

Research Paper
**Scientific Research Basis for
EDUSS Phonics & Reading**

Dr. Robert Peach

Table of Contents

Introduction.....	3
Sound coding systems.....	5
Eduss sound code pattern.....	6
Patterns in vowel graphemes-phonemes.....	7
Patterns in syllable stress.....	8
Spelling-sound patterns.....	9
Patterns in consonant blends.....	10
Patterns in blended phonemes.....	10
Patterns in syllabication.....	11
Patterns in longer words.....	12
Patterns in onset-rhyme combinations.....	13
Patterns in phoneme and/or grapheme word families.....	14
Benchmarks for the effectiveness of the Eduss Phonics Program.....	16
Teacher resources.....	18
Conclusion.....	18
References.....	19

Research Basis of the Eduss Phonics & Reading Program

Introduction – the road to literacy

Chall (1983) and others have mapped the natural and identifiable pathway a child takes from birth to the stage of acquiring the skills needed for “reading to learn.”

The first babblings of a baby, which generally cover the same range of sounds regardless of nationality (Wilson, A. 2000), are gradually changed to conform to the phonemic set of sounds characteristic of the language of the parents. The sounds needed for meaningful communication are reinforced and the non-meaningful are progressively shed. At the same time, the child quickly learns the necessary rules of syntax needed to make meaningful communication in more flexible and more diverse ways.

Children entering formal education already have a speaking vocabulary of several thousand words (Chall, J, 1967), but have very un- or underdeveloped decoding and encoding skills. Decoding – mapping sounds to printed text – is recognized by most as an essential and fundamental skill for fluent reading (Chall’s Stage 2 of Reading). Yet debate about best practice for this essential skill has been and continues to be a source of vigorous debate.

According to Frith (1985) early readers apply alphabetic strategies to analyze words. This involves an interplay between phonemic awareness and the phonics skills of mapping phonemes to letter or letter groups. Hook and Jones (2002) contend that as children become more familiar with letters, their phonemic awareness improves and eventually they begin to grasp orthographic patterns. Indeed, Stanovich (1991, p. 57) says that phonemic awareness is “more highly related to learning to read than is general intelligence, reading readiness, or listening comprehension.” Through this progression the learner has begun the journey toward reading automaticity (see Figure 1, Hook and Jones, 2002).

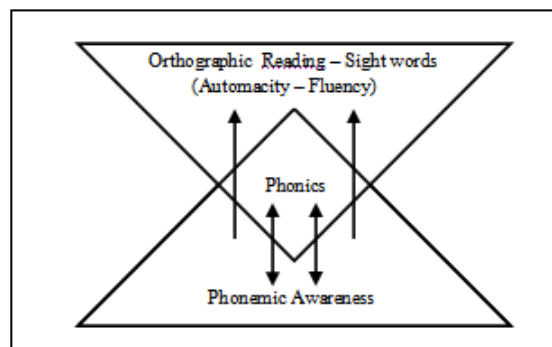


Figure 1. Relationships among phonemic awareness, phonics, and sight word recognition skills.

While the pathway to reading briefly described above is generally accepted, methods to achieve the final goal of fluent reading with good comprehension as prescribed by the Reading First initiative (2001) vary widely. This neat schema in Figure 1 may also delude us into thinking the process should be straightforward and simple. Unfortunately, national data does not paint such a rosy picture.

According to the *The Nation’s Report Card, 2005 National Assessment of Educational Progress*, fourth grade reading rates did increase between 1992 to 2005, but the average fourth grader’s reading score is still only 219 out of a possible 500 (National Center for Educational Statistics, 2005). This can be construed to mean that fourth graders still demonstrate less than half of the mastery level fundamental to reading at their grade level (Otaiba, Kosanovich-Grek, Torgesen, Hassler, & Wahl, 2005). Something is amiss.

For those of us who learned reading and spelling as native English-speaking children, it is difficult to remember the time, energy and frustration many of us spent on the process of mastering these skills. Ask any ESL student how

s/he's handling these skills and you'll get the frequent response, "So, so." Why? Is reading all that difficult? Perhaps a few facts about English will enlighten us or jog our memory.

- 1) English has more fundamental sounds than any other major language.
- 2) Most English vowel sounds can be spelled in multiple ways. For example, the long "a" sound can be spelled in six different ways as in: *day, they, drain, eight, cake, and café.*
- 3) Most English vowel letters can be sounded in multiple ways (Goswami, Ziegler & Richardson, 2005). For example, the letter *a* can be sounded in eight different ways as in: *cat, any, orange, watch, soda, cake, about, and father.*
- 4) Even the consonants, although to a lesser degree, present similar variation. The worst of these is illustrated in the 12 different ways the *sh* sound in *sheep* can be spelled: *ancient, session, mansion, conscious, sheep, chef, unctuous, anxious, ocean, sure, station, tissue.*
- 5) Approximately one-third of the words in English have one or more silent letters in them.
- 6) There are approximately 80 different letters or letter groups that code vowel sounds.
- 7) An ancient 26-letter Latin alphabet is used to code for at least 42 fundamental sounds.
- 8) The English language has by far the largest vocabulary of any of the major languages, in excess of one million words compared with fewer than 200,000 in German and French.
- 9) English has more synonyms than any other major language.
- 10) English spelling and rules of grammar are based on two systems: ancient German and ancient Latin.

Teachers of most other languages are not confronted with this problem, at least not to the same degree. Other European languages are much more phonetic than English. The complex, unphonetic nature of English text provides a unique and daunting challenge for teachers. Unfortunately, many teachers of English reading and spelling programs have not been adequately educated in the language's diversity. As a result they employ simplistic strategies that leave too much untaught, contributing to the present dilemma: high illiteracy rates as students are left struggling to fill in the knowledge gaps and reach competent levels of literacy. It is little help to teach children an over-simplified phonics diet of rules (Wilson, 2001) such as *a* is for *ape*, *c* is for *cap*, *d* is for *dog*. This is confusing to young Amy who already knows *a* makes a different sound in her name and has just learned the words *cent* and *edge* where her other two rules just broke down. Such instruction, not uncommon, is analogous to asking a person to play a piece of music on a piano with half the keys missing.

On the other hand, a high quality and comprehensive phonics educational program is critical to develop a child's reading, writing, and spelling skills. In addition, it is a potent predictor of future success in both written and verbal communication (Share et al, 1984). Nevertheless, one of the great challenges confronted by a good, comprehensive phonics-based reading program is the considerably unphonetic nature of English. While his methodology may be debated, Nyikos (1988) highlights this state of affairs with his claim that there are 1,120 graphemes to spell a sound in traditional English. This is vastly different from many more phonetic languages and is claimed by Schultz (2000) to be the biggest problem for Brazilian learners of English.

Unfortunately, there is no shortcut to reading and spelling mastery of English. In order to remedy the current crisis of high illiteracy rates, several fundamental things need to happen. Teachers need to be better prepared in their training years, and they need to have resources that cover the complete instructional needs for reading and spelling in as simple and complete a system as possible. The Eduss Phonics Program, and soon-to-be-released reading and spelling programs were designed to meet this challenge in a new and more effective way than other such programs. Developed in collaboration with experienced teachers, and from intensive research, the resultant program is a fresh and effective pedagogy which is quickly being embraced by native English-speaking students and ESL students alike. The program embraces the findings of recent research that promote the importance of explicit instruction in phoneme-grapheme correspondences, phonics, and word recognition which (Armbruster, Lehr, and Osborn, 2000; Chall, 2000; Chall and Popp, 1996; Christensen and Bowey, 2005;) are necessary precursors to early reading, writing and spelling success.

Due to the considerable phoneme-grapheme irregularities in English, various techniques have been used to provide phonetic cues to guide the student to correct grapheme pronunciation for reading, and orthographic patterns for spelling.

Sound coding systems

The unphonetic nature of English demands a supplementary sound coding system beyond its Latin alphabet. Look up an unknown word in any English dictionary and you'll be confronted with a sound code to help you pronounce the word. Unless you're readily familiar with this sound code, which is usually a version of the International Phonetic Alphabet (IPA), you'll find you need to crossreference the code to find its corresponding sounds, and then use these to pronounce the unknown word. If we have to go through this procedure as adults, spare a thought for the child struggling with cracking the sound code of the many irregular English words, especially if s/he is an ESL student.

