The Vowel Processing Skills of ESL Learners Related to their English Spelling Difficulties: A Psycholinguistic Approach

Belinda Seeff and Heila Jordaan

Department of Speech Pathology and Audiology,
University of the Witwatersrand, Johannesburg

ABSTRACT

The purpose of this study was to explore the input speech processing difficulties of English Second Language (ESL) learners who experience English spelling difficulties in English First Language (EFL) educational environments. Twenty two adolescent ESL learners participated in this study. A spelling task was designed to assess the subjects' spelling abilities related to words containing four vowel contrasts of native (L1) and non-native (L2) vowels. A psycholinguistic framework was adhered to when assessing the subjects' auditory discrimination and phonological representations at the input level of speech processing. The spelling abilities of the ESL learners were found to be strongly correlated with their input processing of L1 and L2 vowels. An increased length of exposure was found to have a positive effect on their spelling and input processing skills. Subjects who had been exposed to EFL environments for more than two years were able to use their semantic knowledge of English to assist their auditory discrimination of real-word minimal pairs containing L1 and L2 vowels. Implications for the management of ESL English spelling difficulties are discussed.

KEY WORDS: English Second Language (ESL); spelling; input processing; psycholinguistic

INTRODUCTION

This study focused on the speech processing skills of English Second Language (ESL) learners, as an explanation for their difficulties experienced with the spelling of English vowels. The context in which the study took place is South Africa - a multilingual country where at least twenty four languages and numerous dialects are spoken (Schuring, 1993). 'Here, as in other multilingual societies, language exerts a powerful influence on the content, instructional methods and outcomes of schooling' (Lemmer, 1996, p.324).

The issue of access to English through education has become a major priority amongst most South Africans (Lemmer, 1996). The dismantling of Apartheid brought with it the desegregation of state education in 1991, and an ever-growing number of Black students with English as an additional language (referred to here as ESL learners) have entered the 'new' integrated education system at different levels. In this context, the extensive exposure to English First Language (EFL) speakers brings with it the enormous challenge of learning academically through the medium of English together with EFL pupils. ESL learners are forced to deal with the disparity between their English proficiency and the proficiency required of them to master new academic content through the medium of English (Van Rooyen, 1990).

One area in which ESL pupils experience particular difficulty appears to be the spelling of English vowels. Problems arise in standard English spelling when ESL learners' errors result in semantic confusion. For example, the word 'burnt', spelled 'bent' by a second language speaker, expresses a completely different meaning. This difficulty is exacerbated by the fact that teachers in multilingual schools may lack experience in this area and are not prepared for teaching literacy skills across the curriculum to linguistically diverse pupils (Lemmer, 1996). Together with the dearth of research in this area, teachers and other professionals are left uncertain as how best to assist ESL learners with standard English spelling. In such cases it is not uncommon for ESL learners to be labelled as incompetent and their cognitive potential questioned. As this situation appears to be a microcosm of educational experiences within multilingual classrooms the world over, it is crucial that further investigation into the spelling problems of ESL learners, and their possible underlying causes, be undertaken. This, in turn, will facilitate the development of more appropriate and effective intervention strategies..

Spelling Models

The application of traditional spelling models to the ESL population requires investigation. Numerous models (Frith, 1980; Patterson & Shewell, 1987; Snowling, 1985) describe the spelling process as one in which the child may use either a phonetic or semantic route when writing down a familiar or unfamiliar word. An error analysis of spelling in terms of these two routes allows for the identification of the point or points of breakdown which may explain an overt spelling difficulty.

As these models were specifically designed for application to first language speakers, they seem to disregard or take for granted, specific stages within the spelling process that may cause particular difficulty for second

language learners. One such stage is auditory analysis or discrimination. Models such as those of Frith (1980) and Snowling (1985) seem to imply that apart from a physical anomaly such as a hearing loss, the stage of auditory analysis is intact. In addition, other models (Patterson & Shewell, 1987) may assume that the subjects have some sort of phonological representation of all the phonemes they are required to spell. Emphasis seems to be placed on analysing how the internally represented phonemes are translated into grapheme representations, or how automatic spelling instructions are applied to them.

These 'neglected' stages of spelling within traditional spelling models form part of the *speech processing* system, a system upon which the development of spelling is also dependent (Stackhouse & Wells, 1997). Therefore, the investigation of ESL learners' *speech processing* could provide valuable clues as to the underlying difficulties associated with their overt spelling performance.

