling. He showed quite successful initial orthographic approaches to reading, and alphabetic approaches in spelling. His reading suggested a significant underachievement in comparison with his verbal abilities at average levels.

JR was achieving satisfactorily in number skills.

JR's BAS Reading Age was significantly lower than expected in comparison with his WISC Verbal IQ ($p=.014$), Performance IQ ($p=.013$) and Full IQ ($p=.013$). There were no significant differences between his BAS Number Age and IQ's.

In summary, JR was of average ability, with an underachievement in reading, which may link to relative weaknesses in phonological skills, verbal memory, visual memory and verbal learning. His patterning seemed typical of a child with dyslexic features or a specific learning difficulty, although underachievements were not marked in expressive written language and mathematics.

JR was able to apply a range of teaching strategies successfully. He learned spellings particularly well using NLP, Own-Voice and Onset-Rime. These might be interpreted as suggesting that NLP sponsored visual strengths; Own-Voice and Onset-Rime may have built upon JR's phonological skills and enabled him to begin to develop a more effective verbal memory and phonic skills in literacy despite central relative processing weaknesses in verbal memory and learning.

JR showed a rapid implementation of Own-Voice and NLP which appeared to be soon generalised across spelling learning demands.

JR found Tracing particularly ineffective. This strategy seemed unable to tap any motor strengths in JR along with other subjects.

JR had made progress in literacy skills in general terms over the course of his teaching input, although he continued to show some underachievement to low average levels in his spelling. His reading was now average. He had acquired initial phonic skills especially within reading. Further work might build upon his whole word memory via NLP, and offer a structured framework for the development of phonic rule-based approaches. These phonic approaches may be supported via Own-Voice techniques in building memory, and a current focus upon onset-rime divisions in phonic skills.

3:4:6 JT

JT is a boy whose date of birth is the 23rd June 1988. There was no history of literacy problems and JT gained his milestones normally.

JT's cognitive profile

JT showed verbal abilities at average to low average levels.

JT's non-verbal abilities were well below-average. He showed an average relative strength in a test requiring practical observation. He showed particular relative weaknesses in tests concerned with visual memory and matching, and the use of visual orientations.

JT showed particular weaknesses in verbal fluency and naming.

JT showed weakness in literacy skills and especially in terms of prose reading, prose writing, and his initial spelling whole word memory. His literacy development suggested a significant underachievement in comparison with his low-average verbal abilities.

JT's number skills seemed consistent with his development.

JT's BAS Spelling Age was significantly lower than expected in comparison with his WISC Verbal IQ (p=.048). There were no significant differences between the Reading Age and Performance IQ and Full IQ, or between BAS Number Age and I.Q.'s.

JT showed weaknesses to motor skills including arm and leg co-ordination, and imitation.

In summary, JT was of average to low-average verbal ability, with an underachievement in literacy skills, which may link to relative weaknesses in visual processing and motor skills. His patterning seemed typical of a child with dyslexic features or a specific learning difficulty with particular relative weaknesses in visual processing.

<u>JT's learning</u>

JT made good progress using NLP and showed significant learning using Look-Say. He showed a range of relative weaknesses in processing with visual, auditory and motor skills. These teaching methods established viable visually-based pathways for learning spellings despite visual weaknesses, although there may not have been an especially strong cognitive medium through which he could develop. NLP seemed a technique that he acquired and then rapidly used generally within his learning.

JT made limited progress using Simultaneous Oral Spelling and Tracing which might focus upon motor areas of weakness in processing. Picture Association again proved unsuccessful although this was generally not particularly helpful across the subjects.

JT had developed limited literacy skills; he had begun to show a whole word memory and initial phonic skills in reading. He would benefit from the use of NLP to extend whole-word approaches to word-reading and spelling. His phonological skills were poor on re-test and he would be likely to benefit from a phonological linkage programme in order to develop a more consistent use of sounds in language and initial phonic skills in written language.

3:5   Discussion

NLP, Look-Cover-Write-Check and Onset-Rime were the most effective strategies across all subjects. NLP offered the learner a focus in visualisation techniques to assist visual learning, and a linkage to broader orthographic issues such as the word, its meaning and elements contained within the word such as other words. Generally, the word was discussed more in this technique than the others. Look-Cover-Write-Check offered a clear technique for concentrating on a visual whole word learning of the word through writing, and especially checking, and may also offer support through the motor/kinaesthetic elements of writing. However any impact of such motor support is not extended by positive results in the strategies containing these elements such as Tracing or Simultaneous-Oral-Spelling. Onset-Rime offered a level of phonemic analysis and division that seemed particularly helpful to these early readers and spellers. This analysis was linked to orthography and demonstrated in letter forms. It appeared that NLP may be a strategy that is easily generalised and used across learning situations, and different spellings, by children of this late-infant and early Junior age range. The linkage of both visual and phonemic methods to orthography supports the work of Hatcher, Hulme and Ellis, (1994).

Tracing was the least effective strategy across all subjects. It would appear that most children found difficulty in tapping their apparently normal motor skills in learning spellings. This finding runs counter to the multi-sensory elements of many teaching frameworks and does not offer support to Bradley, (1981), Hulme, (1981) and Hulme et al (1987). Simultaneous-Oral-Spelling was similarly not a very effective strategy. S.B. did show relative weakness in his motor skills and the ineffectiveness of these two strategies for him may consequently be anticipated when linking cognitive strengths and weaknesses to the nature of teaching strategies

and their effectiveness. Own-Voice was not effective and did not appear to generate a more effective memory and learning for most children.

It is interesting to contrast the effectiveness of strategies between children who seemed more typically to have dyslexic features, or showed a clear underachievement in ability and literacy skills, and those who seemed to be generally developing at slower rates. S.B., JR, and JT showed many typical dyslexic features with weaknesses in processing in motor/sequencing, verbal and verbal/visual/motor areas. This dyslexic featured sample found NLP and Onset-Rime particularly effective. It might be assumed that these methods enable children with dyslexic features to learn by tapping visual strengths and offering a suitable entry to an area of verbal weaknesses as described in the opening paragraph of this discussion. Teaching to strengths and weaknesses may be effective for young children with dyslexic features. Children with moderate learning difficulties, and especially C.M., did not so readily demonstrate learning successes and failures. However, successful strategies were demonstrated for NP and, to a lesser extent, CH Children with moderate learning difficulties may show broader developmental and intellectual weakness, and may often have the most severe difficulties in learning spellings, and it may consequently be difficult to make any generalisations regarding teaching strategies. However, there are indications that consideration of cognitive profile and learning can be helpful to all individuals.

The single case results offer compelling evidence that it is possible and productive to relate teaching and learning methods in literacy (and especially spelling) to cognitive development and profile, including intellectual/semantic, verbal, phonological, visual and motor elements, as well as to development or stages in literacy development. Literacy development may in part be illustrated by a test such as the Exception/Regular/Nonsense reading and spelling. The Helen Arkell Spelling Test may offer a fuller and better standardised view of any person's current strategies in spelling. Cognitive profile may be assessed through a package such as described in the section 2:7. Effectiveness of teaching may be assessed by graphing development and inspecting rates of learning, and may also be simply and effectively tested through the Mann Analysis of Trend.

The total number of words learned over each teaching programme and percentage retained over time are shown in Appendix 3:7. The number of words retained, and accurately read and spelled, were checked 6 weeks after a teaching programme finished, and again after 3 months. The teaching of spelling had an impact on reading and S.B. and JR generally read all words accurately at the end of any teaching programme. Where effective learning took place (showing significant differences on the Analysis of Trend), children retained on average 80% of spellings over 3 months, with a range of 50% to 100%.

The teaching programmes used in this project seemed to effectively test learning of spellings on similar levels of words over the 15 months of this project. Rates in development in literacy in children were not sufficient to make levels of spelling too easy or inappropriate for teaching. This may in part be affected by selecting children with actual and likely difficulties in literacy. There were however some indications that S.B. acquired improved alphabetic strategies in spelling and improved levels of spelling which were reflected in his performances on his last two strategies, Own-Voice and No Teaching.

Findings can be contrasted with work on senior school age children (Brooks, 1995). It appears that teaching can be effective to strengths for the younger children in the current study, but that

teaching to weaknesses can be effective if it is suitably judged especially in terms of the levels of phonemic skills at which to teach. Older students were taught successfully with teaching to strengths but not to weaknesses. It may be that they were students with severe dyslexic features, whose marked difficulties in phonology and language processing had led to limited responses to highly structured phonic and rule-based teaching over 4 to 6 years. The responses of milder older students with dyslexic features to teaching to strengths or weaknesses would be of interest.

It might be hypothesised that certain strategies would be particularly appropriate to certain words. For example, Phonics might match phonically regular simple words; Onset-Rime might match words in rhyming families; L-C-W-C, Look-say and NLP might match less phonically regular words. Evidence suggested that most effective strategies succeeded across irregular and regular word types. Phonics may be an exception in being tailored to, and much more successful, in regular words. Phonics may consequently have a particular function in specific phonic and
rule-based programmes for reading and spelling, and also offer a carefully defined learning programme that can be especially appropriate to slow learners.

3:6   Conclusions

The single cases showed that we can effectively find a relationship between the teaching of spelling, cognitive profile and development in literacy for those with dyslexic features and often for those with moderate learning difficulties. Those with dyslexic features may show a clearer relationship between these features than the generally weak and often much more troubled development of those with moderate learning difficulties. There is, however, considerable individuality to these relationships in both those with dyslexic features and those with moderate learning difficulties.

3:7   Appendix to Chapter 3

Table 2

Table of children's ages and their scores shown in centiles before and after the research programme in reading and spelling.

		Age	BAS reading centile	HAST spelling centile
SB	Initial	7.4	5	10
	Final	8.7	38	35
CH	Initial	6.7	0	5
	Final	7.1	3	5
CM	Initial	6.4	4	5
	Final	7.7	4	5
NP	Initial	6.1	<7	5
	Final	7.4	4	5
JR	Initial	7.5	12	10
	Final	8.8	50	20
JT	Initial	7.5	4	5
	Final	8.8	5	5

CHAPTER 4:   ANALYSIS OF THE RESPONSES TO 3 DIFFERENT STRATEGIES FOR TEACHING SPELLINGS OF GROUPS OF CHILDREN WITH DYSLEXIC FEATURES, MODERATE LEARNING DIFFICULTIES AND WITHOUT DIFFICULTIES - (STAGE 3)

The project has been divided into several stages, Stage 1 developed a detailed picture of the cognitive profiles of children with no signs of difficulties in literacy acquisition. Stage 2 of the project investigated in detail the acquisition of spellings in six individual children with dyslexic features and children with moderate learning difficulties, exposing them to ten different methods of teaching over a period of 15 months. This showed that it is possible to find a relationship between the teaching of spelling, cognitive profile and development of literacy for children with dyslexic features and those with moderate learning difficulties.

Stage 2 also highlighted the most effective teaching strategies across all the subjects. Look-Cover-Write-Check and Onset-Rime were effective strategies. Neurolinguistic Programming (NLP) offered the learner a successful method of developing a visualisation technique to assist learning as well as a linkage to broader orthographic issues. Tracing was a less effective strategy across all subjects.

Having confirmed in Stage 2 that there is a relationship between teaching interventions and the cognitive profile of children, it is necessary to expand that important finding to examine whether children with differing cognitive profiles acquire literacy skills in the same way, varying ways, or the same way but at differing speeds.

Examination of slow literacy acquisition in the Isle of Wight study (Rutter, Tizzard and Whitmore 1970; Yule 1973 and Rutter and Yule 1975) indicated that children with moderate learning difficulties generally displayed slow maturation and progression in cognitive skills and literacy was normal but slow. In contrast, the literacy development of children with dyslexic features was hampered by specific cognitive and phonological difficulties. It is therefore reasonable to postulate that these two groups of children will not respond equally to the visual, meaningful and phonic based teaching methods. In contrast to the findings from the Isle of Wight study, was work by Brooks (1991), who found that children with moderate learning difficulties were in fact displaying evidence of considerable weaknesses in phonological skills and other cognitive development which caused a major impact upon their literacy development.

There has been much consideration of the differences between children with dyslexic features and those with moderate learning difficulties in cognitive make-up (see, for example, Snowling, 1991, and Stanovich and Seigal, 1994). However, there is limited evidence on the relative differences in literacy acquisition between those with moderate learning difficulties and those with dyslexic features and effects of different teaching methods; see Brooks and Weeks (1998) for a recent publication. This evidence is, however, crucial in applying appropriate remediation to members of those groups, and in delivering suitable teaching programmes, provisions and training across schools.