Apart from the IPA coding system used in most dictionaries and in many ESL classes, there are various other pronunciation coding systems used in educational circles and specifically phonics programs. The question to ask of these is twofold: firstly, how simple and effective are they as a sound code, and secondly, does the code help or reinforce spelling skills? In other words, is the code effective for both decoding and encoding?

To date, one of the highly regarded systems for this is the Orton phonograms (McCulloch, M., 2000). Empirical evidence of its use shows significant successes (Spalding, R. & W., 1957, 1991). The Orton phonograms use a system of diacritical mnemonic marks to distinguish between different sounds, letters, and pronunciation rules that vary from what is regarded as a default rule or most common application. Samples of these diacritical markings are shown below with the corresponding Eduss color code of the same word following:

- Long vowels are underlined once as in cape. cape⁶
- Phonograms of two or more letters are underlined as in bridge. bridge^{3 j}
- Silent letters are double underlined as in cape cape⁶
- consonants, consonant digraphs, and consonant-vowel digraphs are double underlined when their pronunciation does not match spelling patterns as in sugar and exam sugar^{sh 14} exam^{g•z}
- A caret (and a combination of a caret and number are used) to prompt particular letter and/or sound combinations as in soda. so•da^{3 9 5}

As shown above, in this system, different phonetic cues can be represented by the same or very similar markings. For example, the word *white* is coded as w h i t e. Students could be forgiven for any confusion that may result from such similar and multi-used markings.

In all, the Orton phonograms have at least seven rules for their diacritic markings, which do not include syllabic stress. Dictionaries use a considerable number of similar markings to guide the reader to the correct pronunciation and syllable stress. While it is not commonly used in US schools, the International Phonetic Alphabet (IPA) or one of its derivatives, is yet another system used to phonetically sound code English.

Other phonics programs use different sound coding symbols or cues. Several use color to differentiate consonants from vowels, and to identify silent letters, or to differentiate between the same vowel letters that make different sounds.

While the complexities of these coding systems may seem difficult and excessive, the fact remains: given the unphonetic nature of English, the current Latin alphabet does an incomplete and confusing job of mapping sound to text. Remember, English has more sounds than most other languages (Helland & Kaasa, 2004; Shephard, 1987), multiple ways of spelling many sounds and, similarly, multiple ways to pronounce individual letters or letter groups (Goswami, Ziegler & Richardson, 2005). More specifically, this has resulted in English becoming an incredibly difficult language to spell, with numerous citations in the literature decrying the confusing state of English spelling (Goswami, Ziegler & Richardson, 2005; Venezky, 2004). Not only does a large proportion of English words contain

silent letters, many words that are used with high frequency in speech and writing are considered to be irregular due to their inconsistent phonic representation (Carnine, Silbert & Kameenui 1997; Helland & Kaasa, 2004; Venezky, 2004). This point regarding English spelling cannot be over emphasized. Even for native-English speakers, spelling presents a major problem as a result of the broad range of rules, exceptions, and inconsistencies that exist (Juel & Minden-Cupp, 2000). Perhaps Laubach (1996) put this most succinctly with his statement, “English is the world’s worst spelled language.”

Best pedagogical practice calls for ways to minimize the cognitive load caused by these inconsistencies and complexities. In other words, simplify instruction wherever possible. We do this in math, where we teach simple algorithms to multiply, divide, add fractions and so on. Clearly one way to do this for English pronunciation and reading is to find a simple sound code and organize the body of learning into learning objects that embrace as many consistent patterns as possible. Patterns not only present a number of elements according to similarities, they do so in a pictorial manner that aids memory and enhances prediction from the learned pattern to the unknown. Patterns engage different learning styles and so provide another learning paradigm for students. Most disciplines codify as much knowledge or as many skills into patterns as possible. Consider the periodic table in chemistry and all the physical and chemical properties within its rows and groups; the inverse square laws, and wave theory applications in physics, algebraic and calculus patterns in math, the formation of chords in music, patterned movement in dance, patterned elements in poetry, and so on. Patterns simplify knowledge, codify it and give us predictive abilities about its applications and limitations.

Alexander (1977), whose writings many regard as the major source of work on patterns, considers patterns as about best practice – a pattern solves a recurring problem. Further, he proposed the concept of “Pattern Language.” While patterns can be a good solution for fine-grained problems, linking related patterns can also be useful in addressing more complex processes in a step-by-step approach. Such a set of patterns working together is called Pattern Language. While Alexander’s interest was architecture, more recent extensions of his work into pedagogical patterns have been targeted at teaching and educational software. According to Bergin (2001):

“The intent [of pedagogical patterns] is to capture the essence of the practice in a compact form that can be easily communicated to those who need the knowledge...”

The Eduss Phonics program embraces this developing understanding of pedagogical patterns as an efficient and powerful way to teach many of the fundamental elements of reading. This begins with the program’s unique sound coding system. By its nature, this forms the basis for many aspects of the complete program, with its attendant learning objects such as the various sound grids, rhyme grids and pronunciation rules. While they are not exhaustive of the patterns within the program, several have been briefly described below.

Eduss sound code pattern

Firstly, let’s review the Eduss sound code which itself patterns some of the fundamental aspects of the language.

The Eduss code is by far the simplest, yet most comprehensive sound coding system currently available.

The code only uses 5 elements (or patterns) to completely sound code all English words (see example words in Figure 2). Compare the simplicity of this with the numerous cues and diacritical markings used in the Orton phonograms and dictionary pronunciation codes mentioned earlier, and the codes in other comprehensive phonics programs.

The elements of the Eduss code are

- 23 different vowel sounds; the letters encoding each vowel sound are colored red and given a numerical superscript to code its sound.
- All consonants are colored blue; those that are not phonetically sounded are coded with the appropriate superscript; consonant digraphs are underlined to indicate they form a single unit.
- Silent letters are coded gray.
- A dot in the baseline letters marks a syllable break.
- Stressed syllables are shown in bold font.

Various screenshots of the program in Figure 3 show its different functionalities such as video clips of the mouth movements used to make the different vowel and consonant sounds, the record and playback function, and the way coded text is shown within the program. According to Yopp (1992), phonemic isolation exercises such as the exercises in the program and the record and playback feature are an integral part of developing overall phonemic awareness skills.