Speech Processing and ESL Learners

While a number of psycholinguistic models of speech processing exist, the model proposed by Stackhouse and Wells (1993; 1997) was adopted in this study as it delineates the specific stages in the speech processing chain that may account for the spelling difficulties experienced by ESL learners. Although this framework has been applied to various groups of children (Forth, Stackhouse, Vance, Nicholson, & Cook, 1996; Onslow, 1995 in Stackhouse & Wells, 1997), its application to the second language population has, as yet, not been published.

The Stackhouse and Wells model (1997) outlines the speech processing system in terms of *input* and *output* processing. Input processing encompasses auditory perception (discrimination), as well as the establishment of lexical representations. An interpretation of this model suggests that in the absence of retrieval, motor planning or execution difficulties at the output level, the foreign accents of second language speakers may be attributed to their processing at the input level. The present study thus focused on the relevant components of input processing i.e. auditory discrimination and phonological representation. In order to assess the specific difficulties they may experience, the relevant components of the model were adapted and are represented in Figure 1.

Lexical representations contain stored information about words relating to meaning (semantic knowledge) and sound structure (phonological representation). The development of phonological representations commences at an extremely early age. Research conducted on vowels in infant babbling has revealed that language specific developments are evident as early as ten months of age (De Boysson-Bardies, Sagart & Durand, 1989). Primary development of the first language (L1) phonological system continues until approximately eight years of age (Sander, 1972). During this period, a child raised in an African language environment for example, will acquire a vowel repertoire of between five to seven vowels (Finlayson, Jones, Podile & Snyman, 1991; Kock & Moeketsi, 1991; Poulos, 1990; Snyman, 1993; Taljaard & Snyman, 1991). A child raised in a South African EFL environment, on the other hand, will acquire a vowel repertoire of approximately nineteen vowels:- twelve monophthongs, five closing diphthongs and two centering diphthongs (Lass, 1990).

Once the primary development of the L1 sound system has taken place during the critical or sensitive period, it becomes increasingly difficult for new phonemes to be accommodated into the system. The proposed age range marking the end of this period, ranges from as early as six years of age (Long, 1990) to ten years of age (Lenneberg, 1967) and even to puberty, where Flege (1981) sees the close of this critical period to result from some permanent reorganisation of the central nervous system. Lenneberg (1967) predicts that foreign accents emerge from the age of eleven to fourteen years.

Integrally related to the issue of phonological acquisition is the development of the ability to discriminate between sounds. As speech processing begins with this stage of perceptual analysis at the input level, this point in the speech processing chain could also be a potential area of difficulty for ESL learners. Cross-linguistic comparisons reveal that infants begin life with broad-based phonetic discrimination abilities and are able to discriminate the 'universal' set of possible phonetic contrasts (Kent, 1992; Werker & Polka, 1993). However, as the child matures the ability to perceive the differences between speech sounds not within the L1 repertoire decreases. This may be seen at a very early age as Best & McRoberts (1989) and Werker & Lalonde (1988) found clear evidence of language specific influences on speech perception by ten to twelve months of age. A limited number of studies examining the perception of non-native contrasts by pre-school children have also shown clear advantages in the perception of L1 over non-native (L2) contrasts (Burhnam, 1986; Oller & Eilers, 1983).

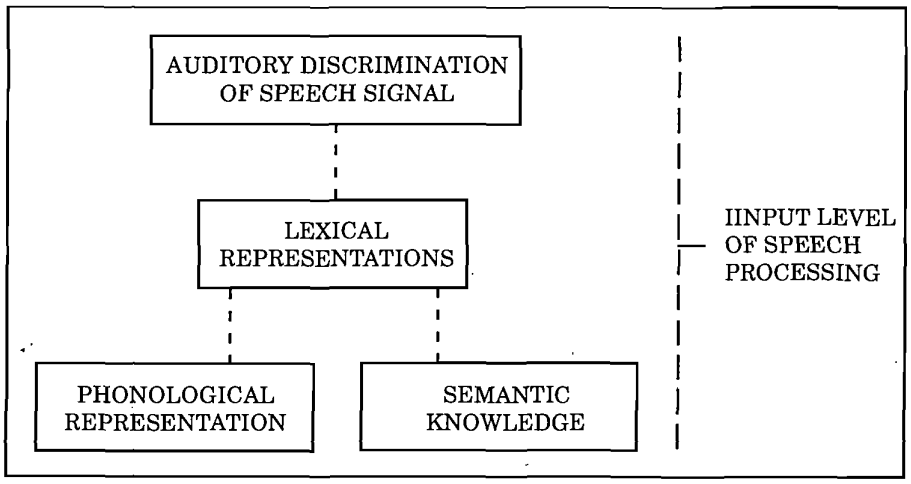

FIGURE 1. An adaptation of the input level of speech processing (from Stackhouse & Wells, 1993 & 1997)

