

CHAPTER 3

PHONOLOGICAL SKILLS, LITERACY AND DYSLEXIA

Chapter Overview

This chapter considers the relationship between phonological processing skills and literacy acquisition with particular reference to learners with dyslexia. The types of phonological processing skills subsumed under the term of 'phonological awareness' are described and some of the relevant research into the relationship between these skills and literacy acquisition is discussed in relation both to young 'beginning readers' and learners with dyslexia. A brief summary of the terms used to categorise and analyse speech sounds is provided to help practitioners appreciate the emphasis given to articulation/pronunciation of phonemes in the Conquering Literacy programme.



Research into the literacy acquisition of both typically-developing children (TDC) and those with dyslexia points to three cognitive functions essential to learning to read. These are letter–sound knowledge, phonemic awareness and rapid autonomous naming skills (Hulme and Snowling, 2013), all of which require good

phonological processing skills. There is general agreement, however (Rose, 2009; Goswami, 2014), with Snowling and Hulme's earlier claim that 'the vast majority of cases of developmental dyslexia are attributable to a phonological deficit that may vary in severity' (Snowling and Hulme, 2005: 400).

The phonology of a language is knowledge of the 'sound' of a spoken language and comprises two aspects:

- non-segmental (or suprasegmental) – concerning control and understanding of volume, stress, and intonation (all of which may affect understanding as well as expressive language);
- segmental – concerning breaking speech and words into smaller units including individual single sounds (phonemes) e.g., the three phonemes in dog are /d/ /ɒ/ /g/ and the syllables in fascination are fas-cin-a-tion. A phoneme is not a unit of meaning, but changing a phoneme in a word can change meaning e.g. top; tip.

Impairments in phonological processing are often described as difficulties in 'phonological representations' (Reid, 2009; Goswami, 2013) i.e., perceptions of speech sounds (perceiving, coding, storing in memory, retrieving and producing sounds). This can affect different grain sizes (the ability to distinguish whole words, on-set rimes, syllables and phonemes; see Goswami, 2013; 2014). It will also affect verbal memory (see Chapter 2) and rapid naming (the ability to name or label object, letters, numbers, symbols at speed) and word-finding (the ability to retrieve an appropriate word quickly).

There has been extensive research into the relationship between phonological awareness and reading since a seminal study by Bryant and Bradley (1985) who found that poor phonological awareness at age 4 predicted possible reading difficulties at age 8 and several studies have suggested that different types of phonological skills may exert a stronger influence than others at different stages of learning to read and spell (see below). Anthony and Francis (2005) claimed that there is now strong evidence that different phonological skills develop/emerge in a predictable sequence for 'normal' children speaking English as a first language. Adams (1990) identified five levels of 'difficulty' of phonological skills, based on research studies of 3–7 year old children. She produced a taxonomy according to 'normal' development, although it is important to note that as children develop the later skills, they continue to use and 'refine' those already acquired.

Phonological Awareness/Processing Skills (after Adams, 1990)

- *Knowledge of nursery rhymes* – she regards this as a primitive skill involving only 'an ear for the sound of words'.
- *Knowledge of rhyme and alliteration* – the ability to produce words that rhyme or to spot 'oddities' which do not rhyme or those which begin with a different sound e.g., cat, can, cot, hen, car. This requires an ability to focus on particular sounds.

- *Blending phonemes and syllable segmentation/spelling* – an awareness that words can be broken into smaller units e.g., rab-bit, snow-man.
- *Phonemic segmentation* – understanding that words can be broken down into a series of single sounds (phonemes) and the ability to produce these phonemes when asked to do so.
- *Phoneme manipulation* – an ability not only to understand the phonemic structure of words, but also to ‘manipulate’ phonemes by adding, deleting, or transposing a phoneme in order to produce a new word or non-word. For example, when given the word ‘cot’, if you remove the /k/ sound and put /d/ in its place, what word do you make? This task also places a heavier load on memory.

A similar approach was adopted by Hatcher in 1994 developing a programme teaching phonological awareness (Hatcher et al., 2014). Adams (1990) pointed out that some of these skills (particularly phoneme segmentation and manipulation) are stronger predictors of progress in learning to read than the earlier acquired skills of rhyme and syllable segmentation.