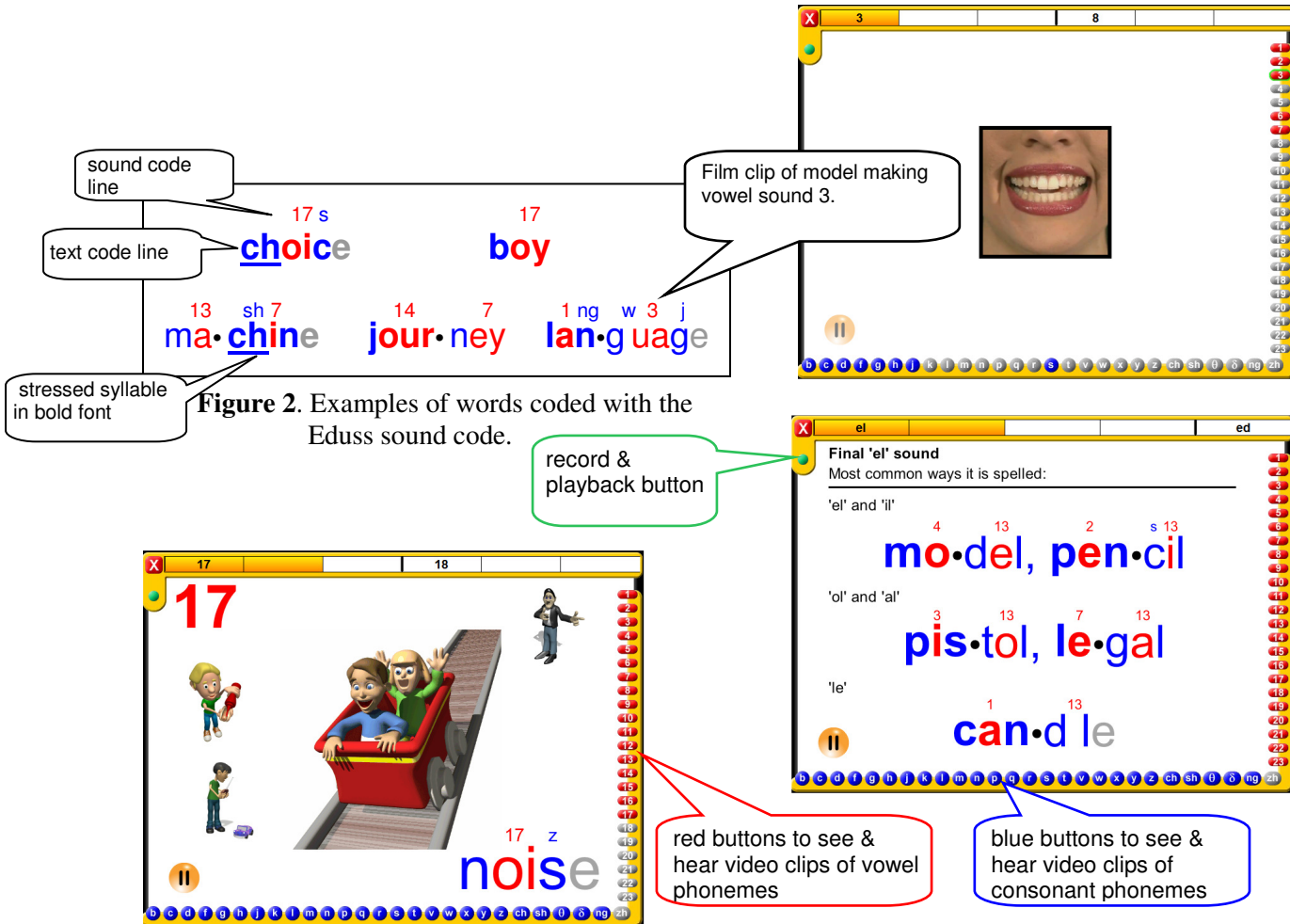


Figure 3. Sample screenshots from the program with explanatory notes of different functions.

Patterns in vowel graphemes-phonemes

Notice how the Eduss code is presented in two parts (Figure 2). The bottom or base line shows the complete spelling of any given word. The upper line shows sound codes corresponding to the text below where this is necessary. All the red letters (letters spelling vowel sounds) have a numerical superscript that represents their sound. An example of this, where 10 different letters code for the long sound of oo (sound 12 in the program), is shown in Figure 4. The last word in this group is thrown in for good measure to show how easy it is to pronounce an unknown word once you know the vowel sound code. Djibouti, formerly French Somaliland, is a country in East Africa. When consonants make a sound other than their most common or default sound, the sound for the consonant is entered into the top line. Examples of this can be seen in Figures 2 and 3.

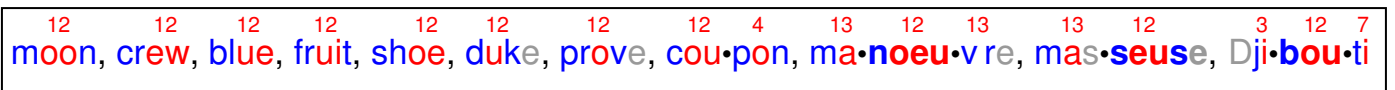


Figure 4. An example of vowel sound coding showing the different spellings for vowel sound 12

In addition, the program provides data on the relative frequencies of the different graphemes used to spell the 23 vowel sounds. For example, the frequency of use of the graphemes used to spell vowel sound 12 are shown in Table 1. This knowledge allows teachers to be more strategic and systematic in teaching these different grapheme-phoneme correspondences.

vowel grapheme	relative frequency	example words
oo	33.7%	tool, zoo, food, school
u	27.8%	tube, rude, rule, truth
o	11.1%	move, who, do, prove
ue	8.5%	blue, glue, due, Tuesday
ew	6.9%	new, grew, chew, knew
ui	4.9%	juice, bruise, fruit, suit
ou	4.6%	soup, wound, group, youth
eu	1.7%	neutral, pseudo, masseuse, chanteuse
oe	0.7%	shoe, canoe, shoelace, shoestring
oeu	0.2%	manoeuvre

Table 1. Relative frequency of occurrence of the graphemes used to code vowel sound 12, taken from a sample of approx. 500 one-and two-syllable words.

According to Ehri (2004, p. 155) a competent awareness of both regular and irregular phoneme-grapheme correspondences is the “glue that holds the word in memory.”

Patterns of syllable stress

The Eduss code also displays syllables with primary stress by font bolding. Poor readers and dyslexic students often have difficulty hearing (Hook and Jones, 2002) and articulating stressed syllables. The prosodic feature of stress, like intonation and phrasing, is an important part of comprehension and intelligible verbal communication. Consequently, it is valuable information to teach students stress patterns in English where they reasonably follow a predictable pattern. Where rules do exist as to which syllable is stressed in multi-syllabic words in English, the Eduss code makes these patterns clear. Fortunately, there are several such rules and one of these is shown in Figure 5. The examples in Figure 5 show the consistent pattern for the stressed syllable in words with the *shuh* sounds such as *shun*, *shul*, *shus*, etc. In such words, the stressed syllable is always (or 99% of the time) the syllable immediately before this sound – shown by the bold font.

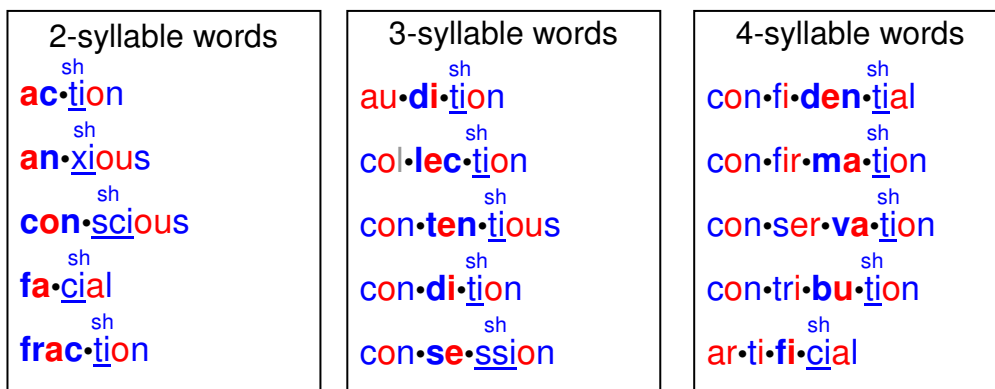


Figure 5. Examples of a syllable stress pattern in a family of words.

A special application within the program (see p. 12) allows more refined or detailed searches of that which is shown in Figure 5. An example of part of one of these more focused searches is shown in Figure 6. This shows the pattern formed by a sample of words that all begin with the same sound (*cu*h), end with the same sound (*shun*), and are three syllables long. Examples like this can be used to illustrate several things:

- 1) The consistent syllable stress pattern formed by the ending sound;

- 2) Some of the different ways the *sh* sound in *sheep* is spelled;
- 3) By speaking through the list, students begin to pattern the rhythm of English (the prosodic aspects of stress, intonation, and intraword phrasing);
- 4) The component word elements in longer English words.

While the advantages of this small exercise are readily apparent for native English-speaking students, they are much more poignant for ESL students whose native tongue will have different stress and intonation patterns.

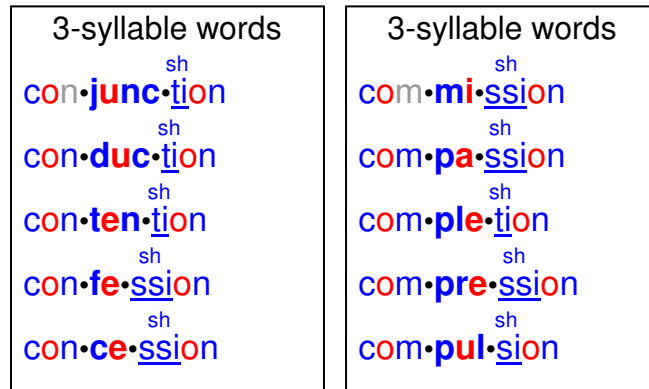


Figure 6. Extract from a refined search to illustrate the four literacy points mentioned above.

