

# A Rhythmic View of Reading: From word recognition to reading comprehension

A submission to ippr's Britain's Got Brains competition

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October 2008

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This paper was first published in October 2008. © ippr 2008

## 'Britain's Got Brains'

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This paper is one of four papers shortlisted by the judges of the 2008 Britain's Got Brains competition. The competition will be run again in 2009. For further details, please visit [www.ippr.org/britainsgotbrains](http://www.ippr.org/britainsgotbrains).

ippr is grateful to Diageo for its generous financial support of the competition, and to *Prospect Magazine*, the competition's media partner.

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## About the author

Having trained at the Royal Academy of Music, **Marion Long** has combined her career as a professional cellist with a keen interest in the effects of music training on children's well-being and development. Her PhD studies were under Professor Susan Hallam at the Institute of Education, University of London. She combines research with work as a Special Educational Needs Co-ordinator and is completing further studies with The Open University. She regularly presents papers at conferences, most recently at BPS Education Division, 'Literacies' Conference in 2007. In addition, Marion facilitates Doctoral Research Workshops at the Institute of Education, University of London.

## Acknowledgements

Many people contributed to this research project. I thank Professors Graham Welch, Keith Swanwick, Jane Hurry and Raymond MacDonald for their helpful suggestions, criticisms and comments at various stages. Sincere thanks to Ian Cross for his invaluable suggestions and criticisms regarding the theoretical framework. I am indebted to Susan Hallam for supervising this work with dedicated critical commentary, rigour and expertise and for answering my many queries with utmost clarity. The project was partly financed by The Harpur Trust and the Bernarr Rainbow Trust. The support and efficiency of the headteachers and staff in each host school and the weekly participation by the children are warmly and gratefully acknowledged.

## Glossary

<i>Alphabetic principle</i>	The system of representation between letters and sounds
<i>Analytical phonics</i>	The isolation and identification of phonemes in words
<i>Bipedal</i>	Locomotion achieved by alternating feet (rather than by jumping or hopping)
<i>Cognitive attention</i>	A hierarchical structure of consciously directed mental focus
<i>Conceptual processing</i>	The extraction of a meaningful mental representation from sequenced elements
<i>Intonation</i>	Variation of pitch in spoken language
<i>Linguistic processing</i>	The extraction of relationships through assignment of symbolic function to sequenced elements in language
<i>National Literacy Strategy</i>	A framework of professional objectives and resources for improving standards in literacy attainment in England
<i>Onset</i>	The initial consonant of a syllable
<i>Opaque orthography</i>	A language with an indirect letter to sound linkage
<i>Phoneme</i>	A single identifiable sound of language
<i>Phonics</i>	Teaching the representation of phonemes as letters
<i>Phonological alliteration</i>	Matching initial consonants
<i>Phonological awareness</i>	The conscious awareness of speech sounds
<i>Phonological discrimination</i>	The discrimination of speech sounds
<i>Phonological rhyme</i>	A repetition of identical or similar speech sounds
<i>Phonological segmentation</i>	The division of the speech stream into words and syllables
<i>Rapid automated naming</i>	Identification of colours, objects, letters or numbers under timed conditions in response to visual cues
<i>Reading Reform Foundation</i>	A non-profit organisation concerned with promoting synthetic phonics
<i>Rhythmic discrimination</i>	The ability to recognise small differences between patterns in relative durations of events
<i>Rhythmic performance</i>	The ability to reproduce rhythmic patterns
<i>Rhythmic stress patterns</i>	Patterns in which intensity strength corresponds with longer and shorter time durations
<i>Rime</i>	The phonemes from the first vowel to the end of the syllable
<i>Rule-based route</i>	Direct links between the phonology and orthography of a word activate its recognition
<i>Searchlight model</i>	NLS reading strategy based on the reading behaviour of established readers. The four searchlights were: phonic knowledge, grammatical structures, contextual knowledge and visual recognition
<i>Shared cognitive processing mechanism</i>	The theoretical concept of a processing structure that serves more than one type of cognitively specialised information processing system such as language or music

<i>Significant effect</i>	The result is unlikely to have occurred by chance
<i>Statistical learning</i>	Rules of probability influence anticipation and prediction of events such as high frequency word sequences
<i>Statistical significance</i>	The result is unlikely to have occurred by chance
<i>Stress</i>	Relative prominence
<i>Synthetic phonics</i>	The method of teaching reading in which single phonemes are blended together to form words
<i>Visual lexical route</i>	Visual features of a word activate its recognition

## Executive summary

### Literacy attainment

The Government's long-term target of 85 per cent of children attaining level four or higher in English at the end of Key Stage 2 (age 10/11) in 2008 has not been realised. This year, 81 per cent of children achieved the level four or higher, but there was also a decrease in the proportion of children attaining level five in English.

These results fuel claims by critics of statutory testing that the general trend for annual improvements in the proportion of children achieving level four and above in English at Key Stage 2 is attributable to 'teaching to the test', which limits opportunity for progress at the lower and upper ends of the ability spectrum. Overall figures show that the number of children who leave primary education having failed to reach level three has not decreased in line with 'rising standards' at level four. In 2008 more than 33,000 children were recorded as below level three in reading at the end of Key Stage 2.

### Investment in contrasting approaches

Since the Independent Review of the Teaching of Early Reading published in 2006, a particular emphasis has been placed on the teaching of phonics skills. Assessment informing target-setting in phonics teaching is set to play an important part in the drive to improve standards in literacy.

Renewed focus on the teaching of phonics was consolidated with the introduction of the 'Simple View of Reading' as the conceptual framework for the National Literacy Strategy (NLS). The Simple View is aptly named because it deconstructs reading behaviour into two dimensions, namely word recognition processes and language comprehension processes. Using this arguably psychometric and deterministic approach, teachers are encouraged to categorise children into one of four possible varieties of reader to assist with target setting.

Contrastingly, the Government has announced a national roll-out of Every Child a Reader. The investment in the Reading Recovery programme is interesting because unlike the bi-dimensional framework of the NLS, this method offers an integrated approach to literacy, in which the meaning of written language is strongly embedded within the development of word recognition processes. Therefore 'learning to read' is integrated with 'reading to learn'. Furthermore, each child is viewed as having unique literacy needs and entitlement to unique literacy provision.

### From word recognition to reading comprehension

The current NLS approach to reading pedagogy focuses heavily on word recognition through its strong emphasis on phonics teaching. Teaching strategies that specifically promote the assimilation of meaning from print, particularly among below-average-ability readers, have been neglected by comparison. Since the ability to assimilate text efficiently is a key component in studying to GCSE level, low attainment in reading at Key Stage 2 due to weak assimilation skills is a reliable predictor of disappointing GCSE outcomes later on.

A new, high-impact approach is needed, addressing two important areas:

- The development of a group teaching method that delivers improved literacy skills for children with below-average ability in reading
- Improvement in how the processes of 'learning to read' and 'reading to learn' are integrated.

This paper reports findings of exploratory research on the timing processes of reading behaviour. Following participation in a group intervention, improved rhythmic skills substantially improved the assimilation of meaning from print in the reading behaviour of below-average-ability readers:

- In randomised controlled trials, gains in reading comprehension produced statistical effects.
- The effects were most pronounced among below-average-ability readers.
- Synergistic gains in timing processes and phonological processes were significant in a study

exploring the effects of phonics teaching and a rhythm-based music intervention on reading behaviour.

- A trial directed by school staff sustained the positive effects found in the random controlled trials. Gains of three years in reading comprehension were recorded for some children.

Further research replicating this exploratory study on a larger scale would confirm whether the findings can be generalised more widely and perhaps rolled out to schools across the country. Overall, the quantitative findings of this research suggested that its potential impact could be to substantially improve the predicted educational outcome for the bottom 20 per cent of the primary population in literacy attainment.

## 1. Introduction

Each year as the results of national tests are published, concern is raised over the Government's failure to reach its target of 85 per cent of children achieving level four or above in English by the end of Key Stage 2 (age 10/11). Results from 2007 show that 81 per cent of children attained level four or above, an increase of 4 per cent from the previous year. However, this increase in level four scores seems to have been gained at the expense of the proportion of children attaining level five.

Confidence in the current system has diminished: according to Burroughs-Lange (2007), the proportion of children leaving primary education without basic literacy skills has remained largely unchanged since the introduction of the National Literacy Strategy (NLS) in 1998 (Ofsted 2002). Moreover, the provisional Key Stage 2 results published in August 2008 show that 19 per cent of children – more than 120,000 – failed to reach level four or above.

In July 2008, The House of Commons' Children, Schools and Families Select Committee reported, 'We believe that the system is now out of balance in the sense that the drive to meet government-set targets has too often become the goal rather than the means to the end of providing the best possible education for all children. This is demonstrated in phenomena such as teaching to the test, narrowing the curriculum and focussing disproportionate resources on borderline pupils.' (p19)

Approximately 30,000 children transferred to secondary school without basic literacy skills last year (Burroughs-Lange 2007). This year more than 33,000 children failed to achieve level three in reading at the end of Key Stage 2 (Department for Children, Schools and Families 2008a). The task of reducing this statistic was described by the Schools' Minister as the 'biggest challenge' (*Guardian* interview podcast, 2008).