Cross-Linguistic Interference

The theories of first language and second language auditory discrimination and phonological development are particularly important for ESL learners who enter English medium schools beyond grade 5/6, after the close

of the critical period. Until then they are exposed primarily to second language models and English First Language phonological representations may not have been established. The vast majority of ESL learners in South Africa are in this situation. Most schools, despite using English as the medium of instruction, are comprised of African first language learners and teachers, whose accents do not reflect native speaker contrasts. Therefore, for these ESL learners, the acquisition of the English sound system will be particularly difficult as interference from the first language affects the acquisition of the second language sound system more than any of the other linguistic systems (Kranke & Christison, 1983).

As far as auditory discrimination is concerned, L1 interference studies have shown that older second language learners tend to perceive the segmentals and supra-segmentals of their second and subsequent languages in terms of the categories of the first language (Broselow, Hurtig, & Ringen, 1982, as cited in Schneiderman, Bourdages & Champagne, 1988; Leather & James, 1991; Strange & Jenkins, 1978). It follows that adolescent ESL learners who are first language Zulu speakers for example, will tend to perceive the nineteen South African English vowels by making reference to their L1 phonological repertoire containing only five vowels. The effect of this disparity between English and African vowel repertoires is that certain sounds which indicate distinct meanings in English are not as clear to speakers of African languages (Stevenson, 1993 in Lemmer, 1996).

The implications of the above factors have thus far only been documented in terms of the speech production or output of adults who have English as an additional language. For example, Lanham and Traill (1965 in Lanham, 1982, p.342) have described the 'variables in pronunciation' of South African Black English. They include:

- no long-short contrasts in vowel nuclei, e.g. the short vowel /I/ in the word 'tick' is lengthened to /i:/ to become 'teak';
- no schwa quality vocoids, e.g. the vowel /3:/ in the word 'bird' is pronounced /ɛ/ to become 'bed';
- no /æ/:/ɛ/ opposition, e.g. the vowel /æ/ in the word 'mat' is pronounced /ɛ/ to become 'met'.

In addition, Wells (1982) has described the lack of /a:/:/ʌ/ opposition, e.g. the vowel /a:/ in the word 'march' is pronounced /ʌ/ to become 'much'.

It is the input processing of these specific vowel contrasts that was focused upon in this study.

Exposure to English First Language Models

A further concern of this study related to whether improvement in speech processing would occur with increased exposure to first language models. A review of the literature reveals that studies have once again focused predominantly on the effect of exposure in relation to the output or accent of second language adults. For example, a study conducted by Flege (1980), investigating the influence of Arabic on English stops produced by Saudi Arabians, found some evidence of phonetic learning as more experienced Saudi speakers of English approximated native English pronunciation more closely than newly arrived Saudis. Other studies support this notion that the pronunciation of a foreign language by both adolescents and adults will improve with additional exposure (Asher & Garcia, 1969; Snow & Hoefnagel-Hohle, 1977). However, the extent to which the L2 pronounciation ordinarily improves seems to be limited (Selinker, 1972).

METHOD

AIMS

The broad aim of this study was to examine the English spelling abilities of adolescent ESL learners in relation to their input processing of South African English vowels. The following specific aims were addressed:

- To determine whether there is a relationship between ESL learners' abilities to spell words containing South African English vowels and:
  - their ability to discriminate between these vowels in real and non-word contexts. The inclusion of non-words allows for the impact of semantic knowledge on vowel discrimination to be investigated.
  - the phonological representations of these vowels in their lexicons.
- To determine whether the length of exposure to EFL models has an effect on ESL learners' spelling, auditory discrimination or phonological representations of words containing South African English vowels.

RESEARCH DESIGN

A single sample correlational design with repeated measures was employed in this study (Leedy, 1985).