Spelling – sound patterns

Ehri (2000), Snow et al. (2005), and Ehri and Snowling (2004) all reinforce the synergistic relationship between spelling and reading. In short, both skills build and rely on the same mental processes. They both depend on mastering the relationships between letters and sounds. Generally, better spellers are better readers, and better readers are better spellers.

While we may deplore the state of English spelling and its irregular sound coding system, we are stuck with it. The challenge is to focus teaching decoding and encoding skills in such a way that shows as many predictable patterns as possible. While the current program is basically a phonics and early reading program, it is designed to be the foundation for a complete reading and spelling program. Reading and spelling are not completely separate domains of knowledge. As mentioned earlier, they are closely correlated. Because of this, the Eduss Phonics Program teaches spelling conventions that are relevant to effective decoding. One example of this is shown in Figure 7 below. This figure illustrates the fact that English words never end with the letter *j* but a considerable number end with the sound *j* makes. In reality, if taught deliberately, this becomes both a spelling rule and a pronunciation rule. As you can see, tables generated like this in the program almost always serve more than one purpose. For example, the words in Figure 7 can be also used to illustrate:

- 1) The rule that *g* followed by *e*, *i*, or *y* most often makes its soft *j* sound.
- 2) How the **VCE** ending most often causes the preceding vowel to make its long sound.

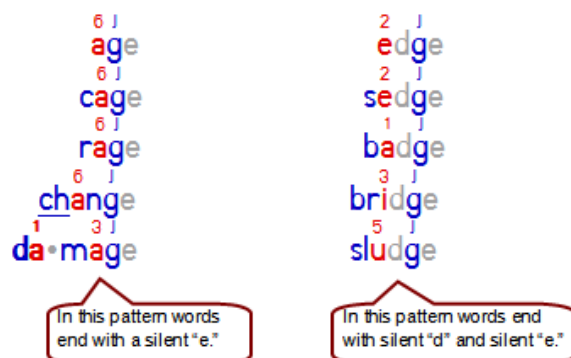


Figure 7. A sample of words showing the two different end spelling patterns when they end with the sound of letter *j*

Similar lessons and exercises on inflections help combat the frequent spelling errors these provide for children in upper elementary grades (Apel et al., 2004).

Patterns in consonant blends

Few languages have as many consonant blends as English where they are liberally used in initial, medial and final positions of a word. Due to their common use, it is important that students become skilled in their grapheme-phoneme correspondences. This provides a special challenge for many ESL students as the rules for syllabic structure in their native language most likely will be different from those in English. (See notes on patterns in syllabication.)

The Eduss Phonics Program teaches consonant blends in a methodical and comprehensive yet unique manner. By using sets of grids (see example in Figure 8), not only are the sounds taught and learned, but the consonant blend patterns shown allow the student to quickly acquire an understanding of the common letter combinations used to form blends – a picture is worth a thousand words. In addition, explanatory notes make the student quickly aware that several different consonant blends can make the same sound such as the initial blends shown in the textbox to the right.

cloud, Klaus, ^kchlorine

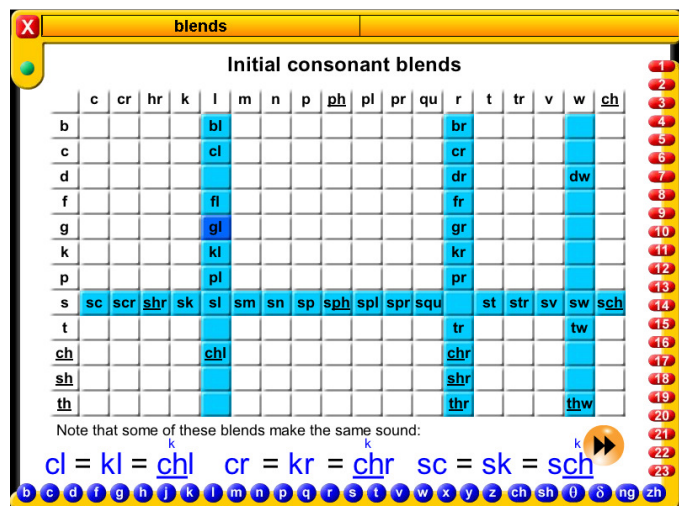


Figure 8. Screenshot of initial consonant blend grid showing which letter combinations form blends. These cells are hot buttons that activate the blend’s sound.

Patterns in blended phonemes

To further emphasize phonemic awareness skills, other grids are used to teach initial consonant-vowel blends. An example of this where initial blends are combined with vowel sounds is shown in Figure 9. Patterns such as this provide a comprehensive and systematic approach to such sound blending. For example, in this grid a clear cell indicates that the combination of a consonant blend sound in the left-hand column, combined with a vowel sound in the top row, exists in English words. A black cell indicates no such sound combination exists in English words. Clear cells are hot buttons that activate the blend’s sound. Grids like those in Figures 8 and 9 form part of the instructional material and are also used in the corresponding exercises.

Explicit instruction in blended phoneme awareness is one of the pre-requisite skills for reading (Armbruster, Lehr, and Osborn 2000; Hook and Jones, 2002; Tangel and Blachman, 1995). The program’s grids present this part of the curriculum in a comprehensive and patterned manner not seen in other programs.

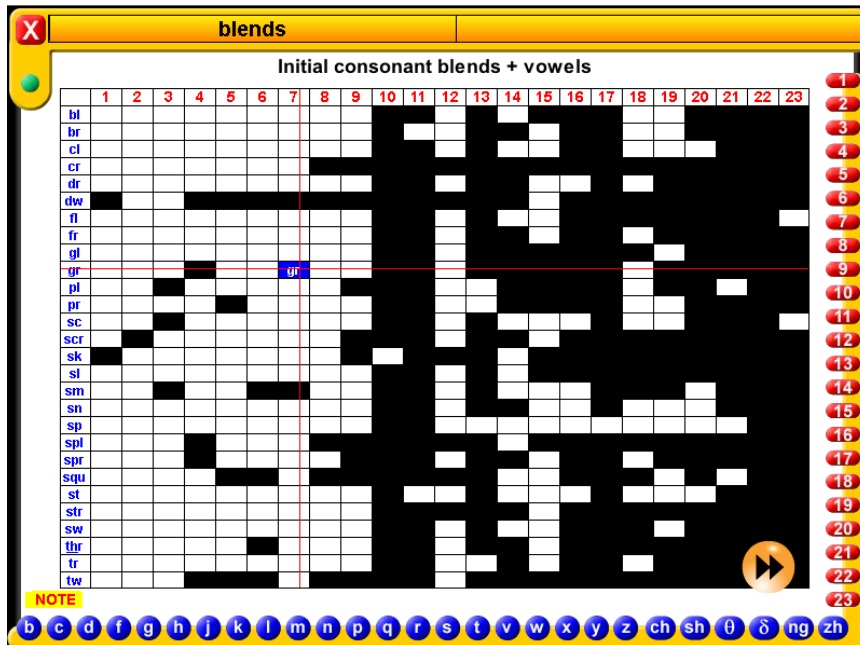


Figure 9. Screenshot of grid used to teach and test combined initial consonant blend and vowel phonemes.

Patterns in syllabication

While the forty to fifty basic vowel and consonant sounds form the fundamental phonemes of English speech, they are rarely spoken in isolation. The basic unit of spoken sound is the syllable, or put another way, syllables are the “building blocks” of the spoken language. Syllabication is included in national reading standards and, according to Moats (2005), should be mastered as a skill by grade 3.

Syllable structure can be different in different languages. While it is important for literacy teachers to know and pass on to students the principles of the syllable structure of English, it is imperative that the ESL teacher have at least a cursory appreciation of how syllable structure in English may vary from that in other languages. In general, a syllable may consist of three parts: consonant onset sounds, the nuclear vowel sound, and the ending (coda) consonant sounds as shown in the Figure 10 below.

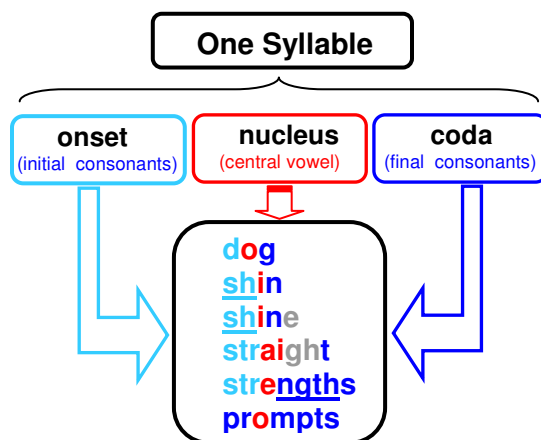


Figure 10. Showing the possible elements of a syllable in English.