### **Purpose and methodology of this paper**

This paper argues firstly, that the narrowing of the curriculum needs to be urgently addressed. Secondly, the current target-driven approaches are not efficient across the ability spectrum: perennial debates about attainment targets set at level four divert public attention away from failure of the current system to address the educational needs of many children that do not achieve level three, remaining trapped in the social snare of illiteracy.

It goes on to build on the existing evidence base on the link between reading and rhythm, asking if training in rhythm can improve reading attainment, and if all children can benefit from a rhythm-based approach to reading.

### **Inside the classroom**

As part of this research, 'teaching-to-the-test' was encountered during a facilitatory observation of a Key Stage 2 English lesson of below-average-ability readers 10 and 11 years of age and witnessed their struggle to read the National Literacy Strategy (NLS) Key Stage 2 texts. They were working towards achieving level two or level three at the end of Key Stage 2.

The children, who were asked to read aloud from the text, did so in a faltering, disjointed way. For some children, individual words posed difficulties and because reading aloud involved sounding out the word, the thread of the sentence was abandoned and not regained. Many simple words were substituted, for example 'we' was read as 'she', which rendered the account incomprehensible. The children read in flat, dull, monotonous voices and were unable to form meaningful phrases while they read, even if they did not experience difficulty with individual words.

The main events of the story and the roles of individual characters were completely obscured by the children's difficulties in reading the text aloud. It came as no surprise that the children's genuine attempts to answer information retrieval questions were wild guesses and showed very limited or no understanding of the story. There were no average-ability or above-average-ability children in the class, so the weak readers did not hear a model of fluent or confident reading. Similarly, there were no children in the room that transmitted a sense of the stimulation or the rewards of reading to counteract the overwhelming sense of frustration of these children.

In this particular classroom, teaching to the test was prominent. This involved adopting a strategy that did not address the children's difficulties with literacy, but instead promoted strategies for drilled performance in the test. The training principally demanded visually identifying one word as the key word in the question, identifying the keyword in the text and writing down the sentence in which the keyword appeared. Often the children showed complete ignorance of the keyword. The objective of this strategy was to teach the children to answer test questions without basic understanding of the text, the question, or, indeed, the keyword.

The central issues concerning the children's poor reading comprehension and reading fluency that were so acutely underdeveloped were not addressed. After the lesson, their highly dedicated English teacher admitted that the children were being taught texts that were far too difficult for them. She was distressed by the fact that the children were not being taught at the appropriate level. On a daily basis, the take-home message for these children was overwhelmingly clear: that reading was indeed a meaningless activity. Learning to mask illiteracy was the priority for these children and their teacher.

## 2. The policy context

There have, of course, been a number of efforts to combat unacceptable educational outcomes surrounding literacy achievement in recent years (Lewis and Ellis 2006). In the early years of the decade, there was a continuing campaign for a synthetic phonics approach to teaching early literacy by the Reading Reform Foundation, which was countered by those that advocated an emphasis on reading for pleasure and a more holistic approach. Ofsted (2001) formalised the growing debate on how best to teach phonics: as a form of pedagogy that focused on the relationships between letters and sounds. Two years later in 2003, a seminar on teaching through phonics was held and attended by researchers, and representatives of the National Literacy Strategy.

Subsequently, the then Department for Education and Schools (DfES) published *Playing with Sounds* (later succeeded by the 'Letters and Sounds' programme), which promoted a balance of approaches to systematic phonics, advocating the allocation of 15 minutes of the literacy hour for the development of phonological awareness, spelling and word level reading. Nonetheless, a debate between synthetic and analytical phonics gained momentum and continued to be played out in the media and through political channels. A key development came in 2004 when a Parliamentary inquiry investigating the teaching methods used in children's early literacy development was set up by The House of Commons Education and Skills Select Committee. The outcome in 2005 was a recommendation to commission a large-scale comparative study between the National Literacy Strategy and the synthetic phonics 'first and fast' method.



### **‘First and fast’: the findings of the Rose Review**

‘First and fast’ in the teaching of synthetic phonics refers to a preliminary period of high-impact teaching routines in which children acquire phonological knowledge of the sounds and sound patterns of the English language prior to reading from books. Findings of a report published by the Scottish Education Executive (Johnston and Watson 2005) were presented to the House of Commons Education Select Committee in February 2005 detailing comparative research into teaching through synthetic phonics that took place in Clackmannanshire.

This study has by no means been uncontroversial. It has been criticised methodologically (Wyse and Styles 2007), and Brooks (2007) has argued that investigations in the form of randomised controlled trials were urgently required. Nonetheless, in spite of weak empirical evidence from the comparative study, the DfES *Independent Review of Reading* (known as the Rose Review) stated:

‘...synthetic phonics offers the vast majority of young children the best and most direct route to becoming skilled readers and writers...’ (Rose 2006: 6)

The Rose Review found that insufficient time was given to phonics teaching in a large proportion of the schools visited and recommended the strengthening of this teaching, as well as a reconsideration of the Searchlight model of reading which had underpinned the development of the NLS framework. In referring to a ‘discrete approach’ (Rose 2006: 4), the report recommended that phonics teaching be delivered as an independent skill, a view that was contested by experts who advocated that phonics teaching is more appropriately delivered during the reading of text, as an embedded skill that complements other reading skills. A heated exchange between competing viewpoints followed. It is highly regrettable that a substantial proportion of disquiet in the ‘phonics wars’, as they have been dubbed, has arisen unnecessarily, from inadequately defined technical terms.

### **Phonics teaching in context: findings of the Rose Review**

A balanced review of the literacy debates, edited by Lewis and Ellis (2006), sets out a glossary of consensual definitions agreed upon by leading academics in the discipline. There are two main approaches in phonics teaching:

- Phonological synthesis: the ability to blend separate phonemes into whole words.
- Phonological analysis: the ability to identify or extract individual phonemes from words.

(A phoneme is a single identifiable sound of language. See the glossary for further clarifications of technical terminology.)

Underlying ‘the phonics wars’ are competing theoretical and, to some extent, ideological positions. Synthetic phonics approaches have been criticised for promoting a constricted pedagogy due to the discrete teaching of phonics and the delayed introduction of essential reading skills, whereas analytical phonics teaching presents phonics in an embedded context, prioritises access to reading for meaning, but has been criticised for an over-reliance on the use of context and illustrations to support the decoding of words through guessing. The Rose Review fuelled this debate by concluding that systematic phonic work is ‘much strengthened by a synthetic approach’ and claimed to have considered ‘a wide range of evidence’ (Rose 2006: 36).

However, little consideration has been given to the array of evidence that demonstrated gains in reading behaviour through interventions based on ‘whole language teaching, whole word teaching, a broader curriculum focus’, and to ‘studies that do not show gains following phonics, [and] studies showing gains when phonics teaching is contextualised within a comprehension-focussed delivery’ (Wyse and Styles 2007: 176). Indeed Brooks (2007) agreed with Wyse and Styles that the Rose Review ‘went beyond the research evidence in advocating synthetic phonics’ (Brooks, citing Wyse and Styles 2007: 170).

Thus in recent years the teaching of reading has recently become more prescriptive than ever before, with the size of the phoneme now under scrutiny. While it is thought that initial teaching in phonics improves the efficiency of decoding text at the subliminal level of processing, the ideal size of the

phoneme to be taught is contested by academics and practitioners alike. For example, should the word 'blend' be taught as 'b-l-e-n-d' with each letter representing a separate phoneme, or as 'bl-end' where letters are blended together to represent larger phonemic units?

The key elements of decoding (segmenting words into their constituent parts) and encoding (constructing words from their constituent parts) are prominent in both analytical and synthetic approaches, and many teachers advocate using a mix of both approaches. At the child development level of the reading debate there are other factors to consider such as the child's motivation to read, familiarity with the activity of reading, level of language development and level of developmental and emotional readiness to read.

A tendency to oversimplify the complex and multi-dimensional orchestration of reading processes can be unhelpful: 'The language of written texts is accessed via the eyes rather than via the ears' (Rose 2006: 89).

In practice, the comprehension of language accessed 'via the ears' is already grammatically organised by the speaker using intonation and stress, whereas the comprehension of written texts accessed 'via the eye' requires the reader to interpret meaning from punctuation and capitalisation. In other words, as well as applying the alphabetic principle, readers also learn to represent meaning by establishing relations between the decoded words, the overall meaning of the text and their own mental structure of prior experience and knowledge of the world (see Cornoldi and Oakhill 1996).

### 3. The reading 'black box': the processes that underlie reading in English

In modelling cognitive processing from print to words, Coltheart's (1978) theory sets out two parallel systems, a visual word recognition system and a rule-based system for decoding text. Both systems have distinct functions and features that are necessary for reading a language such as English, which has an opaque orthography: it is full of anomalies and contradictions in the correspondence between the sound of a word and its visual representation, arising from the language's diverse and fascinating etymology. For example, a simple pattern of words that share the same rime 'ave' would produce the pattern: brave, shave, grave and cave, but this rule-based pattern is violated by a highly used word, 'have', which is assumed to be automatically processed by the visual word recognition system.