It is clear that the phonemic level (distinguishing discrete sounds) is fundamental to learning letter–sound knowledge (grapheme–phoneme correspondence). The implication for all young children learning to read, because these phonological skills are still developing, is that there should be explicit teaching of phonological awareness skills and especially of those emphasising phonemic awareness. This is particularly true for children with (or at risk of) dyslexia and the significant number of other children who also have phonological representation difficulties. There is, however, a reciprocal relationship between phonological processing skills and learning to read, and phonological segmentation/manipulation is actually helped by the process of being taught letter–sound knowledge (Muter, 1996; Goswami, 2014). Phonological training alone is not as effective in improving literacy as training using both reading and phonological awareness training (Snowling, 2012).

Phonological awareness training usually covers all the skills summarised by Adams above because they can be seen as distinct skills. Tests used to assess phonological processing skills such as PhAB2 (Gibbs and Bodman, 2014) and CTOPP2 (Wagner et al., 2013) present specific tasks to assess these separate phonological functions. Goswami (2014) has suggested that the emphasis on phonemic manipulation may have ignored other grain sizes of phonology such as rhyme and syllabification. In earlier work (Goswami and Bryant, 1990) she suggested that rhyming tasks do not require a sensitivity to individual phonemes but to distinguishing onset-rime units (where *onset* refers to initial consonant/consonant blends and *rime* refers to the vowel(s) and rest of the word). They found that onset-rime awareness enables learners to use analogy in reading and spelling. Muter et al. (1994) found that segmentation made a significant contribution to reading and spelling development in the very early stages but rhyming did not. However, when the children in their study were 6 (in their second year at primary school) rhyming as well as phonemic segmentation skills contributed to literacy acquisition and in particular to their use of analogy in spelling.

An example would be to consider the word 'tame' where 't' is the onset and 'ame' is the rime, enabling a family of words to be generated by changing the onset e.g., frame, game, same, blame etc. Difficulties in recognising rhyme may therefore be related to difficulties in hearing/seeing patterns in words, affecting both the reading and spelling of learners with dyslexia. They may need much more explicit teaching of onset-rime.

Hulme and Snowling (2013) emphasised that both letter-sound knowledge and phonemic awareness are 'remediable'. The introduction of 'Letters and Sounds' into the English Primary curriculum and the use of synthetic phonics explicitly address these skills. Effective interventions for learners with dyslexia have, for many years, used synthetic phonics within structured, cumulative, multisensory programmes in order to address the specific difficulties in these areas experienced by learners with dyslexia.

Recent studies by Goswami and colleagues have suggested that prosodic difficulties ('prosody' is the internal rhythmic patterning of words, including stress) may be linked to the ability to recognise phonemes in words. (Thus the supra-segmental aspects of phonology are inter-related to phoneme segmentation.) She found that children with dyslexia were less sensitive than good readers to amplitude modulations (fluctuations in sound waves) in speech (e.g., in identifying syllables). They also had difficulties in their perception of beat/rhythm in music. She proposed that there is an underlying problem in rhythmic entrainment and that this might be 'at the heart of dyslexia' (Goswami, 2013: 109). An implication was to investigate the effectiveness of intervention based on musical activities emphasising beat/rhythm (e.g., drumming, singing, dancing, clapping) in developing literacy skills.

A small-scale study by Thomson et al. (2013) compared the use of a rhythm-based intervention programme (music with and without speech) with a commercially-available phoneme discrimination programme delivered to learners with dyslexia over a six-week period. Both programmes led to similar gains in developing phonemic awareness and some gains in reading, although somewhat higher gains in reading arose from the language-based programme. (Spelling also improved, but this was also true for a control group and therefore could not be attributed to the programme.) The researchers concluded that an effective literacy intervention programme for learners with dyslexia should include musical/rhythm-based activities as well as phonemic awareness, and that this would be particularly important for those 'resistant to conventional phonic-training methods' (Thomson et al., 2013: 139).

The approach used in *Conquering Literacy* is based on synthetic phonics (and then a morphological approach), emphasising the importance of identifying phonemes and developing letter-sound knowledge (teaching the alphabetic principle). There is no inclusion of musical activities, which would, if wished, take place outside the specialist lessons. (We would hope these would also have been an integral part of learning in pre-school and the early years curriculum.) However, readers will note that in the 'alphabet work' (Chapter 10) there is some emphasis on 'stress' (or accent) and 'stress' is a concept introduced within the programme. We suggest that in the light of the research described above, teachers extend activities on stress and the use of intonation

at all stages of the programme (e.g., any syllable work would not just ‘clap’ each syllable but also adjust volume and pace in order to emphasise stress/rhythm). This will also be important when teaching affixes and using a morphological approach (e.g., noting the differences between pho'tograph, photog'raphy).