Research is needed therefore to attempt to clarify these discrepancies which result in the understanding of literacy acquisition still being far from tangible and clear. Stage 3 of our study adopts a group experimental approach in order to observe whether the single case

findings can be replicated in group conditions or if there are qualitative and/or quantitative differences between groups. The groups comprised of children with dyslexic features, those with moderate learning difficulties and those with no difficulties (acting as a control group).

The children with dyslexic features were briefly tested to ascertain their strengths or weaknesses in visual, phonological and auditory development in order to have an understanding of aspects of their cognitive makeup which could affect their acquisition of spellings. In order to formulate the other groups, classes of children were given spelling and reading tests so as to have matched reading and spelling ages across all the groups. Verbal ability testing was undertaken on the children with moderate learning difficulties in order to formulate a group with an I.Q. level approximately 1 S.D. lower than the mean of the other two groups. We were able to gain access to the detailed information the school had on the children with dyslexic features to ensure their I.Q. levels were within a normal range.

Three teaching techniques were chosen from the 10 offered in Stage 2. NLP and Onset-Rime were selected as they demonstrated a contrast between visual and phonic approaches. NLP, at the same time, relies on a semantic input, tapping another strength in children with dyslexic features. NLP also was a method commonly liked by the single case children and this in itself seemed a justification for its selection. Onset-Rime is a method increasingly commonly used in schools and, since it focuses on phonology, argued to be weak in children with dyslexic features but possibly not in those with moderate learning difficulties, it was essential to include this method. It has been shown to offer an in-road into this area of difficulty for children with problems in literacy development (Hatcher et al, 1994, and Snowling, 1996)

Our previous work found Tracing of less value. However, since it provides a third motor/teaching to strengths format and has been found useful in many studies (Bradley, 1981, and Hulme, 1981), as well being a method used in schools, it was decided to include it in the third stage of our research.

The questions directing this investigation were threefold: do children with dyslexic features learn more effectively with visually and meaningfully based teaching methods matching their strengths and less well in phonic methods which are more dependent on their weaknesses?; do children with moderate learning difficulties learn in the same way as children with no difficulties, just more slowly?; and, lastly, do children with no difficulties learn equally well whatever technique is applied?

This stage of the research was guided by 4 hypotheses:-

1)   Due to the discrepancy between children with dyslexic features' overall intellectual development and their phonological processing skills, it was hypothesised that the visual and meaningful teaching method, namely NLP, would prove to be a more powerful method of retaining spellings for children with dyslexic features than the phonological method since Onset-Rime relies on an awareness of the correspondence between orthography and phonology, an area weak in children with dyslexic features.

2) Since children with moderate learning difficulties are generally slow in their intellectual development, they would learn normally but slowly, and might benefit from all three teaching methods

3) The children with no difficulties would in general acquire their spellings with less difficulty and at a faster rate than the other two groups, responding equally well to visual, meaningful and phonic methods.

4) Tracing would be less successful since in Stage 2 it was found to be a less helpful method.

4:1 Method

4:1:1 Design

This project adopts a two-pronged approach to researching the effectiveness of differing teaching techniques, a micro as well as a macro-perspective. Stage 2 was composed of the micro-examination of the relationships between teaching techniques and the individual child's cognitive profile. This stage, Stage 3, adopts a macro or gross examination of the relationships between 3 interventions and 3 differing groups of children, in order to ascertain if the effects found in stage 2 can be transposed into a group situation, representing a more "real classroom" approach, and testing the generalisability of the findings from Stage 2.

4:1:2 Participants

There were 12 children in each of three groups: children with dyslexic features, those with moderate learning difficulties and spelling age matched children with no difficulties (the control group).

The children with dyslexic features attended a local authority junior school which had a special unit attached for children with specific learning difficulties. The process of selection involved discussions with the special needs teacher, who selected children she felt were appropriate for the research both from the difficulties they presented with, but also since they were children for whom the research would not be a disruptive experience. The selected children undertook a Vernon Graded Word Spelling Test, and an NFER Nelson Group Reading Test in order to match the other two groups of children. A British Picture Vocabulary Scale was also administered in order to have a measure of verbal ability to ensure it was at least of average level.

The group of children with moderate learning difficulties attended a school for "moderate learning difficulties" with a similar catchment area to the children with dyslexic features' school. They were chosen since they had I.Q. scores which were 1 S.D. below the mean, (BPVS), and low reading and spelling scores, matching the children with dyslexic features'. They were also selected as being children for whom the research would be seen to be a positive experience and would not be upset in any way by it.

The control group of children without difficulties was chosen from a local primary school. Three classes in the school were given the Vernon Graded Word Spelling Test. Those who scored at a matched age to the group with dyslexic features were selected out and given the NFER Nelson Group Reading Test to ensure an adequate match with the children with dyslexic features and those with moderate learning difficulties. The BPVS was administered to give a picture of average ability.

An attempt was made to achieve an equal balance of male and female children in each group. However, that was not possible in the group with dyslexic features, 25% of whom were boys, 75% girls. This balance happened to reflect the Unit for Specific Learning Difficulties at that time, but is opposite to the bias usually assumed for such specific learning difficulties. It is, however, noted that numbers referred to the Helen Arkell Dyslexia Centre and to units in Hampshire have been much more even between the sexes. There may be some impact of relative concerns for boys' and girls' education and their referral. Also, girls may have been viewed in the current research sample as being more able to manage the research's necessary commitments by their teachers. In the group with moderate learning difficulties, 42% were boys, 58% girls, and in the group with no difficulties, 50% were boys, 50% girls.

Data describing the experimental group:

Table 3

Mean chronological ages, I.Q.s, reading ages and spelling ages of children with dyslexic features, moderate learning difficulties and without difficulties.

	Chronological age	IQ	Reading age	Spelling age
Dyslexic features	8.7 (S.D. 8.6) (R. 7.8 - 10.6)	95 (S.D. 9.4) (R. 65 -112)	7.1 (S.D. 7.5) (R. 6.0 - 7.10)	7.0 (S.D. 8.2) (R. 6.2 - 7.10)
Moderate learning difficulties	11.9 (S.D. 10.8) (R.10.8-14)	66 (S.D. 14.8) (R. 39 - 86)	7.3 (S.D. 5.9) (R. 6.6- 8.0)	7.4 (S.D. 5.8) (R. 6.2-8.2)
No difficulties	6.9 (S.D. 4.3) (R.6.3-7.4)	109 (S.D. 13.4) (R. 89 - 133)	6.11 (S.D. 9.7) (R. 6.0- 9.0)	6.11 (S.D. 5.5) (R. 6.4-7.10)

The data are presented as :- Mean score
                                 (Standard Deviation)
                                 (Range)

Age scores and age range are given in years. months
S.D.'s are given in months for age scores.

4:1:3 Materials

Each child was taught 15 words to spell in each week's instruction period. There were 4 sets of words randomly assigned to the participants and teaching periods. These sets of words were matched for length, grammatical form (ie whether noun, verb, adjective, preposition or adverb), orthographic regularity and imagibility (as Coltheart et al 1983). These words were the most difficult of the 20 used in Stage 2 in each teaching set.

4:1:4 Procedure

The sets of words were allocated to each subject in each experimental group so that there was a balance between each group under each teaching method and ordering of teaching. Each subject had a set of words allocated to be taught by the Onset-Rime, NLP and Tracing method, as well as a No Teaching condition acting as a check on general progress in spelling over the period of the study.

Each group took three weeks to complete the experiment. On the first Monday for each group, the children completed their attempt at the 15 words chosen for the week's teaching. The baseline score was noted, in other words the original number of correctly spelled words. Each error was drawn to the child's notice and taught according to the teaching method allocated for that child in that week. This process was repeated on the Tuesday, Wednesday and Thursday. On the Friday, the child simply wrote the spellings down but was no longer taught the incorrectly spelt words, this score acting as the end score after teaching.

The following 2 sets of spellings were administered using the same procedure as the first set, but being taught according to the method allocated for each individual child for the allotted week.

Also on the first Monday for each group, a "No Teaching" measure was taken. The child was asked to spell a set of 15 words for which no correction or teaching was given. At the end of the 3 weeks the child again wrote out the 15 spellings. This procedure was undertaken in order to assess any changes that may have occurred through the 3 weeks regardless of the experimental teaching.

4:1:5 Teaching strategies

Please refer back to Chapter 3, Section 4 for the details on the teaching strategies. In this stage of the research, Onset-Rime, NLP, Tracing and No-Teaching were used.

4:2 Results

4:2:1 Results of teaching using NLP, Onset-Rime and Tracing methods to teach the three groups.

Summary results of the word spellings can be found in Table 4. The number of words learned for each child under each method was calculated by subtracting the number of words spelled correctly on each Monday session from the number correct on each final Friday session.

Table 4

Increase in number of words spelled correctly for the dyslexic features, without difficulties and moderate learning difficulties groups, using NLP, Onset-Rime and Tracing methods.

	NLP	O-R	T
Dyslexic features	5.00 (SD 2.2) (R 0-8)	4.08 (SD 1.7) (R 1-8)	4.33 (SD 1.7) (R 3-8)
No difficulties	4.83 (SD 2.3) (R 0-8)	4.50 (SD 2.4) (R 2-9)	3.42 (SD 2.4) (R 0-7)
Moderate learning difficulties	5.00 (SD 2.5) (R 1-8)	5.83 (SD 2.6) (R 2-10)	3.58 (SD 2.1) (R 0-7)

The data are presented as:- Mean number of words learned
                                    (Standard Deviation)
                                     (Range)
Number of words learned could range from 0-15 words correctly spelled.

Results indicate that Tracing achieved weaker retention than either Onset-Rime or NLP, however still achieving some improvement (a nearly significant result at $p < 0.05$).
However, for the group with dyslexic features, Tracing was more helpful than Onset-Rime.
Onset-Rime proved to be the strongest teaching method for the group with moderate learning difficulties, while Tracing was the weakest method for this group. NLP was the strongest teaching method for those with dyslexic features. However differences between groups, between teaching methods and interactions between these variables were not statistically significant, One Between and One Within Participants Variable ANOVA ($F = 0.45$,
$df = 2.33$, p ns : between groups of participants; $F = 2.97$, $df = 2.66$, p ns : between teaching methods; $F = 1.03$, $df = 4.66$, p ns : interaction between groups and methods). However, all methods resulted in significant learning across groups. Analysis of progress in spelling was undertaken using a One Between and One Within Subjects variable ANOVA ($F = 3.37$,
$df = 2.33$, p <0.05 : between groups; $F = 5.04$, $df = 1.33$, p<0.05 : between pre and post test scores; $F = 0.70$, $df = 2.33$, p ns : interaction between groups and test scores).

4:2:2   Visual and phonological versus phonological dyslexic features.

Cognitive testing on the children with dyslexic features was undertaken in order to be used as a gauge against the spelling attainments. The testing allowed a "crude" analysis of the strengths and weaknesses of each child within this group and thereby proposed whether the child was primarily weak in visual and phonological skills, or primarily in phonological skills. This has relevance when examining the child's performance under each teaching condition.

Visual skills were assessed using tests from the Wechsler Scale WISC Coding and Object Assembly (Object ass). Phonological skills were analysed using WISC Digit Span (D. Span), and Phonological Assessment Battery (PhAB) tests, namely Rhyme and Alliteration (Allitn). The I.Q score was achieved using the BPVS.

Table 5

Visual and phonological skills of each child with dyslexic features as revealed by WISC., PHAB and BPVS tests.

		C.A.	Coding	Object ass.	D. span	Rhyme	Allitn.	IQ
S1	F	8-5	10	13	8	12	10	9
S2	F	8-10	12	11	5	8	9	11
S3	F	9-1	11	13	4	6	10	10
S4	F	8-1	8	13	9	13	1	8
S5	F	7-8	7	12	12	3	3	10
S6	M	7-10	8	12	9	10	11	13
S7	F	8-1	4	5	4	1	7	5
S8	F	8-6	10	7	10	3	10	12
S9	F	8-2	5	13	8	1	11	8
S10	F	8-7	8	7	10	9	11	13
S11	M	9-6	7	7	7	3	1	9
S12	M	10-5	10	14	8	6	6	9

All scores are offered as WISC scaled scores, ie mean 10, SD 3.

Weakness in visual processing or language processing was defined as at least one score being 1 S.D. below ability level expectation.