The bootstrapping of the learned activity of reading onto biologically pre-determined and socio-culturally acquired processes of language development inevitably generates individual differences which are products of genetic, social and cultural background, even before the type of teaching method is considered. Importantly, in the same way that children prefer to write with either their left or right hand, some children have a natural preference for processing words using one word recognition route to the near exclusion of the other route. A child with a strong preference for using the visual word recognition route will tackle a familiar but irregular word such as 'sword' successfully, but fail to recognise a less familiar, but phonemically regular word such as 'marshes' (enunciating a short vowel sound as in 'mash'). Conversely, a child with a strong preference for the phonemic or rule-based route to the near exclusion of the visual word recognition route will read 'commemorating' with relative ease, but fail to recognise 'sign' (enunciating the silent 'g' as in 'signal').

The visual route is known to be the fastest route for recognising familiar words but is not equipped with any means of tackling unfamiliar words. The rule-based route is slower at recognising familiar words, but tackles unfamiliar words efficiently. Arguably, development of both the visual and the rule-based routes is necessary for children to learn to automatically read regular and irregular words using the appropriate processing system without a loss of fluency.

Nevertheless, pedagogic emphasis on one route to the exclusion of the other may have a deleterious impact on the progress of children that are not naturally predisposed to using the route favoured by the approach. This argument has implications for the assessment of early stages of reading, where

children may be disadvantaged by any weighting in the assessment towards one or other processing route and produce either false positive or false negative findings.

### **Statistical learning**

To compensate for personal preferences in the choice of word recognition routes, readers also use context to anticipate the direction taken by a text. For example, it is not unusual for readers to read 'long ago' as 'a long time ago'. In this instance both the visual and the rule-based routes have been circumvented by the use of context and a familiarity-based system of predictive processing (not unlike predictive text on a mobile phone), which relies on the anticipation of meaning in the short, medium and long term. Anticipation requires verbal reasoning and intuition, whereas guessing involves intuition but no verbal reasoning and this distinction may be helpful in debates that concern reading comprehension and its pedagogy.

Indeed statistical learning, which operates on the principle of probability, has been recorded in infants as young as nine months and this form of learning is associated with phonological segmentation of the speech stream into meaningful phrases and rhythmic perception of phrases (Saffran *et al* 1996, Trehub and Trainor 1993).

It is argued that statistical learning also plays an important part in comprehension processes of reading behaviour. A proposed dynamic system of integrative feedforward and interactive feedback loops may contribute to comprehension processes and an equitable level of momentum in reading. Therefore the subtle complexity of reading may be harmfully constrained by too much emphasis at the phonic level, particularly if the prescribed route does not match the learning preferences of an individual (see Porkoni *et al* 2004).

### **The link between reading and rhythm: is rhythm the fourth 'R'?**

This year the Government published the Early Years Framework (Department for Children, Schools and Families 2008c), setting out learning targets within six learning areas. Traditionally, pre-school and reception level curricula have been relatively holistic in structure, infused with music, movement, action-songs, rhymes and stories. Accordingly, many synthetic phonics programmes reflect something of that tradition by using hand signals and actions in association with individual phonemes.

Investigations into the extent to which phonological awareness develops in young children and the strength of any shared cognitive processing mechanism with rhythmic ability may enrich the debates surrounding phonics teaching. Children aged from four to five years were found to have rhythm-tapped the syllables of words successfully, but had difficulty with rhythmically tapping out the phonemes (Lieberman *et al* 1974). Musical competency in good and poor readers was compared by Atterbury (1985), who found a significant difference in rhythmic performance for poor readers in children at 7 years old.

The effects of musical training on language and literacy skills in good and poor readers were compared by Overy (2000), who found that very highly significant gains in phonological skills and spelling attainment occurred, with the largest improvement being found among children at high risk of dyslexia. The musical training focused mainly on singing, which involves slower temporal processing of phonological information, and this provided a particularly suitable mode of learning for children at risk of dyslexia in line with pioneering work by Tallal *et al* (1996).

Similarly, Goswami and colleagues (2002) conducted a study to investigate whether a timing difficulty might account for differences between dyslexic and precocious readers. Their findings strengthened the argument for the importance of rhyme and rhythm in literacy development in preschool. Similarly, studies in the importance of rhythm as the integrator and regulator of language comprehension have a long and well established history (see Cutler *et al* 1997 for a review).

A longitudinal study conducted by David *et al* (2007) deconstructed factors of rhythm, rapid automated naming and phonological awareness as predictors of reading ability. The outcome showed that rhythmic performance at age 3 related significantly to phonological awareness, reading attainment and rapid automated naming. Rhythmic performance was also found to be the strongest

predictor of word reading skills for children from 9 to 10 years of age, supporting the findings of previous studies where rhythmic training produced significant effects on phonemic awareness (Lundberg *et al* 1988) and reading attainment (Douglas and Willets 1994, Hurwitz *et al* 1975).

The research presented in this paper seeks to build on this evidence base, by asking:

- Can training in rhythm improve reading attainment?
- Can all children benefit from a rhythm-based approach to reading?

## 4. Researching the effect of a rhythm-based music intervention on reading behaviour

To examine the relationship between reading attainment and rhythmic ability, a sequence of three investigations was conducted in a project spanning five years:

- The first stage of the project involved three randomised controlled trials of a music intervention on a *representational* sample of children between 8 and 10 years of age.
- In the second stage the effects of training through a phonics intervention and the music intervention on the reading and phonological abilities of *below-average-ability readers* of between 10 and 11 years of age were compared.
- The third stage of the project involved a trial in two schools, where the music intervention was led by school staff.

Across all three stages of the project, findings consistently showed gains in reading comprehension by below-average-ability readers following participation in the music intervention.

The rhythm-based music intervention was designed to help children who could not clap in time with a piece of simple music. Participation in the intervention involved stamping the feet alternately while keeping time with a musical accompaniment. Synchronised clapping was added to stamping and then finally the full exercise was learned, by coordinating simultaneous stamping, clapping and chanting while reading music notation. The 10-minute music intervention sessions were delivered on a weekly basis for six weeks.

The Neale Analysis of Reading Ability ('NARA'; Neale 1989), designed for use with 6- to 13-year-old children, was used to measure the impact of the intervention on reading behaviour. This test measures the child's oral reading ability and their comprehension of the text. It therefore offers a realistic measure of reading ability, allowing the integration of text with other context-driven features of reading behaviour such as general knowledge and vocabulary. Reading comprehension tests of this type provide a more sensitive measure of a child's ability to assimilate meaning from print than measures such as multiple choice procedures or single word reading tests<sup>1</sup>.

The impact of the intervention on reading was measured using three indicators:

- The *rate of reading* score, recorded as number of words read per minute (wpm).
- The *reading accuracy* score, achieved by recording the percentage of omitted, added, mispronounced, reversed or substituted words in the child's reading.
- *Reading comprehension*, scored by recording the percentage of correct responses to questions demanding literal and inferential responses, posed immediately after the child had read the passage of text. Literal responses required the child to simply retrieve information directly from the text, whereas inferential responses required appropriate interpretation of the text.

1. In Stages One and Two, practical time constraints on individual testing limited each child to reading two or three passages of text and answering comprehension questions on these. This form of testing allowed for before and after comparisons to be made, but was insufficient for the calculation of reading age scores.

### Stage One: Three randomised controlled trials

Three trials were conducted in three separate schools in small regional towns using randomly selected representative samples of 24 children aged 9 and 10 years. At the start of each trial, the children were organised into pairs, matched by ability in reading comprehension, taken from baseline scores. Both children from each pair were randomly allocated to each of the intervention and control groups. This process ensured that reading comprehension levels between the comparison groups were matched. Control group children participated in curriculum music lessons. Intervention group children participated in the rhythm-based music intervention described above. After six weeks, the children's reading behaviour was tested again and the results for the two groups were compared.

The mean score in reading behaviour before and after the experiment was calculated for intervention and control groups and subtracted to give scores measuring mean changes in reading behaviour for each group. This procedure was followed for each of reading comprehension, reading accuracy and reading rate scores. The practice of describing the mean score as representative of a diverse group produces a flattening effect, achieved by the lower ability children being masked by the higher ability children, and so on.

Therefore, a second stage in the analysis involved analysing the results for children of below average (mean) reading ability.