The linguistic complexity of a language can affect phonological development and processing. The sounds occurring in words are influenced by their adjacent sounds, and in turn words are influenced by syntax and morphology (how meaningful units are put together to form words). Anthony and Francis (2005) claim that children who speak Greek, Turkish or Italian, for example, attain syllable awareness earlier than children speaking English because those languages have better-marked syllables and fewer consonant clusters. The phonological complexity of a language should be distinguished from its orthographic complexity. The orthography of a language concerns the written representation (i.e., the spelling of sounds/words). There is likely to be a greater problem in making links between phonemes and graphemes where there is an ‘opaque’ or ‘deep’ orthography, that is, where a sound can be represented in several ways e.g., /k/ can be ‘c’, ‘k’, or ‘ck’. (See *inter alia* Goswami, Zeigler and Richardson, 2005.) Similarly when reading, graphemes may represent varying sounds e.g., ‘ough’ in cough, through, bough, dough, thorough, rough, thought; ‘hoe’ and ‘shoe’ look similar, but do not rhyme; ‘motion’ and ‘ocean’ are spelled very differently, but do rhyme. The lack of ‘transparency’ or consistency in English spelling has sometimes been identified as one reason for a high incidence of early literacy difficulties. While it is possible to enumerate the way in which the 26 letters of the English alphabet are combined to make the 44 sounds, by listing, for example, that there are 28 initial blends, 48 final blends and so on, one implication for teaching must be to teach what *is* consistent and where ‘rules’ can be applied rather than to emphasise irregularities, though dealing with these when they arise.

Teachers may find it useful to understand two processes which affect speech and can then affect spelling, where a learner may be trying to represent the sounds they ‘hear/produce’.

Assimilation: occurs when a phoneme changes according to the following sound because it simplifies the movements involved in articulation. It is not ‘sloppy’ or ‘lazy’ speech, it is due to efficient movement to articulate the sounds. It is noted that /n/ is affected, for example, when followed by /b/ or /p/ e.g., ‘He is in prison’ will usually be formed as ‘im prison’. (Over centuries, the prefix ‘in’ has become ‘im’ in words where the base or root begins with a ‘b’ or ‘p’ e.g., impossible, imbibe.)

Elision: occurs when sounds disappear from words e.g., ‘castle’ becomes ‘cassle’. In single syllable words ending with a final consonant blend, the penultimate consonant is frequently omitted because it is ‘elided’ as the final sound is uttered (e.g., ‘hand’ becomes ‘had’; ‘went’ becomes ‘wet’; ‘milk’ becomes ‘mik’. (In some cases the final consonant is omitted rather than the penultimate.)

We do not suggest teaching these terms and the letters that are usually associated with them. However, knowing about these ‘normal’ processes can help teachers to understand some of the spelling errors made by children. (‘Grampa’ for ‘Grandpa’ suggests elision of the /d/ and assimilation of /n/ to become ‘m’.)

Phonology and Articulation

This section explains some of the main terms used to describe how the 44 sounds (phonemes) of English are produced. These terms can be used to describe speech production/the sounds of *all* languages, although the actual sounds of different languages may be different just as the written forms to represent those sounds may vary. Readers interested in this area may wish to refer to the International Phonetics Alphabet (IPA) where a set of internationally agreed phonetic symbols has been established so that the standard (‘regular’) sounds of any language can be put into a written form that will be accessible to anyone knowing how to ‘read’ (interpret) the symbols. In this book and programme we have not introduced phonetic symbols, with one exception (the symbol /ə/ for the schwa sound /uh/). Sometimes this is the sound of a vowel (as in the ‘a’ in ‘about’ and in words like ‘collar’). However, it is also often an ‘additional’ sound ‘escaping’ as a result of uttering a particular phoneme such as a plosive ‘p’/p/, which often results in a /puh/ or /pə/ sound. It is important not to add a schwa when presenting sounds to a learner, as it can confuse spelling and also affect ‘blending’ when reading.