Onsets are consonant sound/s that form the beginning sound of a syllable. The nucleus of the syllable is the vowel sound, and the coda or tail (from the Latin “cauda” meaning “tail”) is/are consonant sound/s made after the vowel.

This structure is sometimes referred to as a **CVC** pattern where **C** stands for a consonant sound or sounds, and **V** for a vowel sound. Some important points to make here include:

- Onsets and codas may or may not exist, but the presence of a vowel sound is mandatory.
- The nucleus consists of only ONE vowel sound, but this may be spelled by one or more letters.
- Onsets and codas may consist of zero, one or more consonants (the sounds of which blend together), and silent letters. (Note, while the *e* in *shine* and *gh* in *straight* are silent, they are still part of the spelling of the coda of these words.)

The Importance of Syllable Structure to Learners of English

Each language defines its own syllable structure and what it allows by way of onsets, nuclei, and coda. For example, Japanese does not allow consonant clusters in the onset – they have a maximum of only one consonant sound – and very few sounds in the coda.

Other languages (Hebrew, Arabic and varieties of German) don't allow empty onsets. Most languages require a nucleus (central vowel sound) as an integral component of a syllable. Yet there are a few languages (Mon-Khmer, and some Northwest coast Indian languages of North America) that defy this structure of a syllable altogether.

Contrast these examples with English which commonly has consonant clusters in both onsets and codas and allows syllables/words such as *at*, *it*, *of* etc, where there are no onset sounds.

The Eduss Program devotes considerable attention to the skill of syllabication, not only to satisfy national and state reading standards, but because it is a powerful tool to better pronunciation, spelling (Moats, 2005), and word meaning for the many words in English that follow the Latin or Greek word element structures. By using the Eduss color coding system it becomes much easier to visually divide words into their component syllables according to a few simple rules. An example of this in Table 2 shows the rule for dividing words into their syllables when they have two consonants between two vowels.

	word pattern	syllable break	examples
two consonants between the vowels	CVCCV	CVC•CV	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> ¹ cac • ¹³ tus </div> <div style="text-align: center;"> ² streng • ^{8 13} then </div> <div style="text-align: center;"> ^{1 10} an • ¹⁴ ger </div> <div style="text-align: center;"> ⁴ k s13z • ³ g z1 </div> </div> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> ⁴ k s13z • ³ g z1 </div> <div style="text-align: center;"> ³ g z1 • ¹ act </div> </div>
	CVCCVC	CVC•CVC	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> ⁸ sig • ^{3 1} nage </div> <div style="text-align: center;"> ⁸ brigh • ¹³ ten </div> </div>
	CVCCV	CV•CCV	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> ⁴ so • ¹³ ften </div> <div style="text-align: center;"> ⁸ cli • ³ mbing </div> </div>

Note, consonant digraphs are treated the same as single consonants because they make only one sound.

Note, the letter "x" makes two consonant sounds, either "ks" or "gz."

Table 2. Syllable pattern for words with two consonants between the vowels.

Patterns in longer words

A cursory study of the history and development of the English language adds interest and context to reading and spelling skills. Almost all of the words longer than two syllables in modern English find their origins in Greek or Latin and its offspring romance languages. A better understanding of this is extremely helpful to students reading, spelling, and comprehension skills (Moats, 2005). English spelling has been described as a morphophonological alphabetic system. That is, words are spelled according to their phonemes and their meaningful parts (such as prefixes, roots, and suffixes). This is different from other languages such as Spanish. Research has shown that the study of these word elements enhances reading, comprehension, spelling, and vocabulary development (Carlisle and Stone, 2005). Further, Henry (2003) reported that the best order of teaching these word elements begins with the common inflections and then extends to prefixes, roots, and suffixes.

The Eduss program embraces this philosophy, teaching word structure (see example in Figure 11) and then grouping lessons around families formed by a common root, prefix, or suffix to show the effect that each of these elements has on meaning and pronunciation (Henry, 2003, Templeton et al., 1992).

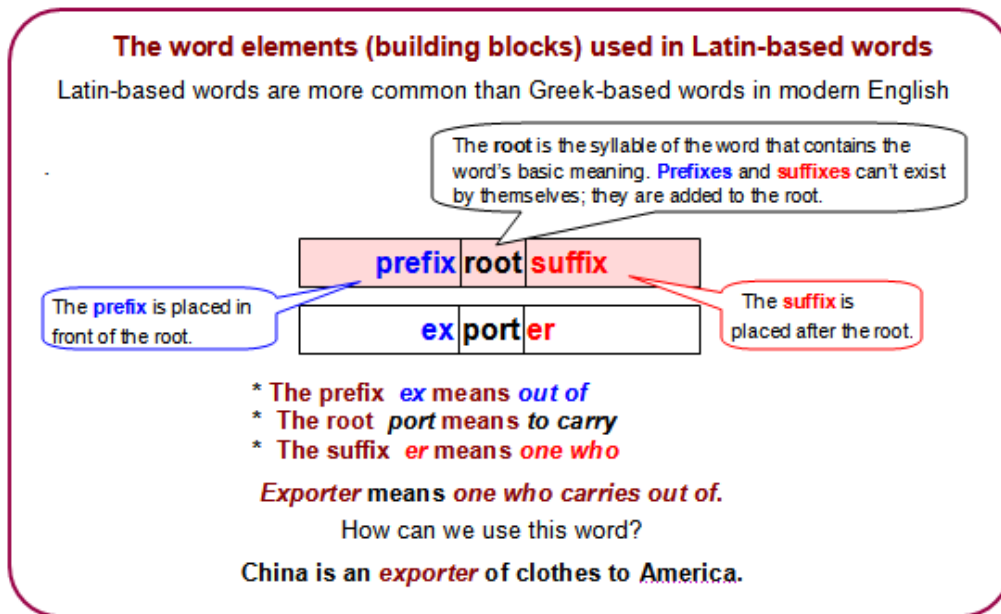


Figure 11. Structure of word elements in a Latin-based word.

Patterns in onset-rhyme combinations

Christensen and Bowey's (2005) research comparing the efficacy of explicit orthographic rhyme to a control group exposed to implicit phonics, showed that the former consistently spelled transfer words better, had better comprehension, and higher oral reading scores than those in the control group. Hook and Jones (2002) suggest that students need to recognize all four basic word kinds (regular for spelling and reading (*cat, back*); regular for reading but not for spelling (*coat, sack* which could be spelled *cote* and *sac* respectively); rule based (*hopping* – double consonant to keep previous vowel short); and irregular (*beauty*) in order to become effective fluent readers. In the Eduss program, it is the rhyme grids that provide patterned instruction that enhances automaticity and fluency in the first two of these four basic word kinds. An example of one of the approximately 30 such grids in the program is shown in Figure 12.

The grids, while showing words that fit into the specific orthographic and sound patterns combinations of the grid, also draw attention to words that do not completely comply. This information provides valuable instruction on the various homonyms (homophones and homographs) of English.

Rhyme Stage 2, Lesson 1 (master table)

One-syllable rhymes of:

1 2 3 4 5
ack, eck, ick, ock, uck

A yellow cell (sac) means there is more than one way to spell the word that matches the sound of the cell.
A green cell (knock) means the word has the same sound as the cell, but it is spelled differently OR you have to choose between two spellings.