### Findings

A summary of findings for the three analyses of variance from Stage One across the three schools, showing sample size (n), means, standard deviations (in brackets) and probability values, is presented in Table 4.1. The significance level was set at .05. Following analysis, a change in scores is regarded as not significant (ns) if the probability value exceeds .05.

		n	Change in reading comprehension			Change in reading accuracy			Change in reading rate		
			Rhythm intervention	Control group	Sig	Rhythm intervention	Control group	Sig.	Rhythm intervention	Control group	Sig
School 1 (n=24)	Representive sample	12:12	30.21 (24.69)	4.12 (25.19)	ns	28.63 (31.57)	14.56 (24.32)	ns	24.08 (10.51)	20.33 (9.57)	ns
	Above-aver. -abil. readers	5:6	<b>15.00</b> (10.46)	<b>-4.17</b> (17.08)	.011	38.78 (41.76)	12.48 (34.45)	ns	25.59 (3.68)	22.58 (8.61)	ns
	Below-aver. -abil. readers	7:6	41.07 (26.73)	12.5 (30.62)	ns	21.37 (22.75)	16.63 (10.24)	ns	22.99 (13.79)	18.08 (10.74)	ns
School 2 (n=20)	Representive sample	10:10	<b>18.75</b> (21.44)	<b>7.5</b> (22.20)	.012	2.00 (2.54)	2.10 (3.00)	ns	5.70 (9.71)	15.30 (11.31)	ns
	Above-aver. -abil. readers	5:6	7.50 (6.85)	8.33 (15.14)	ns	1.00 (1.58)	0.00 (2.59)	ns	3.80 (11.26)	12.00 (10.84)	ns
	Below-aver. -abil. readers	5:4	<b>30.00</b> (25.92)	<b>6.25</b> (33.07)	.007	3.00 (3.08)	4.00 (3.87)	ns	7.6 (8.73)	20.25 (11.91)	ns
School 3 (n=25)	Representive sample	13:12	21.15 (35.86)	<b>-1.04</b> (19.55)	.006	9.62 (21.02)	0.76 (36.71)	ns	0.37 (13.27)	-6.0 (16.24)	ns
	Above-aver. -abil. readers	8:5	10.94 (29.46)	-17.5 (18.96)	ns	4.39 (11.97)	-4.5 (39.86)	ns	0.21 (16.19)	-13.9 (18.97)	ns
	Below-aver. -abil. readers	5:7	37.50 (42.39)	10.71 (8.63)	ns	18.00 (30.52)	4.46 (37.05)	ns	0.63 (8.35)	-0.4 (12.48)	ns

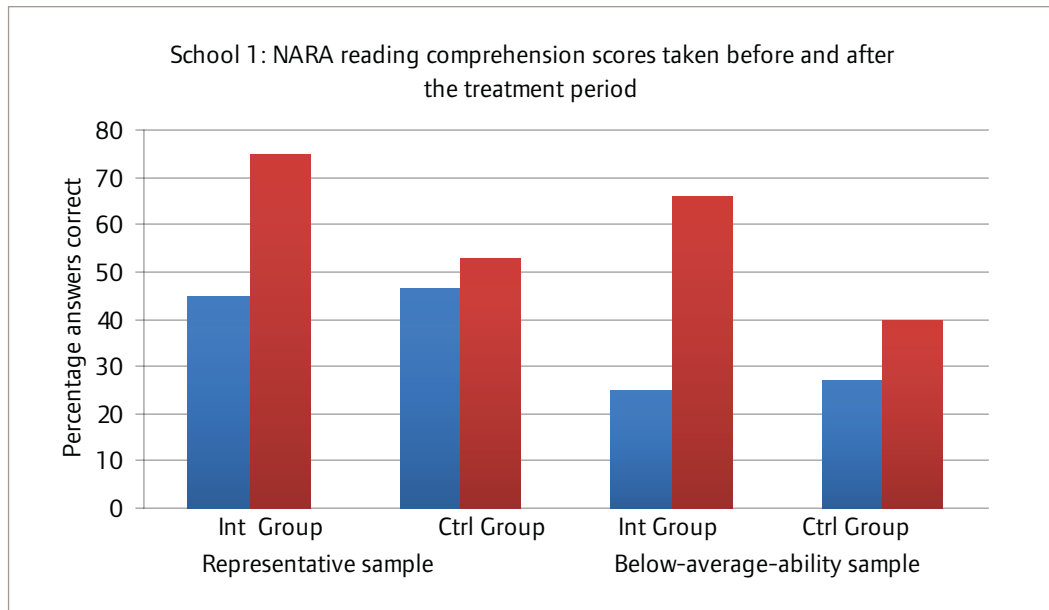
NARA=Neale Analysis of Reading Ability. Significant results are in bold.

**School One**

In the representative sample, there were no significant effects in reading behaviour change but a trend in the predicted direction was observed. The strongest contrast occurred in change scores in reading comprehension, with an increase of 30.21 per cent of correct responses in the intervention group (int) and an increase of 4.12 per cent of correct responses for the control group (ctrl) (see Figure 4.1). The contrast in changes in reading accuracy was less dramatic and there was little difference between the two groups in rate of reading.

Looking at the change in scores for the below-average subgroup, a positive trend was observed for changes in reading comprehension although the mean change in scores did not reach statistical significance (Figure 4.1).

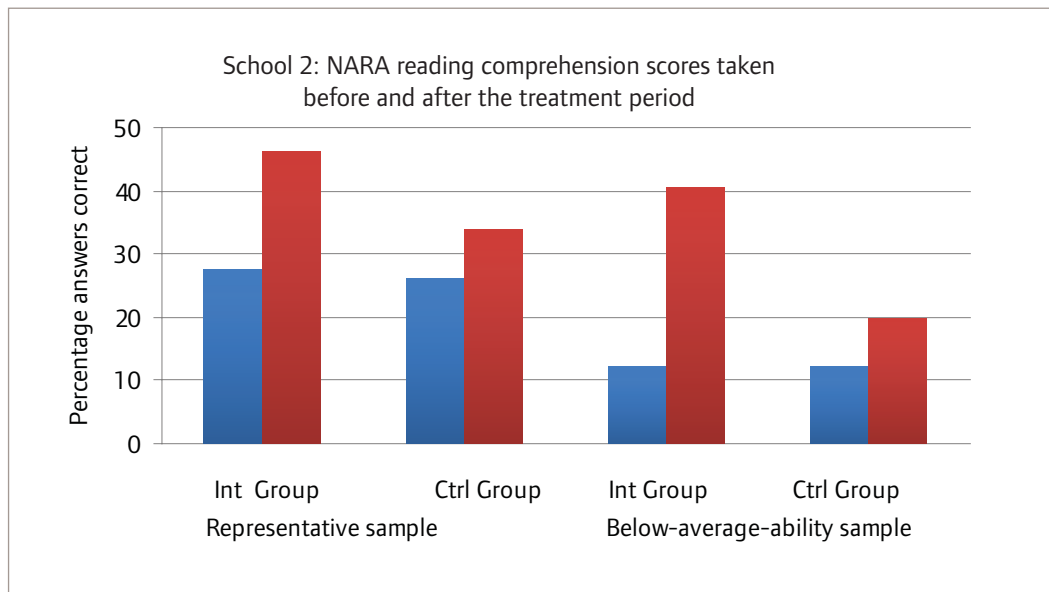
**Figure 4.1.** Baseline scores (blue) and final scores (red) in reading comprehension for the representative sample and the below-average-ability sample in School One



**School Two**

The rhythm-based intervention had a statistically significant impact on reading comprehension compared to the control group for both the representative group and the below-average ability subgroup (see Figure 4.2).

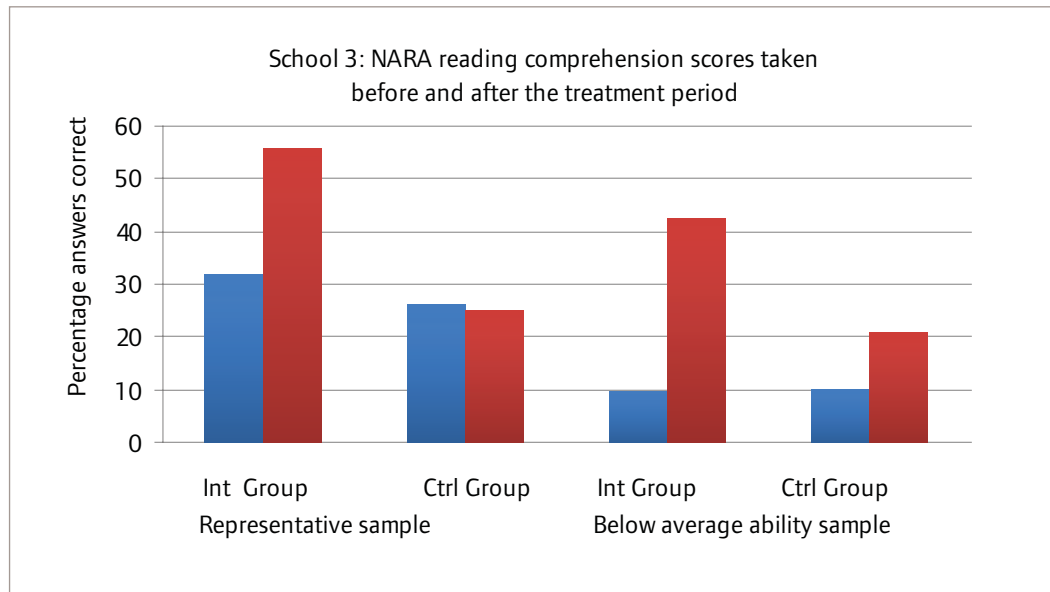
**Figure 4.2.** Baseline scores (blue) and final scores (red) in reading comprehension for the representative sample and the below-average-ability sample in School Two



### School Three

Again, in School Three the rhythm-based intervention had a statistically significant impact on reading comprehension scores compared to the control group (see Figure 4.3).