Although we do not use phonetic symbols (which could impose a further memory load on both practitioners and learners) we have indicated sound by using the symbol / / to surround common letters with diacritical marks and clue words e.g., /ō/ as in ‘bone’ and /ōō/ as in ‘moon’. We use ‘ ’ round a letter to indicate a letter’s name e.g., ‘o’. It must also be acknowledged that regional accents may affect ‘Standard’/Received Pronunciation and therefore teachers will have to exercise their professional judgement in cases where a learner’s pronunciation is at variance with the examples provided and adapt their teaching accordingly.

Practitioners involved in teaching literacy – particularly phonics-based teaching – will find a knowledge and understanding of certain aspects of speech production useful. These are, with examples from English:

- distinguishing between vowels and consonants
 - vowel: a sound produced with an open vocal tract so that air can escape directly, with nothing blocking the air (e.g. / ā/, / ě/, / ĭ/, / ō/, / ū/ and ‘y’ as a semi-vowel when pronounced as / ĭ/);
 - consonant: a sound where there is some blocking of the air (partial or complete) at some point;

- distinguishing between ‘voiced’ and ‘unvoiced’ sounds e.g., /th/ as in ‘this’ (voiced) and /th/ as in ‘with’ (unvoiced). Voicing describes whether the vocal cords or folds are vibrating during articulation. (In teaching, learners will be encouraged to place a hand under the chin, to ‘feel’ this vibration of the vocal chords.)

It is possible to classify consonant sounds according to:

- manner of articulation (how breath is used);
- place of articulation (where/how the sound is produced).

Classifying English Consonants According to Manner of Articulation



Category	Description and consonants			
Stops/ plosives	The airflow from the lungs is completely blocked at some point and then released:			
	<table border="0"> <tr> <td>/p/, /t/, /k/</td> <td><i>unvoiced</i></td> </tr> <tr> <td>/b/, /d/, /g/</td> <td><i>voiced</i></td> </tr> </table>	/p/, /t/, /k/	<i>unvoiced</i>	/b/, /d/, /g/
/p/, /t/, /k/	<i>unvoiced</i>			
/b/, /d/, /g/	<i>voiced</i>			
Fricatives	The airflow is constricted or partially (but not completely) blocked:			
	<table border="0"> <tr> <td>/f/, /th/, /s/, /sh/, /h/</td> <td><i>unvoiced</i></td> </tr> <tr> <td>/v/, /<u>th</u>/, /z/</td> <td><i>voiced</i></td> </tr> </table>	/f/, /th/, /s/, /sh/, /h/	<i>unvoiced</i>	/v/, / <u>th</u> /, /z/
/f/, /th/, /s/, /sh/, /h/	<i>unvoiced</i>			
/v/, / <u>th</u> /, /z/	<i>voiced</i>			
Affricatives	Begin with a complete blockage (like plosives) but then have a partly restricted flow of air (like fricatives):			
	<table border="0"> <tr> <td>/ch/ as in <u>church</u>/</td> <td><i>unvoiced</i></td> </tr> <tr> <td>/j/ as in judge</td> <td><i>voiced</i></td> </tr> </table>	/ch/ as in <u>church</u> /	<i>unvoiced</i>	/j/ as in judge
/ch/ as in <u>church</u> /	<i>unvoiced</i>			
/j/ as in judge	<i>voiced</i>			
Nasals	The air passes through the nose: /m/, /n/ and the /ng/ sounds <i>voiced</i>			
Glides	Where articulators are close to each other: /y/, /w/, /wh/ <i>voiced</i>			
Liquid	Air escapes at the side of the tongue: /l/, /r/ <i>voiced</i>			

While the above provides a useful classification for the teacher and facilitates an understanding of texts on phonology, being able to identify and distinguish sounds according to an awareness of the position of tongue, teeth, and lips is of more use in teaching the programme.

Classifying English Consonants According to Place of Articulation



Category	Description and consonants
Bilabial	Both lips together: /p/, /b/, /m/, /w/
Labiodental	Lower lip in contact with upper teeth: /f/, /v/
Dental	The tongue is behind/touching teeth: /t/, /d/, /th/, / <u>th</u> /
Alveolar	The tongue contacts the upper alveolar ridge behind the teeth: /s/, /z/, /n/, /l/, /r/ (and sometimes /t/, /d/)
Palatal	Roof of the mouth: /j/, /y/
Velar	The soft palate (velum) at the back of the mouth: /k/, /g/, /ng/
Glottal	Throat: space between the vocal chords: /h/

Vowels

Vowel sounds are all voiced and tend to be classified according to whether the lips are rounded (as in 'oo'); or flat/spread (as in /ě/), and whether the muscles round the mouth are tense (as in /ē/ in 'bee') or lax (as in most short vowels such as / ě / in 'bet'). They are also classified in relation to the height of the tongue and whether the tongue is at the front or back of the mouth. When asking learners about how they 'make' a vowel sound, therefore, practitioners should ask about what their lips/lip-shape looks like and where their tongue is – high or low in their mouth and whether it is at the back or the front. If they place their hands or fingers at the sides of the mouth (just on to their cheeks) they will also discover muscle tension. This is particularly useful to help learners distinguish vowels in cvc words where many learners confuse short vowel sounds.