It was suggested that children 2, 3, 4, 7, 11 and 12 showed phonological difficulties and subjects 5, 6, 8, 9 and 10 showed largely mixed phonological and visual difficulties. Child 1 showed no significant weaknesses.

Having allocated the children with dyslexic features to a phonological or visual group, it is interesting to analyse which teaching method worked most effectively with the two groups. Subject 7 was omitted due to the low ability level.

Table 6

Mean number of words learned under the three teaching conditions for the two groups of phonological and phonological/visual children with dyslexic features

	Phonological dyslexic features		Phonological/visual dyslexic features		
NLP	5.4	(SD 1.7) (R 3-8)	3.8	(SD 2.1) (R 0-6)	NP = Neurolinguistic Programming
O-R	5.0	(SD 1.7) (R 3-8)	3.8	(SD 1.0) (R 3-5)	O-R = Onset - Rime
T	5.6	(SD 1.5) (R 4-8)	3.4	(SD 1.4) (R 1-6)	T = Tracing

It should be noted that the numbers of children involved in this analysis was small and it is consequently surprising that significant results were discovered. Results were analysed using a One Between and One Within Variable ANOVA. There were no differences between results for the different teaching methods ($F = 0.03$, df = 2.16, p ns). The children with

phonological dyslexic features learned significantly more words by all the methods than the children with phonological and visual dyslexic features ($F = 8.32$, df = 1.8, $p < .025$). This may reflect difficulties across one modality, rather than two. There was no interaction between methods and the dyslexic featured groups ($F = 0.18$, df = 2.16 p ns).

4:2:3   Words spelled correctly in the No Teaching condition.

Summary results for words spelled correctly at the two No Teaching measures for the three experimental groups can be seen in Table 7.

Table 7

Number of words spelled correctly in the No Teaching condition for the children with dyslexic features, without difficulties and those with moderate learning difficulties.

	Pre.		Post	
Dyslexic features	7.25	(SD 2.7) (R 4-11)	8.50	(SD 2.8) (R 4-13)
No difficulties	5.92	(SD 2.0) (R 1-9)	6.17	(SD 2.4) (R 0-10)
Moderate learning difficulties	8.25	(SD 2.8) (R 1-12)	9.08	(SD 2.9) (R 4-12)

Data are presented as:- Mean number of words learned, (Standard Deviation)(Range) Scores could range from 0 -15 words spelled correctly.

Results were analysed using a One Between and One Within Variable ANOVA. The results indicated a significant difference between groups. The children with moderate learning difficulties and those with dyslexic features were better from the outset than the children with no difficulties. All groups improved in their spellings from the beginning of their three weeks to the end. ($F = 3.37$, df = 2.33, $p < .05$: between groups of participants ; $F = 5.04$, df = 2.33, $p < .05$: between pre and post teaching measures ; $F = 0.7$, df = 2.33, p ns : interaction between groups and measures).

It would appear that the spelling test scores did not coincide with the children's performances on these test words. A further study would need to trial the word sets across children carefully before beginning experimental trials.

There was an impact on spelling performance for all children from the focus offered on this area of the curriculum over three weeks, or the positive attentions of their individual teacher. It seemed less likely that particular strategies had been encouraged as there were no differences between teaching methods and orders in presentation of these.

4:2:4   Sex differences

No significant differences were found between the reactions of male and female children to the teaching strategies, although it is noted that the sample size, particularly of males with dyslexic features, was very small. Sex differences in cognitive development and responses to different teaching methods would be an interesting further investigation.

4:2:5   Interactions between teaching methods and types of words.

There were no significant differences in the effectiveness of the three teaching strategies when used for phonically regular word spellings as compared with irregular words. It may, for example, have been hypothesised that Onset-Rime might be most effective with regular words particularly when based in word families of shared sounds, and that NLP might be effective where visual discrimination is a key, as, for example, in more unusual irregular words such as "yacht". Differences were not found, however, in this study or the previous individual studies of Stage 2. Interactions between word types, teaching methods and school spelling programmes would form an interesting focus for future study.

4:3   Discussion

To recap on the Hypotheses governing this stage of the research project; the first was that the visual and meaningful teaching method of NLP would be a more powerful technique for teaching spellings than Onset-Rime for the group with dyslexic features since the majority showed a general weakness in their phonological awareness.

It can be seen from Table 4 that this was the case but not at a statistically significant level. All methods did result in significant learning but, for the group with dyslexic features, the greatest number of words retained was in the NLP teaching condition. This result implies that NLP taps the visual/semantic strengths of the dyslexic featured child allowing the him/her to retain the word through visualising it and, maybe at the same time, remembering its construction through something meaningful about the word. It supports the notion that children with dyslexic features are weak phonemically, finding difficulty in making grapheme/phoneme associations and are often trapped in the logographic stage rather than passing into the alphabetic stage of Frith's (1985) model. Further work (Frith 1995 and Snowling 1991) also provides evidence that children with dyslexic features have a phonological weakness at a cognitive level.

While NLP proved to be successful for the group with dyslexic features, so too was it a helpful technique for the children without difficulties. However it can be seen in Table 4 that there was little difference in the number of words retained in the NLP and Onset-Rime conditions. This result suggests, as is to be expected, that children without a difficulty in learning to spell, will employ equally their phonological and visual skills to remember spellings depending on the particular word that is to be retained. If it is a phonologically regular word, eg "cat", the child with no difficulties will most likely use the phonological construction (ie sound out the word when spelling it) to spell the word. However, if the word is phonologically irregular, eg "yacht", this is not possible so the child is likely to attempt to visualise the word in order to spell it. This is providing they have passed through the logographic stage of Frith's model, when Frith initially suggested that children were only able to remember the construction of the word through visualisation.

It can also be seen in Table 6 that, when analysis separated the children with dyslexic features into phonologically weak, and phonologically and visually weak, NLP was a successful method for the 2 sets of children. These results suggest that it is productive for children with dyslexic features who are phonologically weak to employ teaching methodology which relies on their strengths. Also, it indicates that teaching these children how to visualise will prove to be a useful learning tool. However, both sets of children with dyslexic features responded positively to Onset-Rime. It would appear that this level of phonological analysis enabled a successful introduction to phonic methods for spelling for these children with dyslexic features. The key difference between children with dyslexic features with phonological difficulties and children with dyslexic features with phonological and visual difficulties was the latter group's relative problems in learning spellings. They may have been unable to support learning through consistent and undamaged visual skills. This result might support a view of children with dyslexic features having a primary phonological weakness that will vary in its impact on spelling according to compensatory strengths available in, for example, visual or semantic areas. It may, however, be more appropriate to view children with dyslexic features as having phonological, or phonological together with related visual, cognitive weaknesses in information processing. This might bring together research in phonological and visual areas (Lovegrove et al 1986).

A significant difference between the two groups in their responses to NLP and Onset-Rime was expected, but no significance was found. It could be speculated this finding came as a result of the group with dyslexic features being too small to subdivide, thus weakening the results. Possibly the divisions were too arbitrary and needed to be made more categorical by greater cognitive profiling. More controversially, it could be argued that this division of dyslexic features is tenuous anyway; these results are simply unable to support the notion that there are sub categories of dyslexic weaknesses. This issue remains contentious in the academic world and our results merely reflect those uncertainties.

Hypothesis 2 proposed that since children with moderate learning difficulties are generally slow in their intellectual development, they would learn normally but slowly. In Table 4 it is possible to see the results support this Hypothesis, with children with moderate learning difficulties achieving spellings effectively through the phonological (Onset-Rime) route and via the visual (NLP) route. These children may show less defined phonological processing relative weaknesses than the children with dyslexic features. This level of cognitive analysis needs further work in these two groups or extremes of learning difficulty.

The null hypothesis was supported in the case of Hypothesis 3. The children without difficulties did not acquire their spellings with less difficulty and at a faster rate than the other two groups, although they did respond reasonably equally to the visual, meaningful and phonic methods. Since the group with no difficulties were up to 4 years in chronological age younger than the groups of children with moderate learning difficulties and dyslexic features (as they needed to be spelling age matched) (Bryant and Bradley 1985), it could be postulated that this had an effect on their learning. It did appear when teaching these children that being taken out of the class by someone they did not know well was a more "traumatic" experience than for the older children. The groups with dyslexic features and moderate learning difficulties were used to be taken out of the class by many extra curricula specialists, possibly affecting their performance less, both because they would have had extra classes but also simply by virtue of their age.

It also could be argued that despite the groups all having a similar spelling age, the chronologically older groups may well have developed "retention" strategies which contaminated the findings, while the younger controls had not had a chance to develop learning strategies. Returning to Frith's model, it could be supposed that because the children without difficulties were so much younger than the other groups, that maybe they had not passed from the logographic stage into the alphabetic stage. The fact that this group benefited from NLP, a visual method, could also suggest these children were still operating in a logographic mode. However, on analysis of the children's spelling errors, it appears clear they were attempting to phonologically spell the words, thereby indicating a progression into the alphabetic stage of the model. For example, common errors made by this group were:-

        -lefd = left
        -pepol = people
        -silva = silver.

A further proposal for this finding is that the groups with dyslexic features and moderate learning difficulties were both used to having spelling tests on a regular basis so the research was nothing new to them. Since the children without difficulties were so young, they were, however, inexperienced with tests, resulting in their performance being affected. A future study might view this feature more fully by also including a normal age-matched control group.

The last hypothesis was that Tracing would not help any of the groups as successfully. In this case, the null hypothesis could be rejected since Tracing was weaker than NLP and Onset-Rime, especially for the children with moderate learning difficulties. However for the group with dyslexic features, Tracing was more helpful than Onset-Rime, emphasising for these children, weak in phonology, phonologically reliant teaching methods may be less helpful. This result supports the finding in Stage 2 that Tracing is a less efficient teaching tool, and raises doubts as to the efficacy of tracing as a technique for supporting the teaching of spellings for children although it did cause learning for all children.

Lastly, Table 7, the No-Teaching condition. The results show that there was a significant difference between the groups, those with dyslexic features and moderate learning difficulties having better skills from the outset than the children without difficulties. This finding came despite matching all groups prior to the start of the programmes for spelling and reading ages. This result links in with the argument that these very young children were affected by the nature of the research, namely being withdrawn from class. The spelling and reading tests were undertaken in their classrooms with their peers and teacher while the teaching was undertaken in the staff room individually and with the "unknown" researcher. It also suggests that there will be differences between overall measures of spelling through a spelling test and actual spelling performance, especially in young children.

However, while the children without difficulties were weaker than the other two groups, all groups increased their spelling over the three week period, another unexpected finding (in Stage 2 the No-Teaching condition showed no significant learning in any of the single cases). This finding could result from the increased focus on spellings over the three weeks, thereby having a "knock-on" effect on all the children's performance. It also could have resulted from spending time with the researcher having one to one teaching, although this is a

counter-argument to the explanation for the controls performing poorly. It could be a time factor, that three weeks is a relatively short time and had the experiment lasted for longer the gain would have been smaller. Results do indicate that the application of additional teaching causes advancement for all children.

The group with dyslexic features was selected by their attendance at a unit for specific learning difficulties and their teacher's opinion. A future small group study should define those with dyslexic features through careful cognitive and literacy profiling, together with those with moderate learning difficulties and children without difficulties. This could make a similar group study more incisive in its judgements.

4:4   Conclusion

This stage of the research supports the notion of children with dyslexic features' difficulties stemming from a cognitive weakness based on a phonological processing difficulty which is now acknowledged as being the core to learning to read and spell. The superiority of a lexical based system could be regarded as indicating that the phonological dyslexic featured child's literacy development is arrested in the logographical phase of Frith's 1985 model, finding difficulty in progressing onto the alphabetic stage. This study indicates that children with dyslexic features rely upon visual and semantic cues to retain the construction of words which is consistent with work of Hulme (1981) and Rack (1985).

This notion is further supported by the findings that children with moderate learning difficulties, who have lower I.Q.s but no relative specific phonological difficulties, will learn spellings using the more traditional route of phonology to aid literacy acquisition when possible. The successful teaching methods, NLP and Onset-Rime, were chosen as they represented visual and phonological methods that had led to effective learning of spellings in Stage 2. They were not selected to pin-point key differences between children with dyslexic features and those with moderate learning difficulties. It is felt that a phonic method based on the linking of letters and phonemes might demonstrate differences. Those with dyslexic features would not be developmentally ready for such a defined phonic approach, but those with moderate learning difficulties might find the simple learning structure of this phonic system helpful. It was shown, as expected, that the children without difficulties would reveal little difference in their performance with either Onset-Rime or NLP since the words could have been divided into phonetically regular and irregular words, and these children could use visual and phonological learning methods well.