**Figure 4.3.** Baseline scores (blue) and final scores (red) in reading comprehension for the representative sample and the below-average-ability sample in School Three



### Discussion

At the end of the first stage in the project, it was clear that the impact of the rhythm-based reading intervention in the three separate schools was similar, with statistically significant impacts on reading comprehension occurring in two out of the three schools for the whole representative sample, in one of the schools for the above-average-ability subgroup, and in one of the schools for the below-average-ability subgroup. This is particularly significant given that the sensitivity of statistical analysis to the distribution of scores is acute in studies where fairly small samples are used, whereas studies with larger samples attain statistical significance more easily. Therefore, the significant effects that were achieved in these randomised controlled trials may be interpreted with confidence.

In School Two, findings for the mean change rate of reading scores showed that the children from the rhythm-based intervention read more slowly than children from the control group. This is probably explained by the fact that it was common to find that children from the music intervention group read more expressively and were more engaged with processes that assisted assimilating meaning from the text. Contrastingly, some children from the rhythm-based intervention group increased their rate of reading in addition to their reading comprehension score. These children were able to read more quickly because their enhanced involvement in the text helped the efficiency of their word recognition skills. The complexity of the interactions between processes of word recognition and processes of assimilation are discussed later in this paper.

### Stage Two: An experiment comparing two multi-sensory interventions

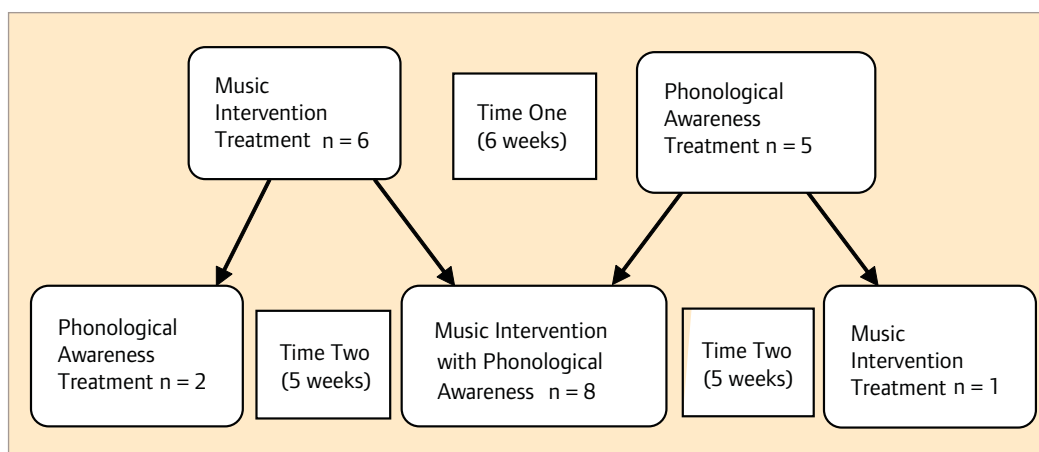
This study contrasted the impact of two different interventions on reading behaviour: phonological awareness and the rhythm-based music intervention. In a fourth school, 11 children with below-average ability in reading, aged between 10 and 11 years, took part. The study lasted 11 weeks.

The phonological awareness intervention used a system of 'flashcards' (Hornsby 1999), displaying phonemes such as 'spl' or 'thr' for multi-sensory learning using vision, hearing, speech and letter formation to support phoneme recognition and discrimination. Additionally, word recognition skills were strengthened by blending sounds together using exercises from stage one of 'Alpha to Omega' (Hornsby and Shea 1980). The 'Alpha to Omega' multi-sensory teaching system recommends two half-hours of individually administered sessions per week. However, for the purposes of this investigation, phonological awareness training was delivered to the children in a small group setting

for 10 minutes each week simply to provide a contrasting treatment to the rhythm-based music intervention.

After six weeks the children had been exposed to a maximum of 60 minutes of either phonological awareness training or the rhythm-based music intervention. With five weeks of the study remaining, all of the children were reallocated to the treatments on the basis of their performance in the training sessions. Participants, numbers 1 and 3 accomplished the rhythm-based music intervention successfully. They were allocated to the phonological awareness intervention only in Time Two. Participant 2 performed very well in the phonological awareness training and she was allocated to the rhythm-based music intervention only in Time Two. The remaining participants received both treatments concurrently in Time Two as their responses during Time One to the interventions indicated that they may progress further if given the opportunity to do so. (See Figure 4.4.)

**Figure 4.4.**  
Distribution of  
participants  
during the two  
time periods



Reading behaviour was measured in the same way as above at three points in time: October (start), December (after six weeks) and February (after 11 weeks). In addition, this study also measured the impact of the interventions on the development of phonological skills at each of these three stages. These were measured using the alliteration and rhyme tests from the 'Phonological Assessment Battery' (PHAB) (Frederickson *et al* 1997).

The alliteration subtest involved identifying two words of a triple presentation that started with the same phoneme. For example, in the triple: 'boot, shop and shoe', the initial phoneme 'sh' is common to 'shop' and 'shoe'. The rhyme sub-test required children to select two words from a triple presentation that shared the same final phoneme. For example, in the triple: 'fed, bed, and leg', 'fed' and 'bed' both have 'ed' as the final phoneme and these two words rhyme.

These measurements created two 'reading profiles' per child following comparisons of the impact of exposure by phonological training only, the rhythm-based intervention only, and both kinds of intervention, as described below:

- Group 1 (seven profiles): analysis of the rhythm-based intervention only
- Group 2 (seven profiles): analysis of five to seven weeks of the phonological awareness intervention only
- Group 3 (five profiles): analysis of five to seven weeks of the phonological awareness intervention plus the rhythm-based intervention (varying amounts)
- Group 3A (eight profiles): Group 3 profiles plus three additional profiles of children (who were the weakest participants) who had received up to 10 weeks of phonological training plus the rhythm-based intervention (varying amounts).

A first analysis compared changes in reading behaviour and phonological skills across Groups 1, 2 and 3, and a second analysis changes across Groups 1, 2 and 3A.



**Findings**

The two analyses are presented in Table 4.2.

**Table 4.2. A summary of two analyses of mean changes in NARA and PHAB scores in School 4**

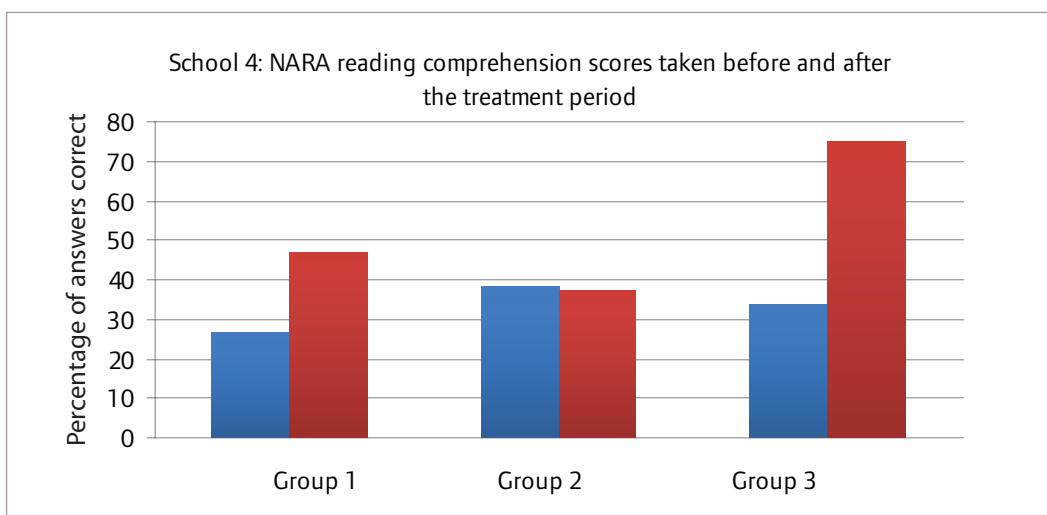
		Group 1 n = 7		Group 2 n = 7		Group 3 n = 5		Sig.* n = 8	Group 3A		Sig.**
		Mean	Std D	Mean	Std D	Mean	Std D		Mean	Std D	
NARA	Change in reading comprehension	20.53	26.12	-0.89	27.58	41.25	28.09	.046	33.60	23.49	.043
	Change in reading accuracy	-1.03	26.98	-0.90	20.55	4.98	19.74	ns	2.33	14.45	ns
	Change in reading rate	15.79	5.25	5.53	20.38	-13.98	10.20	.017	-11.95	8.46	.005
PHAB	Change in phonological alliteration	0.00	20.70	7.14	11.13	6.00	8.94	ns	3.75	8.94	ns
	Change in phonological rhyme	3.19	9.07	3.4	8.57	10.47	7.83	ns	14.28	7.82	.042

Note: PHAB= Phonological Assessment Battery. Std D: standard deviation, Significance level (sig.) was set at .05, Sig \*: analysis of Groups 1, 2 and 3, Sig. \*\*: analysis of Groups 1, 2 and 3A. Significant scores are in bold.