Using the Classification of Vowels and Consonants

There is no intention to teach the terms to the learners but this framework should help teachers when asking learners to describe *how* and *where* they make sounds.

Phonological Awareness and Literacy Development in the Conquering Literacy Programme

At the heart of the programme lies the aim of teaching sound-symbol (phoneme-grapheme) correspondence to facilitate good literacy development for learners who are presenting specific decoding and encoding difficulties (in reading and spelling) despite having experienced good literacy teaching. Multisensory strategies are used to maximise learners' strengths and establish and develop neural pathways using repetition and routines to establish automaticity.

The programme reinforces phonemic segmentation skills by asking learners to listen to and detect a particular sound and note the position (beginning, middle, end) in a word and then produce the sound. The learner is asked to describe *how* they make the sound and to consider the physical aspects of that sound (the position of their tongue, teeth, lips, and the vibrations for 'voiced' and 'unvoiced' sounds – e.g., /th/ in /this/ and /th/ in /thing/). Using small mirrors so they can 'see' their mouth while saying a sound and word is also recommended (see Chapter 11). Opinions vary as to what sort of 'feedback' individuals experience when producing sounds, but these methods at the very least reinforce learners' knowledge of sounds. Teachers can draw on a range of techniques depending on the learner's age/interest e.g., some teachers describe 'smiley /ē/ and 'dropped chin' /ě/.

What is also clear from a study of phonological development is that while the majority of learners with dyslexia will have phonological difficulties, so too will a large number of non-dyslexic learners with literacy difficulties. The Conquering Literacy programme is therefore also appropriate for them, although if they have other associated learning difficulties the programme may have to be adapted to their pace and experiences. We have found that what we have recommended for a one-hour lesson will usually take much longer with learners with more general learning difficulties. In particular they may take longer to acquire concepts, requiring far more examples and practice. More attention has to be paid to language comprehension to ensure learners' understanding of what they decode. They will also often require more practice in phonological awareness training. Nevertheless, they will benefit from a multisensory, structured, cumulative programme with opportunities for overlearning.

Implications for Practice



- Reading and spelling can be improved by intervention which links reading with phonological awareness training incorporating phonemic awareness and attention to prosodic/rhythmic aspects.
- It is important to recognise that learners with dyslexia need systematic teaching to establish sound-symbol relationships (phoneme-grapheme) and this will require practice and overlearning.
- Strategies should aim to develop learners' short-term verbal memory.

Summary



This chapter reviewed some of the research showing how a phonological deficit can affect the acquisition of literacy. This research has suggested that some types of phonological processing skills have a greater impact on learning to read and spell than others. It was acknowledged that there are many learners presenting poor phonological processing skills who do not have dyslexia and that some of the same teaching approaches could be used with them. While phonological processing difficulties are found in most languages, they are more evident in languages which have a 'deep' or 'opaque' orthography (such as English) and not so prominent in more 'transparent' languages. Aspects of speech production were considered to provide background information for practitioners that could facilitate their understanding of the intervention strategies introduced in the Conquering Literacy programme.

The chapter concluded that learners with phonological difficulties, particularly those with dyslexia, will benefit from explicit teaching of phonemic awareness and sound-symbol (phoneme-grapheme correspondence), using a multisensory approach to integrate seeing/forming letters with hearing/speaking the sounds they represent.

Further Reading

Teachers interested in learning more about phonology and phonetics will find the following texts useful:

- Odden, D.A. (2005) *Introducing Phonology*. Cambridge: Cambridge University Press.
Roach, P. (2009) *English Phonetics and Phonology: A Practical Course* (4th edition). Cambridge: Cambridge University Press.

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- Wagner, R., Torgesen, J., Rashotte, C. et al. (2013) *Comprehensive Test of Phonological Processing* (2nd edition). London: Pearson.