These results therefore produce important issues to consider when teaching children with dyslexic features and those with moderate learning difficulties. Both Stages 2 and 3 of this research show that children with dyslexic features achieve when taught to their strengths. Children with moderate learning difficulties have also been shown to benefit from teaching geared to their intellectual makeup (see Chapter 3 for further discussion of this), not merely "more of the same thing". These findings have implications for the provision of resources as well as the way teachers are trained, for it is apparent that teachers should be able to competently assess the strengths of each pupil if they are to make the best of the resources available to them. It is important to remember, however, that, although for research purposes it is necessary to separate out the findings, overall, all the children did gain from this individualised approach to learning.

However, there are problems to this work which need addressing. The no difficulties group, though matched for spelling age, did not perform as expected, possibly due to their age and inexperience. This begs the question as to whether there are more issues involved in the acquisition of spelling which have a maturational component, not yet investigated or understood. It also highlights the possible fragility of performance on conditions and therefore the risk of drawing categorical conclusions and assumptions from the apparent evidence provided by the performance. The work may also have been weakened by the low number of children in each group. The group with dyslexic features was not sufficiently defined by being selected as attending a unit for specific learning difficulties in cognitive and literacy development.

Nonetheless, this stage of the research has supported earlier work (Brooks and Weeks, 1998) undertaken on older children which found that students with dyslexic features do learn more effectively if taught to their visual and semantic strengths. It highlights and supports important issues in the field of literacy acquisition.

The findings also lend some support to work with children with dyslexic features at this young age being beneficial in terms of giving these children a more reliable foundation in phonological skills which can then be linked to orthography, or in building up their weaknesses (Hatcher et al., 1994, Snowling, 1996, Bryant and Bradley 1985). Successful work with children with dyslexic features, moderate learning difficulties and children failing in literacy is likely to fully appreciate, utilise and develop both their cognitive strengths and weaknesses.

CHAPTER 5: ANALYSIS OF THE RESPONSES OF THE GROUP OF CHILDREN WITH DYSLEXIC FEATURES FROM STAGE 3 TO INDIVIDUALISED LEARNING STRATEGIES FOR LEARNING SPELLINGS OVER 15 MONTHS - (STAGE 4)

This small stage of the project continues the theme that runs throughout the research. Individual styles of learning within whole class teaching will result in greater success in learning to spell. In Stage 2, the project examined the relationship between individual cognitive profiles and styles of learning with children with dyslexic features. This was followed by a group study that examined the styles of learning of three qualitatively different groups of children; those with dyslexic features, moderate learning difficulties and no difficulties in Stage 3. Stage 3 supported Stage 2 findings, indicating that there are different styles of learning depending on the profile of the child or groups, which, if matched to appropriate teaching approaches, will result in greater learning achievement.

The aim of Stage 4 was simple in that it was of interest to examine further the Stage 3 group with dyslexic features response to the individualised approach to learning. This Stage was governed by the hypothesis that, having found their best methods of learning spellings, the spelling ages of the children with dyslexic features would increase at a greater rate than their chronological age if they used these methods, thereby achieving a faster rate of spelling increase than would be expected under normal learning conditions. This rate would be especially impressive for these children with dyslexic features and known literacy problems.

5:1 Method

5:1:1 Design

This Stage aimed to examine the long term (over 15 months) effect of the employment of individualised learning techniques on children to whom spelling did not come easily. This Stage acts as a neat intermediary between Stage 3 and Stage 5 since it combines elements of both, as well as developing the theme of Stage 2.

5:1:2 Participants

The group of children with dyslexic features was formulated for Stage 3 of the research. The details of the children can therefore be found in Chapter 4. Four of the original group left the school in-between Stage 3 and the Stage 4 work, leaving 7 girls and 1 boy (Stage 3 found no sex differences in their reactions to the teaching techniques). It should be noted that the group was largely identified through attending a unit for specific learning difficulties and there are concerns as to its consistency in terms of the nature of learning difficulties and the children's development.

5:1:3 Materials

Since the children's best learning strategies had been examined and found in Stage 3 of this research, there were no more materials needed other than the spellings given out routinely to these children as part of their usual schooling.

5:1:4 Procedure

Stage 3 of this research resulted in the clarification of the best methods of learning spellings for these children from a selection of 3 possible strategies. At the beginning of this Stage, the children were reminded of the work they had previously undertaken with the researcher and their best strategies were explained to them again. They were told that, if they continued to use these methods, it was likely their spelling ages would improve. The methodology was explained again to them and they were encouraged to use this at home and at school whenever they had spellings to learn.

A letter was sent home to all the parents to ask them to support their children in their use of the techniques and the class teachers were also asked to reinforce these methods with the children when they were learning spellings in school.

Half way through the year, the researcher visited the children and their teachers to find out if they were using the methods and if there were any problems. At the end of the year, the children were given the Helen Arkell Spelling Test to examine the changes in their spelling levels following the work of this Stage.

For details of the teaching strategies used, please refer back to Chapter 3 of this research.

5:2   Results

5 of the children spent the year using Neurolinguistic Programming, 2 Onset-Rime and 1 Tracing when learning their spellings.

Table 8
Mean chronological and spelling ages at beginning and end of Stage 4 for the children with dyslexic features.

Chronological age		Spelling age	
1997	1998	1997	1998
8.10	10 .1	7.0	8.7
(SD 5.4)	(SD 6.7)	(SD 7.5)	(SD 8.3)
(R 8.1 - 9.5)	(R 9.7 - 10.11)	(R 6.2 - 7.10	(R 7.7 - 9.9)

The data are presented as:- Mean age
                         (Standard Deviation)
                         (Range)
Age scores and age range are given in years. months.
SD's are given in months.

Table 9

Raw scores of the children's increases in spelling ages across the 3 methods employed.

Subject	Method used	Spelling age Initial 1997	Spelling age End 1998	Gain per month in months
①	NLP	7:1	9:4	1.8
②	NLP	6:4	8:1	1.4
③	NLP	7:10	9:9	1.5
④	NLP	7:6	8:9	1
⑤	NLP	6:4	8:2	1.5
⑥	Tracing	6:2	8:1	1.5
⑦	O-R	7:5	9:0	1.3
⑧	O-R	7:8	7:7	- 1

Spelling age given in years:months.

Out of the 8 children, 7 made monthly gains in their spellings ages ranging from 1 to 1.8 months, with an average gain of 1.4 months. One child's spelling age regressed by one month over the 15 months used, but as this was so out of line with the other 7 children it is only possible to assume there were other variables affecting this child's performance. This gain, although not statistically significant, probably because of the small numbers of children involved, is nevertheless a gain greater than would be expected, particularly for children with dyslexic features with known literacy difficulties.

5:3   Discussion

Throughout this research, it has been shown that working with children, whether with dyslexic features or moderate learning difficulties, using an individualised style of learning will increase their rates of success with spellings above the general levels; Stage 5 shows this can be replicated with normally learning children too within their usual class spelling and English experience. This is of importance when considering their academic and personal development.

Despite the small numbers in this Stage of the research, it is apparent that the results support the previous findings, since they show all the children, except two, have made gains almost 50% greater than would be expected over a period of 15 months. When considering that figure, it is also important to remember that these children are those for whom spelling acquisition does not come easily and who were an average of 19 months behind their chronological age with their spelling age, indicating a great difficulty in acquiring spellings. The total group of children at the end were still an average of 18 months spelling age behind their chronological age.

This Stage of the research therefore indicates the importance of identifying early in the child's spelling career the method with which the child will find spellings easiest to acquire, thereby alleviating the likely lag in a key literacy skill and depreciation of self-confidence and beliefs.

Analysis of the difference in the gains between those who used NLP and those who used the other methods, namely Onset-Rime and Tracing, is uncertain since the numbers are so small. However, visual inspection shows that there was a range of increases across the three methods, with the highest increase in a child who used NLP, NLP being the method with which these children with dyslexic features commonly succeeded.

In Stage 2, it was hypothesised that there would be a greater effect with NLP than Onset-Rime when teaching spellings, and although this was found, it was not statistically significant. The discussion proposed that this finding might result from the fact that NLP taps into the visual/semantic strengths of children with dyslexic features, while, although Onset-Rime relies on an area traditionally weak in children with dyslexic features, it nevertheless provides an accessible, structured and ordered framework from which to learn the phonological construction of words. Therefore, on a smaller scale, this finding appears to have been reproduced in Stage 4 of the research.

Throughout the research, another theme has been present. The teachers from one school involved have suggested that the findings, while interesting, are hard to implement since it is impossible to teach children on an individual basis while funding is at its present level.

However, there are three strong counter arguments to this claim. Firstly, the learning methods are used within normal class and school practice and require very limited additional support once a child's chosen method is known, (see 5:1:4 for how this was achieved). Other schools have used the methods with success across whole year groups. The second involves the consideration of what results when children have struggled to keep up with their class peers. There is strong evidence that these children are left with a low self-esteem and a belief that success is not possible for them, as well as weakness in a key communication skill. Thirdly, the government has put in place a strongly prescriptive programme for the learning of spellings for all primary aged children through the establishment of the Literacy Hour and National Literacy Strategy. It is likely that this programme will achieve greater success if the teaching methods selected encourage individual learning strategies shown to have a powerful effect on the attainment levels of children. It takes little time to assess each child to discover which method the child works best with, (for details of this process refer to Stage 5), therefore costing little to apparently save a lot, not only in emotional but also in educational terms.

Stage 5 of this research (Chapter 6), will elaborate on this argument and show that, for <u>all</u> children, spending the initial time on assessment reaps huge rewards and can be undertaken by teachers, classroom assistants or parents. With the government spending large amounts of money in the attempt to raise standards for all, this initial time spent, approximately 80 minutes, will be highly cost effective.

5:4   Conclusion

Although this stage is small, it has strengthened the already powerful theme that runs throughout this research; namely, it is highly efficient to use multi-sensory teaching methods which encompass children's individual learning styles early on in their literacy acquisition. Although this methodology takes a certain amount of time to set up, it has been shown that it will reap strong educational and emotional benefits over time. This research is

complementary to the government's Literacy Strategy and will strengthen the results it desires.

A longitudinal study using the same design would be of value to explore the long term general educational benefits for children offered this teaching approach.

Although compelling, some results have not been statistically significant in Stages 3 and 4, most probably, because the numbers are small and the group with dyslexic features was not sufficiently defined for such a small sample. Further work should be undertaken to examine these important findings with greater numbers of children and over the development of children's literacy. Not only is this likely to benefit large numbers of children, but the work aligns comfortably to the current government's policy to improve educational standards for all.

CHAPTER 6: FIELD TRIALS INVESTIGATING THE EFFECTS OF INDIVIDUALISED LEARNING STRATEGIES FOR ALL CHILDREN IN MAINSTREAM SCHOOLS - (STAGE 5)

The field trial's overall aim was to test the effectiveness of teaching strategies for spelling that have been supported by the earlier research and individual styles of learning in raising children's spelling levels. This Stage of the research was governed by the hypothesis that children have individual styles of learning and, if these are adopted, the success of learning will be greater than expected. It was felt that individualised learning would lead to progress for all children, of all abilities and with, and without, special needs. A brief means for assessing any child's most successful learning method for spelling was evolved, and was suitable for a teacher, assistant or parent to use in about 5 minutes per day over 2 to 3 weeks. The method that was discovered was to be used by the child in any setting where spellings were to be learned such as class tests and errors from work. The field trials did not require schools to alter their policy or provision for spelling and English, and could be used on any chosen group, such as all children, those with spelling difficulty or those with Special Educational Needs (S.E.N.). Results would offer dynamic assessment through children's responses to teaching and would lead to further investigation through refining learning methods and S.E.N. assessment of difficulties for those who failed. The initial method operates at Level 1 of the Code of Practice and would indicate children needing increased attention at Levels 2 and 3. This work is particularly pertinent in the context of the government's Literacy Strategy which prescribes a detailed curriculum for all primary aged children in literacy skills including spelling. The Strategy does not detail word and word segment teaching methods, and the field trials offered a means of complementing this initiative.