In the first analysis (comparing Groups 1, 2 and 3), participation in the combined intervention had a greater impact on reading comprehension than participation in just the music intervention or the phonological awareness intervention (see Figure 4.5), and this impact was statistically significant. This was accompanied by a significant fall in reading rate compared to the other two groups, as had been observed in some cases in the first stage of this research. Again, this phenomenon coincided with an increase in expression in reading style.

In the second analysis, comparing groups 1, 2 and 3A, there was again a significantly greater impact on reading comprehension in the combined intervention Group 3A than in either of the other two

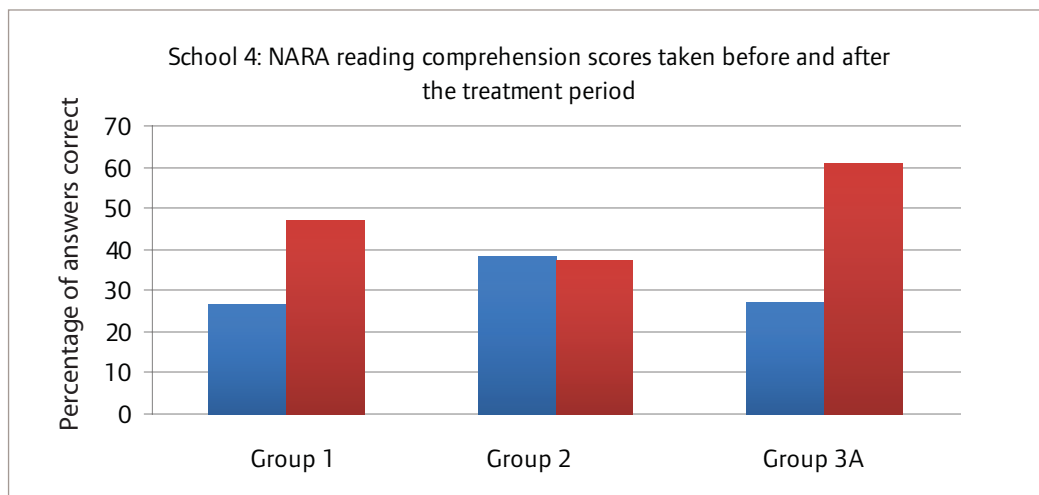
**Figure 4.5.**  
Baseline scores (blue) and final scores (red) in reading comprehension



groups (see Figure 4.6). Again, this was accompanied by a significant decrease in reading rate. There was also a significantly greater improvement in phonological rhyme scores for the combined intervention Group 3A compared to Groups 1 and 2.

Thus although reading comprehension skills had not been directly targeted during the rhythm-based music intervention, the empirical evidence strongly indicates that significant gains in reading

**Figure 4.6.**  
Baseline scores (blue) and final scores (red) in reading comprehension



comprehension were associated with rhythmic activities more than the phonological awareness training. Overall these findings indicate that the positive effects of the rhythm-based music intervention complemented the benefits of the phonological awareness intervention on reading behaviour. Implementing these interventions in combination rather than in isolation produced greater gains in reading behaviour.

### **Stage Three: Trialling the music intervention in schools**

In Stage Three, a brief training course, consisting of two half-hour sessions, was implemented to instruct school staff in the delivery of the rhythm-based music intervention. In School Five, the music coordinator led the intervention, but in School Six the intervention was delivered by two learning support assistants with no previous experience in reading music notation.

There was more time available to test the children's reading behaviour than in Stages One and Two, so any changes in reading behaviour could be measured using reading age scores rather than using comparison groups.

The rhythm-based music intervention was delivered to the children for a period of six weeks. Each weekly session lasted for a maximum of 10 minutes.

In School Five, 15 children, 9 and 10 years of age, participated in the trial as a whole-class activity in music curriculum lessons. In School Six, 11 children aged 10 to 11 years were extracted from their English curriculum lessons in groups of five and six and participated in the trial in the context of a small group. All the participating children were identified by school staff as below-average-ability readers.

#### **Findings for School Five**

Mean reading comprehension, reading accuracy and reading rate were measured before and after participation in the rhythm-based music intervention (see Figure 4.7, next page).

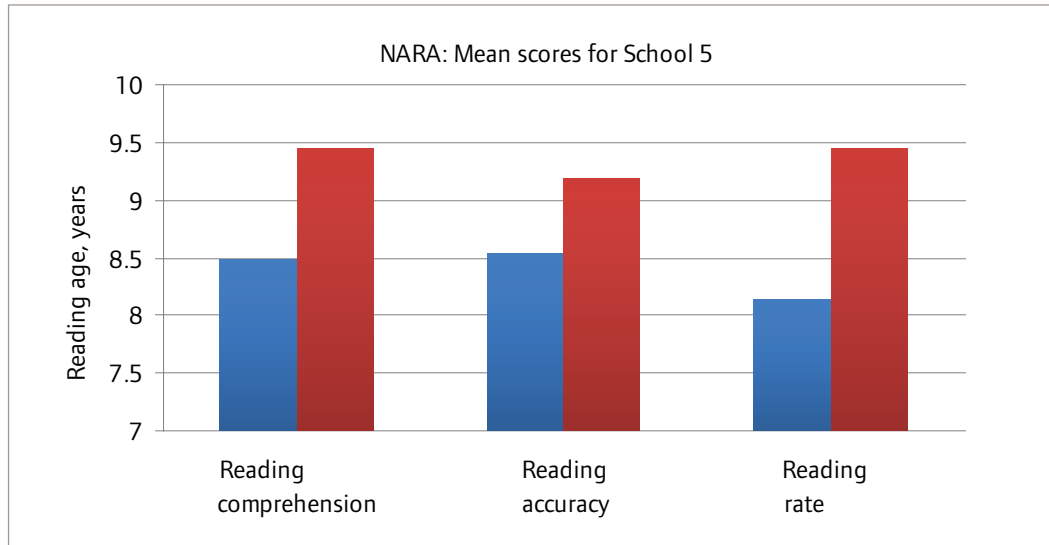
- Reading comprehension increased by 11.4 months.
- Reading accuracy increased by 7.4 months.
- Reading rate increased by 15.72 months.

All these changes were statistically significant at the 5 per cent level.

#### **Findings for School Six**

Again, mean reading comprehension, reading accuracy and reading rate were measured before and

**Figure 4.7.** Baseline scores (blue) and final scores (red) in reading behaviour for below-average-ability readers in School Five



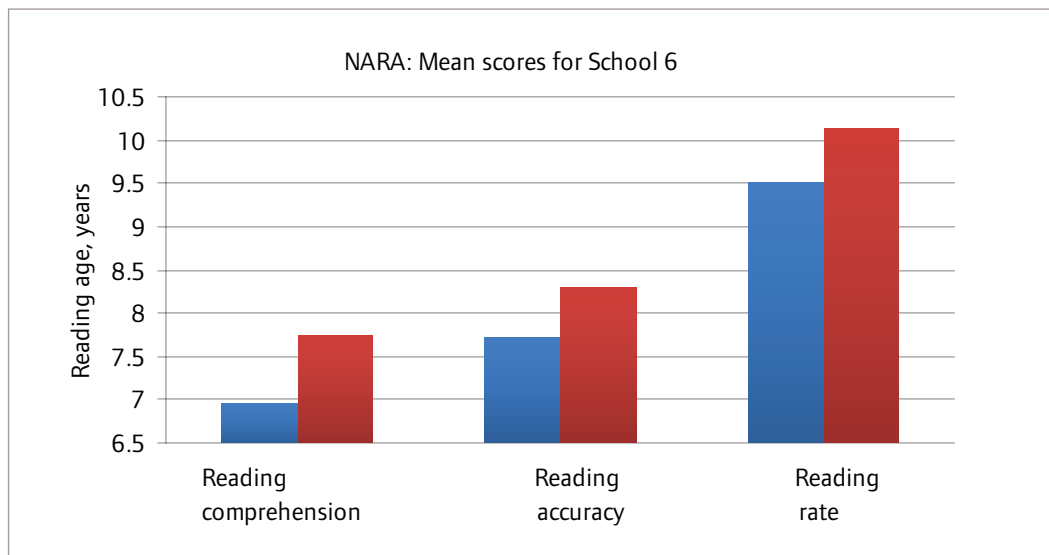
after participation in the rhythm-based music intervention (see Figure 4.8).

- Reading comprehension increased by 9.4 months, and this change was statistically significant at the 5 per cent level.
- Reading accuracy increased by 6.7 months, and this change was statistically significant at the 5 per cent level.
- Reading rate increased by 7.4 months, but this change was not statistically significant.