	1	2	3	4	5
	ack	eck	ick	ock	uck
b	back				buck
C(hard)				cock	
d		deck	Dick	dock	duck
f					
g(hard)					
h	hack	heck	hick	hock	
j or g(soft)	jack			jock	
k or ch			kick		
l	lack		lick	lock	luck
m	mack		Mick	mock	muck
n	knack	neck	nick	knock	
p	pack	peck	pick	pock	puck
qu	quack		quick		
r	rack	wreck	Rick	rock	ruck
S or C(soft)	sac sack		slick	sock	suck
t	tack	tech	tick	tock	tuck
v			Vic		
w	whack wack		wick	wok	
y	yack yak				yuk yuck
z					
ch		check	chick	chock	chuck
sh	shack			shock	
th or th			thick		
HINTS	1 ack	2 eck	3 ick	4 ock	5 uck

	1	2	3	4	5
	ack	eck	ick	ock	uck
bl	black			block	
br			brick		
cl	clack		click	clock	cluck
cr	crack		crick	crock	
dr					
fl	flack	fleck	flick	flock	
fr				frock	
gl					
gr					
pl	plaque				pluck
pr			prick		
sc or sk					
sl	slack		slick		
sm	smack			smock	
sn	snack		snick		snuck
sp		speck		Spock	
spr					
st	stack		stick	stock	stuck
str					struck
shr					
tr	track	trek treck	trick		truck
thr or thr					
	1 ack	2 eck	3 ick	4 ock	5 uck

"Mack" has several meanings including a person's name. It can be short for "macintosh" which is a reincoat.

A "wack" refers to a person that is bad or strange. We get "wacho" from this word.

A "yak" is a hairy ox from Asia. Both "yak" & "yack" mean to talk or chatter.

A "ruck" refers to a group of ordinary people. It is also used to describe a group of players in rugby football.

"Plaque" has several meanings including "an inscribed or engraved plate," and also, the "white film of bacteria that grows on our teeth."

Both "trek" and "treck" mean to travel, or travel slowly.

Figure 12. Example of an onset-rhyme grid showing different homonyms and meanings of rarely used words.

Patterns in phoneme and/or grapheme word families

Unique to the Eduss program is a search engine that can query its extensive coded word database for words with phoneme and/or grapheme similarities. Word families can be found that match grapheme and/or phoneme patterns anywhere in the word. Examples of this are shown in Figure 4 where the program searched for words with vowel sound 12 to show the different ways it's spelled; Figure 5 where it searched for 2, 3, and 4 syllable words with the *sh* sound anywhere in the word; Figure 6 to show the family of three-syllable words that all begin and end with the same letter/sound combination; and in Figure 7 showing words ending with the sound of consonant *j*.

Another example of its use is shown in Figure 13 which displays a portion of the result of a query for one-syllable words that have a silent *b* in them. No other program contains a search tool like this that allows the teacher to

quickly find a family of words s/he may want to use to illustrate sound patterns or rules; phoneme-grapheme correspondences, syllable stress patterns, spelling patterns, and much more.

The screenshot shows a search engine interface with the following components:

- Query:** A text input field containing '0' and 'b'.
- Boolean:** Radio buttons for 'Unary' (selected), 'AND', 'OR', and 'NOT'.
- Accent:** Radio buttons for 'US' (selected), 'AU', and 'UK'.
- Mode:** Radio buttons for 'Fuzzy' (selected) and 'Strict'.
- Syllables:** A text input field containing '1'.
- Buttons:** 'Clear' and 'Search' buttons.

Below the search bar, the results are displayed in three columns:

- Column 1:** bomb (4), climbed (8), combs (9 z), debt (2), doubts (18), limb (3).
- Column 2:** bombs (4 z), climbs (8 z), crumb (5), debts (2), lamb (1), limbs (3 z).
- Column 3:** climb (8), comb (9), crumbs (5 z), doubt (18), lamb (1 z), numb (5).

Figure 13. Sample of search for one-syllable words containing a silent *b*.

In addition, this search engine provides valuable information about the veracity of various pronunciation and spelling rules commonly taught.

The following three examples illustrate this point:

- 1) Rule often taught: in words ending with the sound of *j* that have the pattern *ge* as in *cage* the preceding vowel is always long (Moats, 2006). A battery of longer words (e.g., *damage*, *cottage*, *average*, etc.) contradict this rule.
- 2) The rule that *i* comes before *e* except after *c* works for approximately half the words with this letter combination. However, all the words that have their plurals formed by dropping the final *y* and adding *ies* (*policies*, *currencies*, etc) violate this rule as well as other words such as *ancient* and *science*.
- 3) Some English pronunciation programs teach that the second letter of a two-letter vowel group is silent while the first vowel is long. While this rule works for many two-letter vowels, it is not true for many others. For example, it is not true more than 90% of the time for *ie*: it is not true for *oi* combinations as in *soil*, for *eu* combinations as in *neutral*, and with several other two-letter vowels.

The search engine not only provides the teacher with a tool to tailor-make word families to teach various sound, stress, or spelling patterns; it allows teachers to be confident that what they teach is, in fact, true.

Benchmarks for the effectiveness of the Eduss Phonics software.

McKenna and Watkins (1996) and Wood (2001) provide guidelines for effective software use in the classroom. The following points show how the Eduss Phonics program is aligned to these criteria and what is generally regarded as best practice in teaching phonics (Adams, 1990; Chall and Popp, 1996; Ehri, 1998 and Moats, 2005).

1) **Instruction should be systematic and direct** (McKenna, 2002). The Eduss Program has been designed around a specific curriculum that conforms to recognized research in progressing students through the foundational skills leading to fluent reading (Adams, 1990; Chall and Popp, 1996; Ehri, 1998 and Moats, 2005). The first lessons teach the common and frequently used short and long vowel sounds of the five vowel letters. Consonant sounds are also taught from the beginning and follow an alphabetical sequence. In the more advanced sections of the program, students learn about consonant digraphs, consonant blends, r-controlled vowels, and vowel diphthongs. Later lessons cover blending phoneme sounds as a precursor to syllabication. After this, students learn syllabication rules and use them for pronunciation. Sections on compound words, antonyms, word endings, and prefixes, suffixes, and common roots are also included.

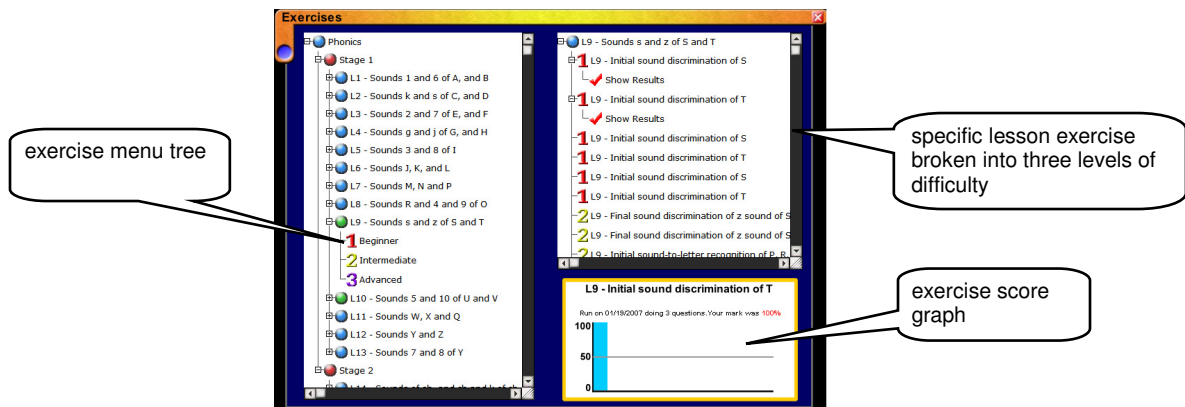


Figure 14. Part of the exercise menu in Stage 1 of the Eduss Phonics program.

2) **Good phonics software facilitates teacher monitoring** (McKenna, 2002). The Eduss Phonics Program has an inbuilt student tracking function. The program allows teachers to set homework and monitor student progress through any lesson and its corresponding exercises. The feedback provides the student’s score and time spent on task. This data allows teachers to quickly monitor each student’s progress and level of success. The teacher can then use this information to provide complementary classroom activities. Samples of lesson and exercise records are shown in Figure 15.