6:1 Method

6:1:1 Design

The project has adopted a two pronged approach to researching the effectiveness of differing teaching techniques, a micro as well as macro perspective. As the project has developed through the 5 Stages, the perspective has taken a more gross examination, moving from individuals to whole schools, of the interrelationship between learning techniques and the individual, Stage 5 adopting the broadest approach. The dominant theme throughout is the individualised nature of the research and stresses the effectiveness of individual styles of learning. This design is therefore unusual in its field. It extends work, initially developed for children with dyslexic features with difficulties in literacy, to whole schools.

6:1:2 Participants

4 schools agreed to take part in the research, although due to a high staff turnover, one school opted out mid way through. Out of the 3 schools that took full part, 2 were local authority primary and junior schools. The third was a private preparatory school. Three were in Surrey but serving different catchment profiles with mixed classes and abilities in the schools, 1 in Middlesex. 60 children took part, 34 boys and 26 girls. It was unfortunate that the 4th school in Manchester withdrew since it was an inner-city school and would have made an interesting comparison in terms of the nature of catchment and geographical location.

The children targeted were in years two and three (6-8 year olds) in order to match the age ranges of the children to the other Stages of this research. The teachers were encouraged to include as many or few children as they chose, with any educational makeup, ie, they could be children to whom spelling was not/was a problem, children with special needs, children to whom English was a foreign language and children the teachers were worried about. The aim of this Stage of the research was to have the learning techniques used by a normal cross section of children from these year groups.

Since the children in Year 3 were the older ones, they started the programmes in the first 5 months of the school year, with the Year 2 children following on for the last 5 months of the trial. This offered a control, with the second group being able to be judged against the first with no input and then similar input for the second half of the academic year.

The literacy policies the children had been exposed to, up to and through the trial were various. Some teachers used literacy packs, others used a selection of methodologies and one teacher used her own teaching programme developed over her years of teaching. In Beacon Hill School, the chosen method for teaching spellings by both teachers was often Look-Cover-Write-Check, although methods might vary for different words and settings. At Newland House School, one teacher used NLP and the other a variety of methods depending on the spellings to be learnt. At St. Peter's School, there were three teachers involved and generally they used Look-Cover-Write-Check but would employ other methods if they felt them appropriate.

Newland House School put 12 children through the programmes between September and February, with the children continuing their strategies for the rest of the year; 7 boys and 5 girls. 14 children entered the programmes in February, 11 boys and 3 girls. Two of these children spoke English as a second language. There was little direct selection, although children with extremely well developed spelling skills tended not to be chosen; a large proportion of each class took part.

Beacon Hill School entered 9 children for the first half of the year, 5 boys and 4 girls, with one child having English as a second language, and 12 children in the second half, 5 boys and 7 girls. They were chosen as a range of children with, and without, difficulties in spelling and literacy, and across all abilities.

St. Peter's School unfortunately found the management of the project more difficult, putting 13 children through, but at varying times throughout the year, which resulted in the data being differently presented from the other schools and without the intended control design. Out of the 13 children, there were 6 boys and 7 girls. They tended to be children with particular difficulties in spelling and literacy.

6:1:3 Materials

A teaching pack was developed in which 10 teaching techniques were offered along with simple explanations as to how to use them. Three of the teaching strategies were the ones found in the previous Stages to be most effective and the rest were ones that research had shown to be of value, or might appeal to the learners' and/or teachers' styles. An example pack can be found in the appendix 6:5, showing the choice of strategies and how they were taught. A graph to plot each day's correct spellings was provided which at the end was to be

used to assess the child's best learning method. Methods of assessing learning methods are contained in Appendix 6:5.

6:1:4 Procedure

The researchers invited teachers, classroom assistants and parents to discussion groups in which the research was explained and a pack explaining the research and the teaching techniques was available for everyone. The materials developed aimed to be simple in order that the children could be taught the techniques by anyone in contact with the child. It was left to the individual classroom teachers to decide how they wanted the programmes to be given to the children, which spellings they wanted the children to learn and which children would be selected. A sample pack of materials is Appendix 6:5.

The project materials enabled each child's most effective strategy for learning spellings to be established. A child would be given a list of 10 words to be taught for one week. The words would be derived from the school's usual sources: a spelling programme, current project words, the child's errors in work, etc.. Each day, the child was tested on the words by a teacher, assistant or parent. As he/she made an error, he/she was taught by the nominated teaching strategy. The number of words correct was noted each day on the graph. The teaching strategy would be chosen, usually by the teacher, from consideration of information such as the effectiveness of strategies found in this research, other research and views, the child's previous history and responses, or the teacher's or child's favoured methods. Ten possible strategies were contained in the pack of materials. Any other strategy could be used.

The following week, a new set of words would be taught using a different teaching strategy. This procedure was used for 2, or more, strategies until a preferred strategy was chosen, according to the greatest number of words learnt, or rates of learning, over the three individual weeks, many teachers comparing 3 strategies. This chosen method was then used by the child for learning spellings in the future within the class's usual language programme. No additional input was offered. This was reinforced by the researcher and the class teacher to ensure the child understood the method by which he/she was to learn future spellings given.

6:1:5 Hypothesis

It was hypothesised that the children who used individualised methods for learning spellings would advance more in spelling over the first half of the year than those that did not. In the second half of the year, both groups would show enhanced levels of spelling due to both then using individualised methods.

6:2 Results

Increases in spelling in Beacon Hill School and Newland House School are illustrated in Table 10.

Table 10

Increases in spelling in Beacon Hill School and Newland House School

Intervention for whole year (Groups A and C.)		
Initial SA (years: months)	Increase in SA (months) Sept. to Feb.	Increase in SA (months) Feb. to July
7:6 (SD 12.4) (Range 5:0 - 9:10)	10.0 (SD 6.1) (Range -4 - 26)	8.0 (SD 4.9) (Range -1 - 17)
Intervention for 2nd half of year only (Group B and D.)		
Initial SA (years: months)	Increase in SA (months) Sept. to Feb.	Increase in SA (months) Feb. to July
6:9 (SD 13.9) (Range 5:0 - 9:11)	5.0 (SD 4.6) (Range -10 - 13)	9.4 (SD 5.9) (Range 1 - 18)

All data are mean results presented in months except for the initial spelling age and its ranges which are given in years : months.

Analysis

The most powerful analysis that could be offered was a One Factor Repeated Measures Design Analysis of Variance (ANOVA) on all the results from Beacon Hill School and Newland House School over the period September to February when the impact of using individually chosen learning methods should have an impact on one Group from each school (Groups A and C) and not on the other (Groups B and D). The ANOVA would control for family-wise errors. This compared overall spelling ages in September (before any intervention) and February (when one Group from each school had used their individual chosen learning methods for 5 months). Data for each school are presented in Tables 11 and 12.

The ANOVA produced a significant difference between Groups A/C and B/D (using chosen learning methods for this time, or not), $F=8.28$, df 1,45, $p<0.006$.

There was a significant difference between the September and February spelling ages, $F=82.29$, df 1,45, $p<0.001$.

There was a significant interaction, a key significance to the hypothesis, between the Groups and the spelling measures, $F=11.62$, df 1,45, $p<0.001$.

Results were analysed for each school using ANOVA's. Detailed analyses between the Groups and spelling ages at September and February were offered through post-hoc analysis using *t* tests. It is noted that the use of the Sheffe test may have given a less liberal analysis. Results between these stages and July were analysed using *t* tests.

6:2:1   Results for Beacon Hill School

Table 11

Table showing the initial mean spelling age (SA), and the increases in SA in the first half and second half of the year of those children who undertook the programmes for the whole year and those who had them for half a year only at Beacon Hill School.

Intervention for whole year (Group A)		
Initial SA (years: months)	Increase in SA (months) Sept. to Feb.	Increase in SA (months) Feb. to July
7:6 (SD 18) (Range 5:0 - 9:10)	10.8 (SD 6.9) (Range 1 - 26)	10.1 (SD 3.0) (Range 6 - 17)
Intervention for 2nd half of year only (Group B)		
Initial SA (years: months)	Increase in SA (months) Sept. to Feb.	Increase in SA (months) Feb. to July
6:3 (SD 9.0) (Range 5:0 - 7:3)	4.0 (SD 3.0) (Range -1 - 8)	9.7 (SD 4.4) (Range 2 - 18)

All data are mean results presented in months except for the initial spelling age and its ranges which are given in years : months.

Analysis

Initial analysis of the Beacon Hill School data was undertaken using a One Factor Repeated Measures Design ANOVA.

There was a significant difference between Groups A and B, F=9.34, df 1,19, p<0.013.

There was a significant difference between spelling ages in September and February, F=33.71, df 1,19, p<0.001.

There was a significant interaction between Groups and the spelling measures, F=9.34, df 1,19, p<0.007.

Post-hoc analysis gave the following results:

Results of the children who had interventions for the whole year

A non significant difference, t = 0.38, df = 8, p ns.(1 tailed) was found between the increases in SA between the first and second halves of the year.

A significant difference, t = 4.4, df = 8, p< 0.05 (1 tailed) was found in the increases of SA between the initial SA and the SA in February.

Results of the children who had interventions for the second half of the year

only

A significant difference, t = 4.00, df =11, p<0.005 (1 tailed) was found between the increases in SA between the first and second half of the year.

A significant difference, t = 4.7, df =11, p<0.005 (1 tailed) was found between the initial SA and February SA.

Results of the interrelationship between the two groups of children in terms of the increases in SA

A significant difference, t = 3.1, df = 19, p<0.005 (1 tailed) was found between the increases in spelling ages of group A and group B in the first half of the year

No significant difference, t = 0.08, df = 19 p ns. (2 tailed) was found between the increases in spelling ages of group A and group B in the second half of the year

6:2:2   Results for Newland House School

Table 12

Table showing the initial mean spelling age (SA), and the increases in SA in the first half and second half of the year of those children who undertook the programmes for the whole year and those who had them for half a year only at Newland House School.

Intervention for whole year (Group C)		
Initial SA (years: months)	Increase in SA (months) Sept. to Feb.	Increase in SA (months) Feb. to July
7:6 (SD 4) (Range 6:3 - 8:3)	9.9 (SD 5) (Range -4 - 17)	5.8 (SD 4.9) (Range 1 - 19)
Intervention for 2nd half of year only (Group D)		
Initial SA (years: months)	Increase in SA (months) Sept. to Feb.	Increase in SA (months) Feb. to July
7:3 (SD 12) (Range 6:3 - 9:11)	6.6 (SD 5.7) (Range -10 - 13)	9.1 (SD 7) (Range 1 - 28)

All data are mean results presented in months except for the initial spelling age and its ranges which are given in years : months.

<u>Analysis</u>

Initial analysis of the Newland House School data was undertaken using a One Factor Repeated Measures Design ANOVA.

There was no significant difference between Groups C and D, F=1,58, df 1,24, p <u>ns</u>.

There was a significant difference between spelling ages in September and February, F=50.18, df 1,24, p<0.001.

There was no significant interaction between Groups and the spelling measures, although the F value approached significant levels, F=3.04, df 1,24, p<0.094.

<u>Post-hoc analysis gave the following results:</u>

<u>Results of the children who had interventions for the whole year</u>

A significant difference, t = 3.29, df=11, p<0.005 (1 tailed) was found between the increases in S.A between the first and second halves of the year.

A significant difference, t = 6.3, df = 11 p< 0.005 (1 tailed) was found between the increase in the initial SA and February's SA.

<u>Results of the children who had interventions for the second half of the year only</u>

A significant difference, t = 3.01, df=13, p<0.005 (1 tailed) between the increases in SA between the first and second half of the year.

A significant difference, t = 3.8, df =13, p<0.005 (1 tailed) was found between the initial SA and February SA.

<u>Results of the interrelationship between the two groups of children in terms of the increases in SA</u>

A significant difference, t = 1.49, df = 24, p<0.1 (1 tailed) was found between the increases in spelling ages of group C and group D in the first half of the year.

A significant difference, t = 4.23, df = 24, p<0.01 (2 tailed) was found between the increases in spelling ages of group C and group D in the second half of the year.

6:2:3   Results for St. Peter's School

The data for St. Peter's School are presented differently from the other two schools, since the school approached the teaching differently and put the children through the programmes at various times. This means the children did not undergo spelling tests in the middle of the year and the controls hoped for, therefore, were not possible. Only comparisons between their beginning and end spelling ages are available.

Table 13

Table showing the initial mean spelling age (SA), and the mean increase over the year at St. Peter's School.

Interventions throughout the year)	
Initial SA (years: months)	Increase in SA (months) September to July
6:9 (SD 14.4) (Range 5:8 - 10:0)	13.0 (SD 13.0) (Range -9 - 31)

All data are mean results presented in months except for the initial spelling age and its ranges.