**Children’s attitudes to the music intervention**

This stage of the research also investigated children’s views on the rhythm-based intervention and its

**Figure 4.8.** Baseline scores (blue) and final scores (red) in reading behaviour for below average ability readers in School Six



effect on their reading, explored by asking each child four open-ended questions:

- What did they think of the stamping exercises?
- Did they think the exercises would be useful for other children to do?
- Why?
- What sort of changes had they noticed in their own reading?

In School Five, positive comments were made by 13 out of 15 children. Two children found it was ‘easier to read harder words’ and four children said it was ‘easier to understand’ what they were

reading. Six children described that they noticed it was 'easier to read' and two children said they could 'understand more'. Some children's reading gains over a six-week period were dramatic and their comments were illuminating. For example:

'It's easier to read harder words now. I'm better at keeping my place. I think stamping is good. It's easier to understand what the words mean.'

*Child 1 (improvement in reading comprehension of 36 months, reading accuracy of 24 months and reading rate of 15 months)*

'Stamping was fun. My reading has stayed the same.'

*Child 2 (improvement in reading comprehension of 23 months, reading accuracy of 12 months and reading rate of 18 months)*

'My reading just got easier...and stamping: I felt new as if I was just born. I could read more better [sic].'

*Child 5 (improvement in reading comprehension of 12 months, reading accuracy of 12 months, decrease in reading rate of 3 months)*

'Reading has got a bit easier, it's flowing better. I feel the same as usual. I enjoy reading. Yes, stamping was helpful but I'm not sure why.'

*Child 6 (improvement in reading comprehension of 42 months, reading accuracy of 14 months, increase in reading rate of 14 months)*

'I've become more interested, reading is easier now – there's more point to it. I enjoyed stamping.'

*Child 8 (improvement in reading comprehension of 4 months, reading accuracy of 7 months, increase in reading rate of 24 months)*

'Reading has got better. Words are easier to understand – they have more meaning. I'm reading faster, I'm not enjoying it though. Stamping was enjoyable. It would be helpful for all children.'

*Child 13 (improvement in reading comprehension of 6 months, reading accuracy of 3 months, increase in reading rate of 29 months)*

In School Six, seven of the 11 children made positive comments when questioned about their participation in the study. Three children observed that for them the words had more meaning, three children found that reading had become easier and three children said that they liked reading more, following their participation in the rhythm-based music intervention.

'Stamping is quite fun. I can read further and the words have more meaning while I read.'

*Child 3 (improvement in reading comprehension of 13 months, reading accuracy of 7 months, increase in reading rate of 1 month)*

'I like reading more now. My reading has slowed down and there's more meaning in the words.'

*Child 4 (improvement in reading comprehension of 23 months, reading accuracy of 14 months, decrease in reading rate of 5 months)*

'I don't lose my place so much now. It's easier to join the words. The meaning in the words is the same as before.'

*Child 6 (improvement in reading comprehension of 11 months, reading accuracy of 4 months, increase in reading rate of 25 months)*

'Reading is easier now. I have achieved higher reading scores. It's easier to understand reading now.'

*Child 9 (improvement in reading comprehension of 10 months, reading accuracy of 16 months, increase in reading rate of 44 months)*

## Responses of school staff

In School Five, the music coordinator had directed the rhythm-based music intervention. She found that the children would wait expectantly to begin the exercises, standing quietly behind their chairs at the beginning of each music lesson. Reading notation had been straightforward and in her view, the intervention 'had worked'.

In School Six, the experience of the two support staff was pragmatic. They found that some of the children found the coordination aspects of the intervention were difficult and their behaviour became quite difficult to manage. However, the staff felt positive about the training and materials used in the intervention. They noted that stamping was a particularly positive aspect of the intervention.

### **Discussion of the Stage Three results**

Previous studies have suggested that rhythmic ability at age 3 is correlated with reading ability at age 10 (David *et al* 2007). The authors of this study suggested that early rhythmic ability had subsequently facilitated children at age 10 in recognising multi-syllabic words in which an appreciation of strong and weak stress patterns was essential to the structural aspect of word recognition.

Here, it is suggested that the rhythm-based music intervention was effective in galvanising the children to assign appropriate stress patterns to more challenging words, perhaps for the first time. The children's comments suggested a change of this type had occurred: 'I can learn new words...'; 'I'm reading at a higher level...'; 'It's easier to read harder words...'. Using newly enhanced rhythmic ability, the children were able to apply stress appropriately to tackle longer words. They also used rhythm in assigning the words to the function of noun or verb at an implicit level, contributing to both reading accuracy and reading comprehension.

Overall, it is therefore plausible that enhanced sensitivity to rhythmic stress production during reading may explain the increase in reading accuracy scores and reading comprehension following participation in the rhythm-based music intervention. Although the collective response to the rhythm-based music intervention was very positive when directed by school staff, the complexity of integrative processes in reading behaviour was highlighted by the highly individual changes in the children's reading profiles.

## 5. What might explain these results? A theoretical basis for a timing deficit in reading behaviour

What might explain the observed results? Arguably, the efficacy of the rhythm-based music intervention functions at a subliminal level.

Firstly, the children were required to stamp their feet alternately in time with the musical accompaniment. This involved mentally anticipating the lifting of one foot while striking the other foot against the floor to synchronise with the strong beat of the musical accompaniment and the stamping impulses of the other children in the room. In accordance with work by Clayton *et al* (2004) and M.R. Jones and colleagues (for example, Jones and Boltz 1989), maintenance of a synchronised, bi-pedal, binary pattern (of lifting and striking in this instance) is consistent with a fundamental and stable organisation of the distribution of cognitive attention.

Sentence structures are fundamentally binary in their formation (see Chafe 1972), requiring a subject and a predicate. A binary organisational structure is common to the fundamental control of bipedalism (Clayton *et al* 2004), rhythmic linguistic structures (Halliday 1985), modelled distributions of attention (Jones and Boltz 1989) and the organisation of reading skills (Long 2007). The potential for the existence of a shared cognitive processing mechanism between these organisational structures goes some way towards explaining why the rhythm-based music intervention was so influential in achieving a positive effect on the temporal organisation of reading behaviour.

Secondly, the children were required to synchronise their stamping feet with clapping actions which, in

accord with Jones and Yee (1993) divided the temporal organisation of attention, in this instance between upper and lower limbs. Therefore, in terms of executive function of working memory, attention was distributed to the volitional physical control of both upper and lower limbs, in anticipating, synchronising, monitoring and integrating their coordination in synchrony with the musical accompaniment and the rhythmic impulses of others in the room.

Thirdly, the children read music notation, chanting out the names of the printed notes in synchrony with the self-disciplined control of their stamping and clapping actions. Therefore, while maintaining, monitoring and integrating the physical component of the rhythm-based music intervention, the children additionally recognised and named the printed notes, their attention supported and maintained by a stable but simple binary framework.

Arguably, the rhythm-based music intervention provided a subliminal means of regulating, dividing and integrating cognitive attention into a simple and stable binary structure that benefited reading behaviour. This self-disciplined organisation of resources permitted the children to integrate different parts of a whole, to move from attributes (word shapes) to relationships (meaningful phrases) to contexts at a conceptual level (comprehension). Therefore this method provided a cognitive scaffold enabling the children to accomplish the transition from 'learning to read' to 'reading to learn'.

It is therefore proposed that a lack of rhythmic stability in reading behaviour obscures rhythmic perception of the natural stress pattern of the language and prevents rhythmically sensitive linguistic processing from being activated. This study has demonstrated that when unevenly distributed cognitive attention is rhythmically regulated to produce an even distribution, the bootstrapping of reading comprehension onto language comprehension is achieved in accord with Gough and Tunmer's Simple View of Reading, the conceptual model underpinning the NLS.

While phonological awareness training has attracted the attention of practitioners and policymakers for almost a decade, rhythm-based music exercises are not currently associated with literacy development. However, rhythm-based music exercises have a rich history in music education and continue to feature in both Jaques-Dalcroze and Kodaly musical training systems (Bachmann 1993, Hurwitz *et al* 1975) where musical action-games and songs play an essential role in the development of young children, not only in terms of their musical development, but also in terms of health, well-being, imagination, vitality and responsiveness. This perspective coincides with current concern for the whole child expressed by Secretary of State Ed Balls in the aims of the forthcoming Primary Curriculum Review by Sir Jim Rose (DCSF 2007).

## 6. Conclusions

So what implications does this study have for reading in schools?

In Stage Three of the project, the rhythm-based music intervention was trialled in two schools to investigate whether the positive effects on reading behaviour would be sustained when school staff directed the music intervention. The rhythm-based music exercises fitted easily into the first 10 minutes of the weekly music curriculum lesson in School Five, directed by the music specialist. In School Six, two teaching assistants with no previous experience of reading music notation delivered the rhythm-based music intervention during English curriculum time.

These trials provided a strong indication that the rhythm-based music intervention could be replicated widely in schools and potentially benefit a below-average-reading-ability population of Key Stage 2 children. Overall, the Stage Three findings suggested that the most appropriate delivery of the intervention would be by a musically trained teacher to a medium sized group of approximately 15 children.