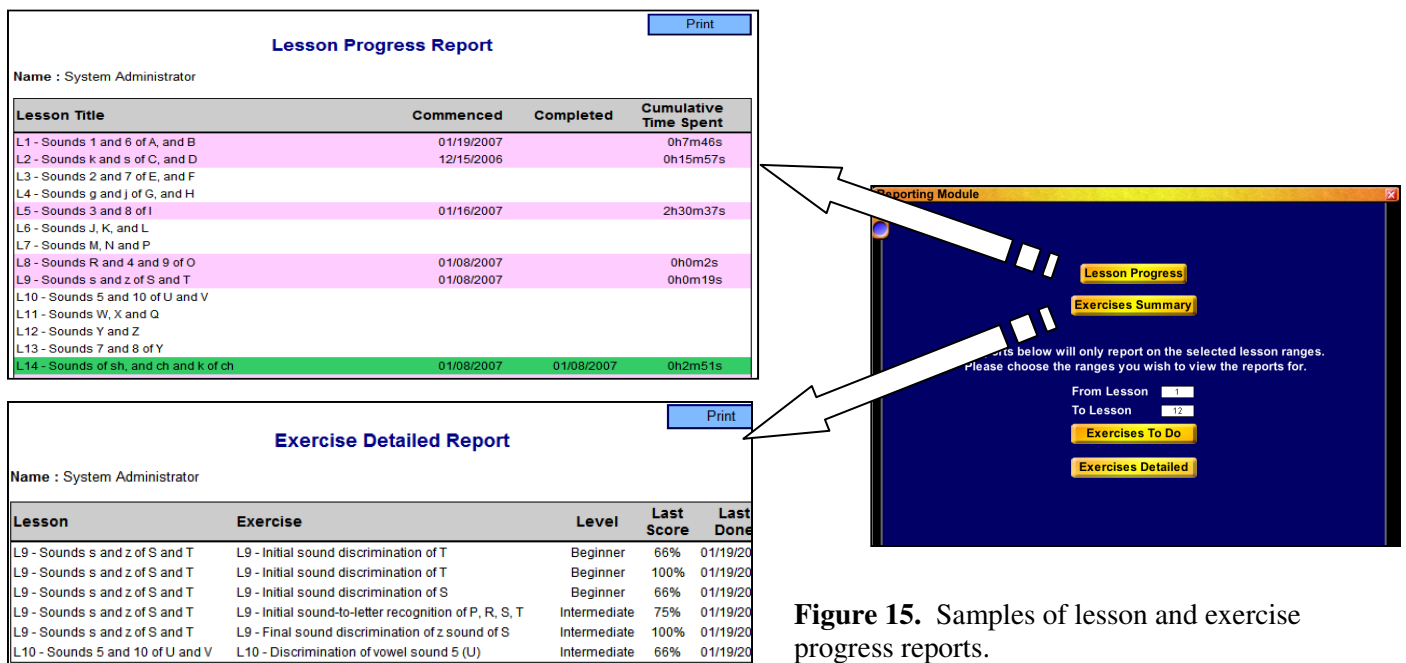


Figure 15. Samples of lesson and exercise progress reports.

3) **Good phonics software helps children progress from alphabetic to orthographic decoding... and from monosyllabic to multisyllabic words** (McKenna, 2002)

The Eduss Phonics software provides content in an ordered, systematic, and sequential manner. Initial alphabetic decoding is followed by orthographic decoding. Wherever a spelling rule helps decoding (such as words ending with the sound of *j*) it is explicitly taught in the program. The program begins with simple monosyllabic words and then moves to multisyllabic words. As part of this progression students are introduced to the schwa sound, syllable stress, and elementary syllabication. The collage of screenshots in Figure 16 shows aspects of this variation.

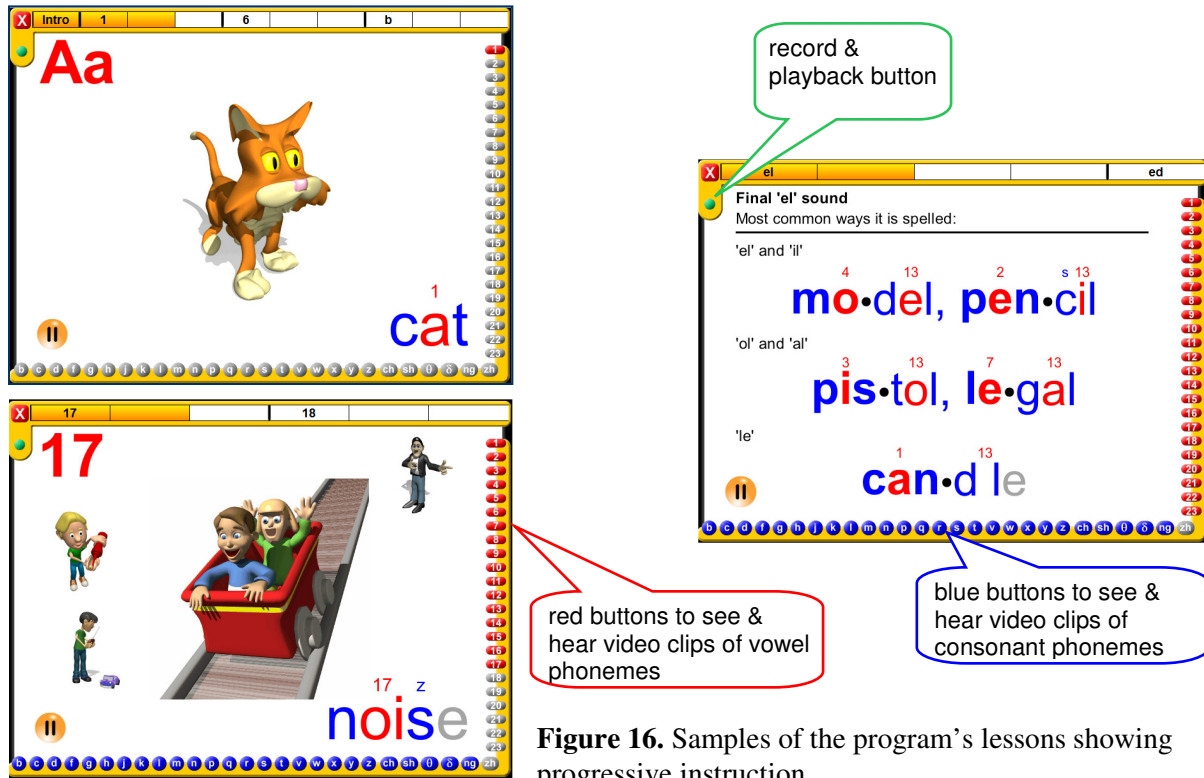


Figure 16. Samples of the program's lessons showing progressive instruction.

4) **Good phonics software employs onset-and-rhyme format** (McKenna, 2002).

Lessons and exercises within the Eduss Program are devoted to forming hundreds of words from onset-rhyme combinations (see example in Figure 17). Many of these are presented in a grid format which allows students to readily see patterns and exceptions to these patterns. It is within this context that students are introduced to homonyms and heteronyms.



Figure 17. Exercise example showing matching onset grapheme with its given phoneme.

5) Good phonics software maximizes time on task (McKenna, 2002).

The Eduss Program was not designed around games. It is pre-eminently an educational program that uses children's animations to help interest and engage the student. Consequently, no time is lost to entertainment that can distract students from the principal objectives of the program.

6) Educational software should provide opportunities for students to repeat work until they achieve mastery (McKenna, 2002)..

Verbal feedback within the program is designed to acknowledge students' success. If a student's answer is incorrect, the program asks him/her to try again. In many exercises the correct answer is shown if the student's is incorrect. The program is also designed to allow students to repeat units of work as often as needed. It is not designed to preclude students from moving to the next lesson if, for some reason, they have not passed the previous lesson. This lets the teacher move the student to anywhere in the program that may benefit him/her.

Teacher resources

All the relevant data derived from the research in developing the content of the Eduss Program is available to the teacher as notes within the program. Approximately 200 pages of notes provide teachers with more than enough information to make them competent professionals in all facets of phonics and reading, through to the comprehensive section on prefixes, roots, and suffixes.

Conclusion

Eduss Phonics and Reading in the classroom

Essentially, the Phonics Program software was designed as a tool that can be integrated into the traditional classroom to enhance the fundamental skills needed to develop competent readers. It was developed from extensive research and employs a novel coding system and other patterned learning objects that enrich and simplify both decoding and encoding skills. The program also provides individualized instruction thus providing for remediation needs as well as ongoing instruction for the more able student.

It embraces the proven research regarding successful acquisition of pre-requisite fluent reading skills and the progression to attain these.

In-built tracking or reporting functions allow teachers to monitor progress and take whatever action they think appropriate depending on each student's progress. MacGregor's work (2004) showed that the use of technology in classrooms both supports and improves skills taught in the core curriculum.