Analysis

Results of all the children having interventions throughout the year

A significant difference, $t = 9.5$, $df=12$, $p<0.05$ (1 tailed) was found between the initial and end SA of the children.

6:2:4   Gains in spelling using different learning strategies.

Table 14

Mean gains (in spelling ages in months per chronological age in months) made with the teaching strategies across all schools.

Teaching strategy	Mean gain (in spelling age months /chronological month)
SOS	2.78
O-V	2.3
O-R	2.27
Phonics	2.16
NLP	2.07
LCWC	1.98
Mnemonics	1.7
PA	- 0.9

Mean gain across all strategies 1.8
(Standard deviation 1.05)
(Range - 0.9 - 2.78)

SOS - Simultaneous Oral Spelling   5 children used this method
OV. - Own-Voice   2 children used this method
OR - Onset-Rime   9 children used this method
Phonics   3 children used this method
NLP - Neurolinguistic Programming   19 children used this method
LCWC - Look-Cover-Write-Check   20 children used this method
Mnemonics   1 child used this method

PA - Picture Association   1 child used this method

Three of these children had English as a second language, two used LCWC and one NLP. There were no differences between their rates of learning and the other children's.

Unsurprisingly, analysis of the results did not indicate significant differences as lower rates of progress were achieved in methods used by only one child each (PA and mnemonics).

6:3   Discussion

In the introduction to Stage 5, it was stated that the hypothesis governing this Stage of the research proposed that children have individual styles of learning and using these would increase their rates of learning. This was examined through the learning of spellings. Each child's best method of learning spellings was discovered, following which, the child was encouraged to employ the method each time he/she wanted to learn a word. Over time, it was proposed this would result in an increase in spelling age greater than usual over this period.

Both Stages 2 and 3 examined broadly similar hypotheses, except they focused on children with specific learning difficulties. This Stage is unique in that it takes a selection of all children, chosen by their teachers (see 6;1;2), and examines their responses. These results offer an initial insight into the likely responses of all children to an individualised approach to learning spellings, and the individual techniques need not stop at spellings. Learning any material is likely to be easier if the child discovers the way he/she learns best, whether through auditory, visual, semantic and many other modalities. Materials could include reading, vocabulary, number skills, mathematics, study skills, foreign languages, etc..

Overall results from Beacon Hill School and Newland House School showed a significant influence from giving children their own learning methods for spelling on their rates of acquiring spelling. The interaction effect between Groups having individual methods for learning, and not, was highly significant.

With reference to the results section and Table 11, and the Beacon Hill results, the children who used the interventions for the whole year showed a significant rise in their spelling ages between their first spelling test, before using the techniques, and the second spelling test results, (September to February), when they had been using their techniques for 5 months. They showed a non-significant difference in their increase in spelling ages between the first and the second halves of the year (February to July), when they continued to use their chosen methods. These results show, along with the mean scores, that the children's rate of acquiring spellings leapt up once they found their best technique to learn spellings, and then the rates of learning spellings were maintained throughout the rest of the year.

The children who used the interventions from February onwards showed a significant increase in their rate of learning spellings between starting using their chosen method in February and July, while the increase between their spelling age at the beginning of the study in September and February, when they had not yet started using their chosen method, was slightly less than their age increase. These two sets of results indicate that, once the children found out how to effectively learn their spellings, their spelling ages increased above their chronological age, highlighting the benefits the children were enjoying from the

individualised approach to learning. These children's progress over the first half of the year indicates normal progress similar to the months passed.

By way of cross checking this interpretation of the results, analysis was undertaken across the two groups of children. This is the key analysis of the effects of individualising learning.   A significant difference was found between the increases made in the first half of the year of the group who had their own learning methods as opposed to the group who had not yet started their individualised methods of learning, Group A's levels of learning being more than doubled. However, once both groups of children had access to their own learning methods there was no significant difference in the gains made.

In Newland House School, Groups C and D made significant advances in spelling from September to February, but the difference between the Groups was not significant. Most pointedly to the overall hypothesis, the interaction between the Groups and advances in spelling over this period approached significance rather than being highly significant.

A fascinatingly different profile emerged from the Newland House Group C results,
(Table 12), showing the strong influence of intervening variables on results. It can be seen that, amongst the children who had the individual learning methods for the whole year, although the children showed similar gains in their learning of spellings to the Beacon Hill children due to the field trial methods, there was a drop in the rates of acquiring spellings between February and July.

These findings require consideration of the teaching styles of the teachers and the literacy policies of the schools. All the teachers, except the teacher for Group C, taught spellings using a variety of techniques. They all taught the children spellings according to the words; so, for example, if the word was phonetically regular they would teach it using the phonics method of learning, if it was irregular, but easy to make a mnemonic to go with it to help the children remember the order of the letters, (for example, **because** : **b**ig **e**lephants **c**an **a**lways **u**nderstand **s**mall **e**lephants), they would adopt this approach. This varied application of styles, common in schools, results in a slower rate of learning than would be possible with the individualised approach relying on the individual child's strengths in learning spellings.

In contrast to this approach, the teacher who taught the Newland House "using individual learning methods all year" children, taught as a class always using the Neurolinguistic Programming (NLP) method, a method that is strongly visual, and one which throughout this research has been found to be consistently helpful for children who are relatively strong visually. When the figures in the later section of the results are considered (Table 14), it is possible to see that NLP is not in fact the method that results in the highest mean spelling age increase (SOS results in the largest mean gain across all schools).   Added to this, examination of this teacher's results across all methods, shows a mean overall gain of 14 months for those who used NLP all year, while a mean gain achieved with the other methods was 16.7 months. These results indicate that using one method alone to teach children, when their individual styles are not known, can result in lower spelling age increases than an eclectic group of methods, one of which should suit each child in the class.
Added to this problem, was the research coming into the classroom and in effect clashing with the one method that the children had been taught beforehand, resulting in a "learning chaos" or, in psychological terms, too much "noise" for the children. Although for the

children themselves this had a negative effect on their spelling levels, in terms of the research, this effect is of great interest, since it goes further to back the whole message of the work, namely **all** children, whether with dyslexic features, moderate learning difficulties or no difficulties, have their own styles of learning, with detectable patterns evident in cognitively similar groups of children.

These findings question class teaching methodology without reference to the individual. It appears from these findings that, at best, this results in learning but at lower levels than achievable through individualising the approaches, but, at worst, risks resulting in a detrimental outcome. It is, however, possible to add individual styles of learning to any class teaching and curriculum, as demonstrated in this Stage.

The work in Stage 3 further questions whole class or whole group methodology without opportunities for individual styles in learning, in that the children without difficulties and with moderate learning difficulties learned within their groups at a similar rate whether working with NLP or OR. However, if the approach had been individualised, it is probable there would have been marked differences in success rates between the individuals and the method chosen. The group with dyslexic features' results were clearly better when using the approach that relied on their strengths since this group's cognitive makeup was more likely to be based on similar strengths and weaknesses, by definition, than the other two groups' based more on overall ability.

Group D's results were similar to those of Group B although the increase is not quite double. They benefited significantly by using individual methods for learning spellings.

The figures examining the interrelationship between Groups C and D describe the drop in the rates of learning spellings of Group C in the second half of the year, thereby resulting in the significant difference being found, as discussed.

The results of the St. Peter's children (Table 13) were what would be expected given the arguments already offered. The children all made marked progress in spelling despite all being selected as needing particular help in this school.

The mean gains in months with the individual teaching strategies across schools and the numbers of children using each strategy have been given in Table 14. On the whole, each child involved in the research was given three strategies in order to find the strategy that the child learnt most spellings with. The choice of the strategies used was left up to the schools. The Beacon Hill and St. Peter's teachers chose to use the NLP, OR and LCWC methods, while Newland House experimented with a greater variety of methodology. Most children used the LCWC method since it appears this is the spelling method teachers are most familiar with, followed by NLP, since this is now a well documented new method. All schools were also told these were the methods we had found most useful in the earlier sections of this research.

It is interesting to note from Table 14 that there were not any methods that stood out as having achieved notably higher gains than others. The one exception to this was the overwhelming failure of the Picture Association method, a method included in this research since it might offer a more purely visual association for a word. Interestingly, the two highest achieving methods, SOS and OV were methods that involved an auditory input to the

learning, and were methods that did not achieve great success with the single case children with dyslexic features. This continues the argument that providing a variety of methods to suit the variety of cognitive profiles in any one class will strengthen results achieved and that a single method, while possibly satisfying some children in the classroom, will not help all the children with their varying strengths and weaknesses.

6:4   Conclusion

Clearly, whole class teaching increases spelling ages of children. Nevertheless, this research throughout its Stages has increasingly uncovered how individual children learn and, despite being hampered by small numbers at times, has revealed a valuable insight into the individualised nature of the learning process. As adults, anyone who has taken study to a higher level will have observed how fellow students prepare for exams. Each will have their individualised method of learning, be it through recording the information on tape, putting flow charts over their room or using mnemonics to recall vital information. Why then should this not be the case when looking at children very early on in their academic careers? Indeed this Stage has shown just that. The individual learning methods can be complementary to whole class teaching as, for example, in children using their own learning methods when being taught one group of spellings or, indeed, other information and concepts.

Children approximately doubled their normal rates of learning spellings once they had discovered their own successful method of learning. The teacher's, parent's or helper's input, over the three weeks of working with the child in discovering their individual method, was, at most, 80 minutes. This work did not require any alteration to the schools' structures or the children's levels of literacy input. There is a substantial increase in teaching efficiency and, despite teachers' natural worries, must reduce teaching time later on in the children's learning. It is interesting to note that most teachers were enthusiastic regarding the methods and these are being fully maintained in Beacon Hill School.

Since the government's aim is to improve literacy for all, these findings are of paramount importance. The work complements the government's new Literacy Strategy and can be easily incorporated into it in order to strengthen the effect the new policy will have on the nation's children. It adds individual learning to a country's curriculum.

6:5   Appendix - the field trial materials

The field trial materials are included as an appendix at the end of the report.

CHAPTER 7:   OVERALL CONCLUSIONS

Throughout the western world, and possibly even the whole world now, literacy skills are essential. Word level literacy is central to language and school development, and success at school, since the industrial revolution, has been highly regarded. Connections are now readily accepted between poor literacy development and employability, even crime rates and mental well-being. In this context, it would be expected that much thorough research would have been undertaken to examine in detail how to improve skills in children who are failing.

Over the last 50 years or so, there has been a growth in the research and understanding of individual differences in people. Almost concurrently, research has been growing investigating learning difficulties, and dyslexia has been researched from many perspectives. Especially in the last 20 years, cognitive psychology has produced considerable evidence (see, for example, Brown and Ellis, 1994, Ellis, 1993, Frith, 1995, and Snowling, 1991) that those with dyslexic features demonstrate a central phonological weakness at a cognitive level which interlinks with the development of literacy skills and related cognitive skills, such as working verbal memory, and information storage and retrieval. However, there has not been work teasing out the links between individual differences and individual learning styles, or the strengths and weaknesses within the cognitive apparatus of the individual, which will impact on literacy acquisition. We have much information on the development of literacy and word level literacy skills, and the weaknesses that cause difficulties such as dyslexia. There is limited evidence linking this understanding to improved teaching and learning techniques.

This research has, therefore, been innovative in its modus operandi, and as a result has been able to make valuable connections between cognition and learning styles. It has investigated individual children who have dyslexic features or moderate learning difficulties with a cognitive style that is qualitatively and quantifiably different from the child without difficulties in Stages 2 and 4; it has compared groups of children with dyslexic features and moderate learning difficulties with different learning makeups in Stage 3; and, finally, it has taken a complete cross section of all children in mainstream schools in Stage 5.

Consistently, this project has shown that, by tapping the individual's learning style which is influenced by the child's cognitive makeup, it is possible to improve the spelling age of the child beyond the rate expected. There has been an emphasis upon teaching to strengths in thinking, but also in making weaker areas more accessible. For example, those with dyslexic features often show a clear ability to support their phonological weaknesses through the use of their visual and semantic strengths. In contrast, they may build upon their weaknesses by entering word level literacy through an accessible level of phonology. Teaching to strengths and weaknesses in an individual will be complementary and included in most successful remediation programmes.

This philosophy of individualising styles of learning can be extended to all children, whether with dyslexic features, moderate learning difficulties or no difficulties in their development, and in all settings, whether individual or in groups, classes and schools. The ability to give an individual his/her own style for learning spellings requires little time and has not been linked to any changes in normal class teaching of English and spelling, additional programmes or specialist teaching. It is, perhaps, surprising that such a minimal input has served to approximately double the rates by which children improve their spellings. The

methods can be self-reinforcing for children, and give a sense of self control and ability to take more responsibly for their own learning.