The rhythm-based music intervention does not incur financial outlay and no commercially invested

interest motivated this research project. The improvements that were recorded in the children's reading were the product of a natural response to an activity that promoted physical coordination, rhythm, and social cohesion. The findings support an argument for a more ecologically sustainable approach to education, where:

- greater value is placed on children's socio-cultural development
- authentic and 'low-tech' teaching methods are encouraged rather than neglected.

Some Key Stage 2 children described in the introduction were already disaffected by their school experiences. They initially resisted the challenge of learning to read music notation as this represented a new opportunity for learning failure. Following reassurance they attempted the rhythm-based music intervention. They were amazed and delighted by their ability to succeed in an activity that they strongly associated with the academic success and social status of their confidently literate peers. This project therefore indicated that the damaged self-esteem of below-average-ability readers can be effectively restored through participation in this teaching method.

The practical application of this study may therefore be seen as a useful strategy for addressing the reading difficulties of children aged between 8 and 11 years. Further research into this area would be appropriate for gaining further insight into the duration of the effects of the music intervention, and also to direct the study at a larger sample in random controlled trials. Overall, the quantitative findings of this project suggested that its potential impact could be to substantially improve the predicted educational outcome for the bottom 20 per cent of the primary population in literacy attainment.

## References

- Atterbury B W (1985) 'Musical differences in learning disabled and normal achieving readers, aged seven, eight and nine,' *Psychology of Music*, 13 (2), 114–123
- Bachmann M L (1993) *Dalcroze today: An education through and into music*, Oxford: Oxford University Press
- Brooks G (2002) *What Works for Children with Literacy Difficulties? The Effectiveness of Intervention Schemes*, London: Department for Education and Skills
- Brooks G (2007) 'Rationality and phonics: a comment on Wyse and Styles (2007) in response to Wyse and Styles' article, Synthetic phonics and the teaching of reading: the debate surrounding England's "Rose report"', *Literacy*, 41, 3: 169–176
- Brooks R and Tough S (2006) *Pupil Attainment: Time for a three Rs guarantee* London: Institute for Public Policy Research, available at [www.ippr.org.uk/publicationsandreports/publication.asp?id=517](http://www.ippr.org.uk/publicationsandreports/publication.asp?id=517)
- Burroughs-Lange (2007) *Evaluation of Reading Recovery in London Schools: Every Child a Reader 2005–2006*, London: Institute of Education, University of London
- Chafe W L (1972) 'Discourse structure and human knowledge', in Freedle R O and Carroll J B (eds) *Language Comprehension and the Acquisition of Knowledge* Washington DC: VH Winston and Sons
- Clay M (1985) *The Early Detection of Reading Difficulties*. Third Edition. Portsmouth, NH: Heinemann
- Clayton M, Sager R and Will U (2004) 'In time with the music: The concept of entrainment and its significance for ethnomusicology', *ESEM Counter Point*, Vol. 1
- Coltheart M, Curtis B, Atkins P and Haller M (1993) 'Models of reading aloud: dual route and parallel-distributed- processing approaches', *Psychological Review*, 100: 589–608
- Cornoldi C and Oakhill J (1996) *Reading Comprehension Difficulties*, Mahwah NJ Erlbaum
- Curtis P (2008) Lord Adonis interview by Polly Curtis, education editor, podcast, *The Guardian*, [www.guardian.co.uk/education/2008](http://www.guardian.co.uk/education/2008), accessed on 29.08.08
- Cutler A, Dahan D and Donselaar W (1997) 'Prosody in the comprehension of spoken language: A literature review', *Language and Speech*, 40: 141–201
- David D, Wade-Woolley L, Kirby J R and Smithrim K (2007) 'Rhythm and reading development in school-age children: a longitudinal study', *Journal of Research in Reading*, 30, 2:169–183
- Department for Children, Schools and Families (DSCF) (2007) *The Children's Plan: building brighter futures* (Cm. 7280) London: The Stationery Office
- Department for Children, Schools and Families (DSCF) (2008a) *National Curriculum Assessments at Key Stage 2 in England 2008 (provisional) SF 19 / 2008*, retrieved from [www.dcsf.gov.uk/rsgateway](http://www.dcsf.gov.uk/rsgateway) on 10.08.08
- Department for Children, Schools and Families (DSCF) (2008b) *Every Child a Reader (ECaR) Toolkit*, DCSF Publications Centre, 00034-2008
- Department for Children Schools and Families (DSCF) (2008c) *Statutory Framework for the Early Years Foundation*, London: DCSF
- Department for Education and Skills (DfES) (2006) *The Primary Framework for teaching literacy and mathematics*, London: DfES
- Douglas S and Willats P (1994) 'The relationship between musical ability and literacy skills', *Journal of Research in Reading*, 17 (8): 99–107



- Frederickson N, Frith U and Reason R (1997) *Phonological Assessment Battery*, Windsor: NFER-NELSON
- Goswami U, Thomson J, Richardson U, Stainthorp R, Hughes D, Rosen S and Scott S K (2002) 'Amplitude envelope onsets and developmental dyslexia: A new hypothesis', *PNAS*, vol. 99, no. 16: 10911–10916
- Gough PB and Tunmer WG (1986) 'Decoding, reading and reading disability', *Remedial and Special Education*, 7: 6–10
- Halliday MAK (1985) *An introduction to functional grammar*, London: Edward Arnold
- Hornsby B and Shear F (1999) *Alpha to Omega: A. to Z. of Teaching Reading, Writing and Spelling: Flashcards*, London: Heinemann Educational
- Hornsby B and Shear F (1980) *Alpha to Omega: A. to Z. of Teaching Reading, Writing and Spelling*, London, Heinemann Educational
- House of Commons Children, Schools and Families Select Committee (2008) *Government and Ofsted responses to the committee's third report of session 2007–08*, Fifth special report of session 2007–08, retrieved from [www.publications.parliament.uk](http://www.publications.parliament.uk) on 19.08.08
- Hurwitz I, Wolff P H, Bortnick B D and Kokas K (1975) 'Non-musical effects of the Kodaly music curriculum in primary grade children', *Journal of Learning Disabilities*, 8: 45–52
- Johnston R and Watson J (2005) 'A seven year study of the effects of synthetic phonics teaching on reading and spelling attainment', *Insight 17*, Edinburgh: Scottish Executive Education Department
- Johnston R and Watson J (2007) *Teaching Synthetic Phonics*, Exeter: Learning Matters
- Jones M R and Boltz M (1989) 'Dynamic attending and responses to time', *Psychological Review*, 96: 459–491
- Jones M R and Yee W (1993) 'Attending to auditory events: the role of temporal organisation', in McAdams S and Bigand E, *Thinking in sound: The cognitive psychology of human audition* Oxford: Oxford University Press: 68–112
- Lewis M and Ellis S (2006) *Phonics, Practice, Research and Policy*, London: Paul Chapman, Sage
- Liberman I Y, Shankweiler D, Fischer F W, and Carter B (1974) 'Reading and the awareness of linguistic segments', *Journal of Experimental Child Psychology*, 18: 201–212
- Long M (2007) *The effect of a music intervention on the temporal organisation of reading skills*, Unpublished doctoral dissertation, University of London
- Lundberg I, Frost J and Peterson O (1988) 'Stimulating phonological awareness', *Reading Research Quarterly*, 23: 263–284
- Neale M D (1989) *Neale Analysis of Reading Ability Revised British Edition*, Windsor: NFER-Nelson
- Ofsted (2001) *Teaching of Phonics in Primary Schools*, London: Ofsted
- Ofsted (2002) *The National Literacy Strategy: The first four years, 1998 – 2002*, London: Ofsted
- Overy K (2000) 'Dyslexia, temporal processing and music: The potential of music as an early learning aid for dyslexic children', *Psychology of Music*, 28: 218–229
- Porkoni J I, Worthington C K and Jamison P J (2004) 'Phonological awareness intervention: Comparison of Fast ForWord, Earobics, and LiPS', *Journal of Educational Research*, 97 (3): 147–157
- Qualifications and Curriculum Authority (QCA) (2006) *Consultation on Proposed Changes to the Key Stage 1 English Programme for Reading and a Foundation Stage Early Learning Goal*, London: QCA
- Rose J (2006) *Independent Review of the Teaching of Early Reading*, Nottingham: DfES Publications

- Saffran JR, Newport EL, Aslin RN (1996) 'Word segmentation: The role of distributional cues', *Journal of Memory and Language*, 35: 606-621
- Tallal P, Miller S L, Bedi G, Byma G, Wang X, Nagarajan S S, Schreiner C, Jenkins W M, Merzenich M M (1996) 'Language Comprehension in Language-Learning Impaired Children Improved with Acoustically Modified Speech', *Science*, New Series, Vol. 271: 81-84
- Trehub S E and Trainor L J (1993) 'Listening strategies in infancy: the roots of music and language development', in McAdams S and Bigand E (eds) *Thinking in sound: The cognitive psychology of human audition* Oxford: Oxford University Press: 278-317
- Wyse D and Styles M (2007) 'Synthetic phonics and the teaching of reading: the debate surrounding England's "Rose Report"', *Literacy*, 41, 1: 35-42