The Eduss Program can be implemented as an intervention tool or as the main phonics learning curriculum. It can be easily integrated into a variety of different core reading programs. The program provides students with an attractive interactive format for learning phonics skills that is based upon extensive scientific research. While it embraces proven pedagogy for a phonics program, it does so in a more effective manner by using a powerful and effective coding system that enhances both student decoding and encoding skills. Together with its sister product, Eduss Grammar Program, it includes the following essential components of reading instruction as noted by the national Reading First initiative:

- 1) phonemic awareness
- 2) phonics
- 3) vocabulary
- 4) fluency
- 5) comprehension

References

- Adams, M. (1990). *Beginning to read: Thinking and learning about print*. Cambridge, MA. MIT Press.
- Alexander, Christopher, Ishikawa, Sara and Silverstein, Murray (1977) *A Pattern Language: Towns, Buildings, Construction*. London. Oxford University Press
- Apel, K., Masterton, J.J., and Niessen, N.L. (2004). Spelling assessment frameworks. In C.A. Stone, E.R Silliman, B.J. Ehren, and K. Apel (Eds.), *Handbook of language and literacy: Development and disorders*, pp. 644-660. New York. Guilford.
- Armbruster, B. B., Lehr, F., & Osborn, J. (2000). *Put Reading First: The Research Building Blocks for Teaching Children to Read*. Washington, DC. National Institute for Literacy
- Bergin, J.(2001). *Mining Pedagogical Patterns*. Retrieved January, 2007 from <http://www.pedagogicalpatterns.org/meetus/ecoop2001.html>
- Carreker, S. (2005). Teaching Spelling. In J. Birsh (Ed.) *Multisensory teaching of basic language skills (2nd Edition)*, pp. 257-295. Baltimore, Md. Paul Brooks.
- Carlisle, J.F., and Stone, C.A. (2005). Exploring the role of morphemes in word reading. *Reading Research Quarterly*. 40(4), 428-449.
- Carnine, D.W., Silbert, J., & Kameenui, E.J. (1997). *Direct instruction reading*. New Jersey: Prentice Hall.
- Chall, J. (1967). *Learning to Read, The Great Debate*. New York: McGraw Hill.
- Christensen, C. A., & Bowey, J. A. (2005). The Efficacy of Orthographic Rime, Grapheme-Phoneme Correspondence, and Implicit Phonics Approaches to Teaching Decoding Skills. *Scientific Studies of Reading*, 9(4), 327-349
- Chall, J.S., (2000). *The Academic Achievement Challenge: What Really Works in the Classroom?* New York. Guilford Press
- Chall, J.S., and Popp, H.M. (1996). *Teaching and Assessing Phonics: Why, What, When, How*. Cambridge, MA. Educators Publishing Service, Inc
- Ehri, L.C. (1998). Grapheme-phoneme knowledge is essential for learning to read words in English. In J.L Metsala and L.C. Ehri (Eds.), *Word recognition in beginning literacy*, pp. 3-40. Mahwah, NJ. Erlbaum.
- Ehri, L. (2000) Learning to read and learning to spell: Two sides of a coin. *Topics in Language Disorders*, 20, 12-36.
- Ehri, L.C. (2004). Teaching phonemec awareness and phonics. In P. McCardle and V. Chhabra (Eds.), *The voice of evidence in reading research*, pp. 153-186. Baltimore, Md. Brookes Publishing.
- Ehri, L. and Snowling, M.J. (2004). Developmental variation in word recognition. In C.A. Stone, E.R Silliman, B.J. Ehren, and K. Apel (Eds.), *Handbook of language and literacy: Development and Disorders*, pp. 433-460. New York: Guilford.
- Frith, U. (1985). Beneath the surface of developmental dyslexia. In K.E. Paterson, J.C. Marshall, and M. Coltheart, (Eds.), *Surface dyslexia: neuropsychological and cognitive studies of phonological reading*. Hillsdale, NJ: Lawrence Erlbaum Associates.

- Goswami, U., Ziegler, J.C., & Richardson, U. (2005). The effects of spelling consistency on phonological awareness: A comparison of English and German. *Journal of Experimental Child Psychology*, 92(4), 345-365
- Helland, T. & Kaasa, R. (2004). Dyslexia as a second language. *Dyslexia*, 11, 41-60.
- Juel, C. & Minden-Cupp, C. (2000). Learning to read words: Linguistic units and instructional strategies. *Reading Research Quarterly*, 35(4), 458-492.
- Hook, P.E. & Jones, J.D. International Dyslexia Association quarterly newsletter, Perspectives, Winter, 2002, vol. 28, no. 1, pages 9-14. IDA website: <http://www.interdys.org>.
- Laubach, F.C. (1996). *Let's Reform Spelling - Why and How*. NY: New Readers Press.
- Moats, Louisa C. (2005). How Spelling Supports Reading. *American Educator*, Winter 2005/06, 12-43.
- McKenna, M. C., & Watkins, J. H. (1996, December). *The effects of computer-mediated trade books on sight word recognition and the development of phonics ability*. Paper presented at the National Reading Conference, Charleston, SC
- McCulloch, M. (2000). *Writing and Spelling Road to Reading and Teaching: A Neurolinguistic Approach to Cognitive Development and English Literacy*. Portland. The Rigg's Institute.
- Nyikos, Julius. 1988. *A Linguistic Perspective of Illiteracy*. in S. Empleton (ed.) The Fourteenth LACUS Forum 1987. Lake Bluff, IL: Linguistic Association of Canada and the U.S., 146-73.
- Put Reading First: The research building blocks for teaching children to read. 2001. Washington, DC: The Partnership for Reading.
- Schultz, R. (2000) *Diferencas de pronuncia entre Ingles e Portugues* (on-line) Available at: <http://www.English.sk.com.br/sk-pron.html>
- Share, D.L., Jorm, A.F., Maclean, R., and Matthews, R. (1984). Sources of individual differences in reading acquisition. *Journal of Educational Psychology*, 76, 1309-1324.
- Shepherd, D. (1987). *Learner English*. Cambridge: Cambridge University Press.
- Snow, C.E., Griffin, P., and Burns, M.S. (Eds.) (2005). *Knowledge to Support the Teaching of Reading: Preparing Teachers for a Changing World*. San Francisco. Jossey-Bass.
- Spalding, R. & W. (1957, 1991). *The Writing Road to Reading*. New York. William Morrow.
- Stanovich, C. (1991) *Metalinguistic Awareness and Beginning Literacy: conceptualizing what it means to read and write*. New York. Oxford University Press.
- Tangel, D. and Blachman, B. (1995). Effect of phoneme awareness instruction on the invented spelling of first-grade children: A one-year follow-up. *Journal of Reading Behavior*, 27, 153-185.
- Templeton, S., and Bear, D. (Eds.) *Development of orthographic knowledge and the foundations of literacy*. Hillsdale, N.J. Lawrence Erlbaum Associates.
- Uhry, J.K. and Shepherd, M.J. (1993). Segmentation, and spelling instruction as part of a first grade reading program: Effects on several measures of reading. *Reading research Quarterly*, 28, 219-233.
- Venezky, R.L. (2004). In search of the perfect orthography. *Written Language & Literacy*, 7(2), 139-163.

Wilson, A. (2001). *Language Knowledge for Primary Teachers*. London. David Fulton Publishers.

Wood, J. (2001). Can Software Support Children's Vocabulary Development. *Language Learning & Technology*, 15(1), 166-201

Yopp, Hallie Kay. 1992. "Developing phonemic awareness in young children." *The Reading Teacher*.

About the Author

Robert J Paech was the founding principal of King's Christian High School on the Gold Coast in Australia. During the 10 years under his leadership the school grew from 330 students to over 1,300 making it one of the largest private schools in the state of Queensland.

Robert graduated from the University of Queensland in science as the top student in his department and later was awarded a scholarship to become a research scholar within the university. His work led to a research masters in science.



As a result of his work within the Christian school movement, Robert was awarded a doctorate in Education. King's quickly expanded its overseas students' enrolment to approximately 100 students, chiefly from Asia. His involvement with ESL students and the difficulties they faced learning English provided the incentive to develop a program to help these students. The resultant phonics program is the culmination of four years of research. Robert has brought to this program a distinctly scientific mindset which is clearly seen in the methodical approach used in its development.