The study, while developing its focus from the individual to whole classes, has inversely aligned itself to the Levels of the Code of Practice. The field trial (Stage 5) operates at Level 1 of the Code of Practice, in that it is aimed at all children, and will screen out children with slow progress through their responses to teaching. Level 2 focuses on children with additional needs for literacy from teacher, assistant and home. This requires the refinement of learning methods and should lead to more individually based methods and monitoring. Responses from structured teaching will inform and lead to more individualised and structured learning and teaching, and inform further, more traditional, S.E.N. assessments and inputs. Level 3 is designed for children with continuing difficulties, and the focus on individual learning styles and responses promoted by the research will help the child and contribute to further specialist assistance, such as an Educational Psychologist's assessment and further specialist teaching. Clarity in individual learning styles and responses to offered teaching will detail a child's needs and associated provisions at Levels 4 and 5, as they enter Formal Assessment and a Statement of Needs. Levels 3, 4 and 5 are characterised in Stage 2. With the adoption of an individualised approach to learning early on in the child's learning career, the numbers of children passing through these Levels will be reduced, as well as limiting the numbers of adults coming out of school with literacy weaknesses and a feeling of inadequacy and failure.

The establishment of an individual's most effective learning style can be used at any age and with many skills. This project has focused upon all children and children with dyslexic features of 6 to 8 years of age, and spelling. Field trials and Stage 4 have included a wider primary age group. Further literacy and language skills might include: 4 year olds working on underlying phonology, 8 year olds in reading and spelling words, and 15 year olds in literacy and study skills such as learning facts and revision techniques. The individual provision of a learning style for each child would be likely to be suited to many areas beyond literacy: number skills, reading comprehension, mathematics, study skills, history, foreign languages, machine and computer operation, behaviour management, etc.

The recently introduced Literacy Strategy offers a curriculum or framework, and broad teaching methods, for teaching word level literacy in primary aged children. However, there is currently little focus on teaching or learning methods for individual words and word segments at a more microscopic level. It is suggested that phonically irregular words can be investigated and learned by meanings, common spelling patterns, sound patterns, locating them in dictionaries and other texts, creating mnemonics, investigating and playing word games, proof reading and checking them in independent writing. The approaches from this study enable further and more detailed learning methods to be tapped, and offer more effective learning of words and word segments on an individual child basis, although in the context of the usual Literacy Hour groups, classes and teaching. Especially, the range of more phonic based learning methods, such as Onset-Rime, Phonics and Simultaneous Oral Spelling, can similarly be utilised across the central phonic structure of the Strategy. It should also be noted that methods that are not phonic can be used effectively for learning within a centrally phonically based curriculum; for example, Tracing could be used to learn "standard". This research fits comfortably with the new Strategy as well as offering a useful addition to it, in aiding its future success via the individualising of learning strategies. The

study's approach provides individual learning styles that will be of value to all children, including those with special educational needs.

The aim of the research was not to produce or claim that any one teaching technique was the answer to all children's literacy problems. There are frequent claims advocating one particular method as a "cure-all"; for example, the Daily Mail (22rd Sept 1998) "Dyslexia can be cured in five days" through the employment of the Phono-Graphix method devised by Carmen and Geoffrey McGuinness. Their claim is, if a child is having problems with literacy acquisition, then it is the teaching method that is at fault. Our research would support this claim but suggest that a teaching method needs to match an individual's learning style. However, they proclaim that all problems can be solved through their method, while there is quite limited evidence supporting it. The McGuinnesses argue the National Literacy Strategy is wrong since it is a "potpourri of failed methods devised over the past 200 years" (Guardian Education 23rd June 1998). Our response, based on our presented scientific evidence, is that it is not the pot pourri of methods that is at fault but the lack of attention given to the individual's style of learning, and consequent effects on appropriate teaching, that could be a most efficient means for extending positive results. Further examples of possible panaceas include: "Simultaneous Voice Output" (T.E.S. 19th February 1993), "Multi-sensory Approach" (Daily Express 16th July 1992), and a range of tinted lenses, medications, therapies and early school interventions.

Despite the almost obvious risk of claiming that one method is the cure to all evils, it is a common theme in research. Most research focuses on one method's effectiveness or not, rarely contrasting one method with another, or attending to individual styles, or having reliable controls. This research clearly attends to all of these issues resulting in a rigorous study from which claims can more safely be made, although in the knowledge there are still many areas which require further attention. Throughout this study, the children have acted as their own controls or normal control groups have been established. Methods have constantly been compared with other methods and individual styles have, of course, been at the forefront of the work. The only conclusion that has been attempted, with caution, regarding particular teaching methods, is that there appear to be some teaching methods which have produced better results consistently than others, for example, Onset-Rime and Neurolinguistic Programming, with defined groups of children.

The overall hypothesis governing this research is that every individual has their own method of learning which, if tapped, can reap valuable rewards. This philosophy applies to all children, whether taught individually, in classes or in groups, and does not involve any alterations to school's structures and children's levels of input. Adopting this approach can approximately double rates of learning spellings (see field trial results). This research has focused on 6 - 8 year olds; previous research by Brooks and Weeks (1998) investigated older children's reactions to individual teaching approaches and achieved similar results to this work. It appears fair to suggest this approach should be equally successful at any age and with many skills. It requires the use of simple materials only, and costs very little to implement in terms of finance and time.

The research contains important theoretical implications which will be explored in associated academic journal and conference contributions. Results largely support the view of those with dyslexic features suffering a central obstacle in their phonological processing, and consequently often responding to learning methods that tap their visual and semantic

strengths. It would be of interest to further investigate the interaction between cognitive strengths and weaknesses, and current literacy skills and acquisition, as children progress from 3 years to adulthood. Responses to teaching clarify normal literacy development and weaknesses in failing children and those with dyslexic features. These methods highlight individual differences in learning and learning difficulties, and will be important to future theoretical models, as well as effective teaching and success within education for children.

As with all research, further investigation is indicated and necessary. The numbers of children involved, although more than in many studies, have still been small, at times having an impact on the significances obtained. The study, although over three and a half years, has been limited in time, and further work is needed to address both the developmental view of children's cognitive and literacy growth and interactions with teaching, as well as increasing the numbers of children studied. The field trials need to be fuller, covering a greater variation of types of schools, which was attempted but had to be aborted. There has been regard to the teaching background of the child and the interaction of those experiences with the individualised teaching techniques or learning style, but these aspects require further investigation in class and specialist teaching settings. However, in Stage 5, all the children had been exposed to a variety of teaching methods, and their spelling ages clearly improved when the most effective learning style was offered. Further work is needed to focus on the effects of the words being learned, as well as examining the Literacy Strategy's words and curriculum chosen. Attention also needs to be given to view learning styles in other areas, such as number, mathematics and foreign language acquisition.

This study explored the uptake of spelling, which was chosen for investigation since it is an area which is easy to adapt for scientific study and is a key aspect of literacy with regard to further language development, education and dyslexia. Reading acquisition, for example, is much more difficult to quantify although it is directly affected by spelling acquisition. However, what has been shown to be the case in this research with spelling, could just as easily be applied to, for example, mathematics, language, or chemical formulae learning. The message is simple and generalisable; namely, once a child or adult discovers his/her own individual approach to learning, it is possible to speed the learning process up without costly or time consuming techniques, and will be useful throughout the individual's life, along with preventing the loss of a potential workforce. On an emotional level, it will help prevent the suffering that all too often follows failure at school.

These research findings, if implemented, will help to achieve many of the present government's aims and objectives, "to give everyone the chance, through education ......to realise their full potential"; "ensuring that all young people reach 16 with the skills......that will give them a secure foundation for lifelong learning"; "developing in everyone a commitment to lifelong learning.......in particular by making learning attractive and accessible" (DfEE 1998). If this research is followed up in developing the issues discussed, future work may achieve many more objectives of this government.

It seems a good note to end this work on, by considering the children involved and their feelings. Visiting them recently, a year following the end of working with them, it was powerfully moving listening to their responses to the work they had done for the research.
In particular, S.B. and J.R's responses to questions regarding how they felt before the work about themselves and how they felt now, adds more weight to the research than any statistical significances. S.B. dissolved into tears when asked about how he used to feel and said it was

too painful to go back to those feelings. The teasing, the difficulties, the tears, the lack of self-worth, however, have now all gone. He said he could write stories and really express what was inside him, rather than relying on the simplistic words he could spell. He said he now felt as clever as his friends and he enjoyed school. When JR was asked whether the work was worthwhile, he said, "definitely", because now, rather than struggling with spellings, he "just knows how to spell them from his head".

We, therefore, encourage adding individual learning to a child's education and a country's curriculum.

CHAPTER 8:   RECOMMENDATIONS

Further work indicated includes :

Making inexpensive guides to establish individual learning methods available to all, which will complement multi-sensory teaching materials.

Extending field trials over larger numbers and other geographical areas. This would judge individual styles of learning further, and enable extended evaluation of learning methods that have been considered and other proposed methods.

Recognising the value of individual strategies for learning, extending and measuring their effectiveness in teaching methods and the curriculum employed by the National Literacy Strategy.

Viewing individual styles of learning and their interaction with children's cognitive and literacy development over the ages of 3 years to adulthood. This will clarify implications for education at all stages, and theoretical models of literacy development and dyslexia.
Investigating the learning of children with dyslexic features and moderate learning difficulties, and those with no difficulties, in field trials in more carefully defined group studies. This will clarify differences and the need for assessment and specialist teaching inputs. It will carry implications for curricula, teaching methods and resources, and teacher training.

Assessing the impact of individual styles of learning on other materials, such as number, mathematics, reading, reading comprehension and foreign languages.

Contrasting sex differences in learning styles, literacy acquisition, and dyslexia and other learning difficulties.

Establishing an institute to evaluate teaching and learning methods, and their impact upon education, teaching, training and resourcing. The Helen Arkell Dyslexia Centre currently works closely with Surrey University, Manchester Metropolitan University and the Roehampton Institute, and consequently could contribute fully to this centre of educational and psychological expertise in such a consortium.

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APPENDIX:

The field trial materials

HADC / DfEE Project on Spelling

Field Trials in Schools

Field trials will be run in 3 local authority infant or primary schools and 1 independent pre-preparatory/preparatory school from September 1997 to July 1998. The trials will aim to test the effectiveness of teaching strategies for spelling that have been supported by earlier research and that enable individual styles of learning in raising children's spelling levels over this period. The children will be aged 6 to 8 years in Years 2 and 3. Half of each school will begin using the materials in September 1997; the remainder will use the materials from February 1998. It is anticipated that schools will be halved according to classes as it may be impractical to try to divide any single class. The materials and input are designed to be simple and easily offered such that they can be used by class teachers, special needs teachers, assistants and parents. The project should fit any current school spelling policy and materials can be offered to all children, those showing difficulties or an arrangement favoured by the school. The project should not alter any special needs provisions made by the school.

The project materials will enable any child's most effective teaching strategy for learning spellings to be established. A child would be given a list of 10 words to be taught for 1 week. The words would be derived from the school's usual sources: a spelling programme, current project words, the child's errors in work, etc.. Each day the child is tested on the words by a teacher, assistant or parent. As he/she makes an error, he/she is taught by the nominated teaching strategy. The number of words correct is noted each day on a simple graph.
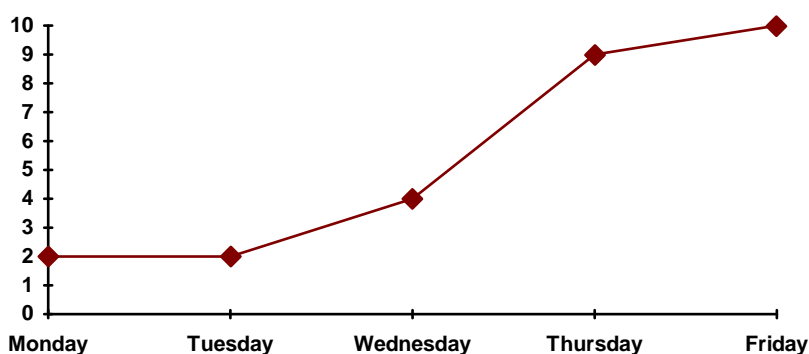
Next week a new set of words is taught using a different teaching strategy. This procedure is used for 3 or more strategies until a preferred strategy is chosen. This chosen method is used by the child for spellings each week in future.

A collection of teaching strategies will be offered. This will include 3 methods found effective in our research and some other methods that seem different and which may appeal to the learners' and teachers' styles. The strategies used for any child can be decided by the child and his teacher, assistant or parent although it is suggested that some of the strategies found most effective in our research are at least tested.

What do we expect from the school? We would aim to meet with relevant class teachers (and any other interested parties!) for one hour in September 1997 in order to deliver and explain our materials and the project. We would hope for the school to use the materials. We would hope to gain feedback on the use of the materials and comments in conversation over the year and will provide class lists to note chosen teaching strategies for any child using these. We will similarly bring the next half of classes into the project in a one hour meeting in February 1998.

We will test all children's spelling in September 1997, February 1998 and July 1998; all results will be given to the school. We will visit each school at least once per half term in order to check on any difficulties. We will be available to discuss children who are not making progress and to offer advice on further teaching methods and to assess further if appropriate. We will share our final reports with schools.

Sally Weeks   Research Officer

Peter Brooks   Principal Educational Psychologist

TEACHING AND LEARNING SPELLINGS

Some notes for teachers

Many of the teaching methods have been used in earlier work with individual children and in group studies. Some of these findings may be helpful.

Neurolinguistic Programming (NLP), Look-Cover-Write-Check (LCWC) and Onset-Rime were the most effective in teaching spellings to 7-8 year old dyslexics and slow learners. NLP and Onset-Rime were particularly effective with dyslexics, seeming to emphasise thinking strengths in visual areas and finding an in-road into weaknesses in using sounds in language respectively.

Slower learners may have marked difficulties in making progress but we have again found NLP and LCWC to be helpful. Phonics may give a clear structure that can be easily reinforced for these children.

NLP seems a strategy that can be easily generalised and used across different spellings and learning situations by children in the late-infant to early junior age range.

The choice of teaching methods to try on a child may also be affected by the child's and teacher's preferences. Indications of motor, visual or language problems in the child might suggest a deliberate move to teach to strengths or endeavour to build consistency in an area of weakness. The child's liking for a method and his/her feeling of success can be a very useful indicator at the end of a teaching trial.

The sets of ten words can be made up from any words that are needed by the child. Possible sources could include spelling test lists, words used frequently by young children, errors made from work, words from a class or individual spelling programme, current topic words,......... It will be helpful if the 10 words used for each spelling programme could be of a roughly similar standard as, for example, in length.

Overall, our philosophy rests on individuality in children and teachers. Teaching methods should be varied and adapted to offer the best learning. Do let us know any successful adaptations or alternative teaching methods.

Please photocopy any materials.

TEACHING AND LEARNING SPELLINGS

Notes for parents, teachers and assistants

We can try to find the best way for a child to learn spellings.

We find 10 words the child needs to spell. Each day for one week he/she tries to write the words. If a mistake is made, we teach the word in the way given on the teaching page. The number of words right on each day is marked on a graph.

The best ways of learning spellings for many children are on teaching pages 1, 2 and 3 but you can use any pages you think the child will like for each week's teaching.

We find 10 more words and learn them for one week using another teaching page. We compare the graphs to see the better way to learn - the higher graph is the best.

We can repeat this testing until we feel we have the best teaching method. 3 or 4 test weeks are likely to be enough.

HADC

TEACHING AND LEARNING SPELLINGS

Number of
words right
each day

	Monday	Tuesday	Wednesday	Thursday	Friday
10					
9					
8					
7					
6					
5					
4					
3					
2					
1					

Day of the week

Name: _____ Date on Monday :_____

When we are happy that we have the child's best way to learn spellings, we use that with him/her for learning any spellings in school and home.

If there are any problems over words to be learnt, teaching pages, graphs or the best way to learn, ask your child's teacher.

Please photocopy any materials

TEACHING AND LEARNING SPELLINGS

<u>Teaching page 1</u>

<u>NLP</u>   (Neurolinguistic Programming)

We try to get the child to think visually and to see things and words. We start this by saying that we all have a camera in our heads which lets us remember things as if a picture was taken.

Ask the child to see his/her bedroom in his head. Ask the child to see and tell you details such as where the bed is, the shape of the window, how it opens.....

You need only do this "seeing work" the first time.

Ask the child to write the spellings for this week.

For each word that is wrong, write the word correctly on a piece of paper this size. Hold the word 3 feet in front of the child so he/she can see it, about 1 foot to the left of the child's face and about 1 foot above the child's face.

Illustrative picture in the actual materials

Talk about the word while it's held there - its meaning, its shape, bits that stick up or down (eg like   long   ),words that are in the word (like <u>or</u> in <u>word</u>) beginnings or ends of the word (like play<u>ing</u>)........

Ask the child to write the word and check it's right.

<u>Please photocopy any materials.</u>

TEACHING AND LEARNING SPELLINGS

Teaching page 2

Onset-Rime

Ask the child to write the spellings for this week.

For each word that is wrong, spell out the word using plastic or wooden letters, or letters written on small pieces of paper. Show the child how the word can be broken into sounds by moving parts of the word. (page has the sounds p age). Say, "*We can break up the word and listen to its sounds like this (p age). If we put the pieces together the word is (page)."* Move the letters together as you say the whole word.

Ask the child to break up the word, say the sounds in the word, say the word and put the sounds together, as you have done.

Words can be broken up like this:-
(if they have one beat or syllable)

        p age / page   pl ay / play

        b ig / big   sch ool / school

(if they have more beats or syllables)

        l et = t er / letter

        h e = ll o / hello

        g ood = b ye / goodbye

        w in = t er / winter

        t o = m or = r ow / tomorrow

Ask your teacher if you have any problems!

Please photocopy any materials.

<u>HADC</u>

<u>TEACHING AND LEARNING SPELLINGS</u>

<u>Teaching page 3</u>

<u>Look-Cover-Write-Check (LCWC)</u>

Ask the child to write the spellings for this week.

For each word that is wrong, write the word correctly. Ask the child to look at it carefully - allow about 10 seconds. Cover the word. Ask the child to write it out. Ask the child to check his/her spelling with the correct spelling and talk about any mistakes.

<u>Please photocopy any materials.</u>

HADC

TEACHING AND LEARNING SPELLINGS

Teaching page 4

Own - Voice

Ask the child to write the spellings for this week.

For each word that is wrong, the child records the whole word on tape, (page), then the individual letter names (p a g e), and again the whole word (page). The tape is re-wound, the child listens to the tape and writes the word again. Check it is right.

Please photocopy any materials.

TEACHING AND LEARNING SPELLINGS

Teaching page 5

Tracing

Ask the child to write the spellings for this week.

For each word that is wrong, write the word on a card with letters 2 inches high. The word is written on sand paper, so the word can be felt. Ask the child to trace over the letters with his/her index finger as if writing them.

Please photocopy any materials.

TEACHING AND LEARNING SPELLINGS

Teaching page 6

Simultaneous - Oral Spelling

Ask the child to write the spellings for this week.

For each word that is wrong, write the word correctly; say each letter name as you write it. Ask the child to write the word and say each letter's name as it is written. Ask the child to say the whole word and check it is right against your own word.

Please photocopy any materials

<u>HADC</u>

<u>TEACHING AND LEARNING SPELLINGS</u>

<u>Teaching page 7</u>

<u>Picture Association</u>

Ask the child to write the spellings for this week.

For each word that is wrong, discuss a picture with the child that he/she feels shows the word. Draw the picture with him/her on a card or paper. Write the word underneath. Each day that the child gets the word wrong again, ask him/her to look at the picture and word for about 10 seconds.

<u>Please photocopy any materials</u>

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TEACHING AND LEARNING SPELLINGS

Teaching page 8

Mnemonics

Ask the child to write the spellings for this week.

For each word that is wrong, write the word correctly. Talk through a saying each word of which starts with each of the letters in the spelling. For example, with page we might use the saying *pigs are good eaters*! The child repeats and learns the saying to help remember the word's spelling.

Please photocopy any materials

TEACHING AND LEARNING SPELLINGS

Teaching page 9

Phonics

Ask the child to write the spellings for this week.

For each word that is wrong, spell out the word using plastic or wooden letters or letters written on small pieces of paper. Say each sound in the word such as   b i g (in big), s t ay in (stay) and w i n t e r (in winter), and y acht (in yacht). Say the whole word.

Ask the child to say the sounds in the word and the whole word just as you have done. Ask the child to write the word. Check it is right.

Please photocopy any materials

TEACHING AND LEARNING SPELLINGS

Teaching page 10

Look - Say

Ask the child to write the spellings for this week.

For each word that is wrong, write the word correctly. Ask the child to look at the word carefully, allowing about 10 seconds, then say the whole word.

Please photocopy any materials

GLOSSARY

This glossary gives definitions of terms employed in the final report that may not have been encountered by the reader before. It is not a comprehensive list of all the technical words used, but, instead, lists terms not expanded upon in the text, or abbreviations which have been used. The terms are presented in alphabetical order.

ANOVA. Analysis of variance - a statistical test for making simultaneous comparisons between two or more groups of data.

BAS. British Ability Scales, a test to assess word reading ability.

BPVS. British Picture Vocabulary Scales. A test examining listening vocabulary.

Centile. Any point on a ranked distribution of scores, each of which contains 1/100th of the scores. Therefore, a centile rank of 55 means that the score representing the rank is higher than 55% of all the other scores.

Cognitive/Cognition. A broad psychological term traditionally used to refer to activities such as thinking, conception of thoughts and reasoning.

Chronological Age. Actual age, ie time since birth, rather than age measured by another mode such as ability.

Digit Span. A test of immediate short-term memory. The participant is given a series of random numbers and has to immediately recall them in the order offered.

DST. Dyslexia Screening Test. A test used to give indications as to whether the individual presents with any dyslexic tendencies.

Dyslexia. Also known as a specific learning difficulty. There is a lack of consensus among psychologists as to exactly how to define dyslexia; however, broadly the term is used for children who are significantly behind their chronological age in reading and spelling skills, when there is no evidence of any debilitating disorder such as emotional problems, hearing difficulty, English as a second language and mental retardation. There is a discrepancy between literacy skills and ability levels.

ERN. Exception, Regular and Nonsense Words. A test developed for the research to assess the children's reading and spelling skills and their approaches to reading and spelling.

Family-wise errors. Chances of getting statistically significant results are increased when a series of analyses are offered on related data.

HAST. Helen Arkell Spelling Test. A test developed by the Centre to assess spelling ability.

Mann Test of Trend/Mann Analysis of Trend. A statistical test used compare changes in 2 groups of data.

NLP. Neurolinguistic Programming. A method for learning employing visualising skills - *For further detail see pages 17-19.*

Nonsense Word Reading. The participant is given words to read that do not exist but could be attempted since their make-up is phonically based. This indicates if the child is using phonic methods.

Orthography/Orthographic Skills. Orthography is a generic term used to cover any writing system. Orthographic skills is used to refer to the child's writing skills.

PhAB. Phonological Assessment Battery. A series of tests used to assess phonological skills, or the precise use of sounds in language.

Phonology. A phoneme is the minimal unit of speech that affects the meaning of a word. A child's phonological skills are those that allow him/her to hear and decipher the meaning of the word.

S.E.N. Special Educational Needs. This refers to a child who, for a variety of reasons, requires some form of extra educational support in school.

S.D. Standard Deviation. This is a measure of the variability of a sample of scores from the mean of the sample. This is given as an arithmetic mean of the differences between each score and the mean.

Teaching Strategies - *See pages 17-19 for explanation. These strategies were adapted for research purposes. For a fuller form of the methods, see the Teaching Package to be produced following the completion of the research (Helen Arkell Dyslexia Centre).*

Technical Report. A full report on the research held at the Helen Arkell Dyslexia Centre.

T Test. This is a statistical test which is used for testing differences between two conditions when only one variable is being manipulated. It can be used when numbers of participants are small.

WISC. Wechsler Intelligence Scale for Children. A series of tests used to assess the intellectual ability of children (and in another form, adults).

Working memory. This is a hypothesised memory system which "holds" the input while an interpretation of it is worked out. The input is assumed to be in verbal form which is held verbatim while its meaning is extracted.

The tests used to assess children in this study were either developed for the research, developed by the Centre, or are published. Where the tests are original, detail can be found in the report or from the Helen Arkell Dyslexia Centre; otherwise please refer to the test itself, or the publisher, for further information.