SUBJECTS

Twenty two ESL learners participated in this study. The following subject variables were considered:

- *Language Background:* Subjects had all acquired English after the age of three years. This age criterion was used in order to distinguish between simultaneous and second language acquisition (McLaughlin, 1984). A demographic breakdown of the South African population reflects the urban settlement of large groups of people who come from a variety of cultural and first language backgrounds. Children who spoke primarily one or more of the South African black languages in their formative years (McLaughlin, 1984) were included as subjects. This did not pose a methodological problem as the phonological variability between the South African black languages is extremely small as they all have vowel repertoires of between five to seven vowels (Finlayson et al., 1991; Kock & Moeketsi, 1991; Poulos, 1990; Snyman, 1993; Taljaard & Snyman, 1991). Nine subjects spoke Northern or Southern Sotho as their first language, and seven subjects spoke Setswana. Four subjects had Zulu as their first language, while two subjects spoke Xhosa.
- *Age:* Subjects' ages ranged from 12.3 to 15.8 years of age, with a mean age of 13.7 years. This age group was selected for the following reasons:
  - Within any education curriculum students have been exposed to all the English spelling rules by this age

(Ervin, 1995). Although points were not deducted for words spelled incorrectly as a result of inaccurate application of spelling rules, familiarity with the spelling rules reduces the number of demands placed on the subjects and hence the variables that could possibly affect their performance.
- By the age of twelve years, children have acquired adequate cognition and metalinguistic awareness to be able to understand the task instructions in this study (Gaylard, 1996).

- *Schooling:* All subjects were in Grade Eight for the first time, without having repeated a class.
- *Exposure to EFL Models:* Subjects were required to have as little exposure as possible to EFL models during the sensitive period for phonological acquisition and were excluded if they had been exposed to EFL models in an educational setting before eight years of age (Sanders, 1972). It is acknowledged that the exact amount of exposure to EFL models is difficult to determine. However, as children spend a large portion of their day at school, their educational environment would have contributed substantially to the amount of exposure they may have had to EFL models. Subjects were divided into two groups:- those exposed to EFL models in an educational setting for less than six months (Grp1), and those exposed to EFL models in an educational setting for at least twenty four months (Grp2). Questions included in the case history questionnaire (Refer to Appendix A) revealed that subjects were exposed to ESL models in their home environments and appeared to have approximately the same amount of exposure to EFL models, mainly through radio and television.
- *Hearing Status:* As the peripheral hearing status has an effect on the processing of sounds (Dodd & McCormack, 1995) all subjects were required to have hearing within normal limits at the time of testing. A hearing screening of all potential candidates was performed by an Audiologist prior to the commencement of the research. No subjects had a history of previous hearing loss, as determined by questions included in the case history questionnaire.
- *Intelligence:* Subjects were required to be of at least average intelligence. Only subjects who had been selected to participate in an academic placement project were included in this study. The Rand Afrikaans University (RAU) project, sponsored by *PERSKOR* (Press Corporation), identifies black pupils with good academic potential in traditional township schools and places them in high school environments that are considered to facilitate the development of their intellectual potential. As the true potential of these pupils is often difficult to determine, a comment on each subject's academic potential was also made by their respective teacher.
- *Communication Skills:* Subjects were excluded from participating in this study if, according to case history information, they had experienced any communication difficulties in their first language, including speech and language difficulties, and severe attention deficits.

The subjects' characteristics are summarised in Table 1.

PROCEDURE

Subjects were assessed individually in a quiet area of their school for approximately 25 minutes. All stimuli were pre-recorded onto a digital audio tape (later dubbed onto a chrome cassette tape) by a first language speaker with a South African English accent. Only one voice was used in order to prevent variation in the acoustic quality of vowels (spectral characteristics and formant frequencies) which may occur when generated by different speakers (Schoup & Pfeifer, 1976). In overcoming the problem of artificiality occurring when words are produced in isolation (Schoup & Pfeifer, 1976), carrier phrases were used where applicable. Standardisation in the presentation of these carrier phrases was achieved in relation to pitch and stress factors.

TASKS

Four tasks were constructed for the purposes of this study. The first was a spelling task, while the remaining three tasks were adaptations of the assessment procedures proposed by Stackhouse and Wells (1993) to assess the input level of speech processing. The items of each task were devised by the researcher for the specific purposes of this study.

Four South African English vowels and their corresponding non-native pronounciations by ESL speakers, were investigated in this study. These were:- /I/ and /i:/; /ɑ:/ and /ʌ/; /ɛ/ and /3:/; /æ/ and /ɛ/. These specific vowel contrast pairs were chosen based on their picturability and the availability of minimal pair words, as well as the fact that the investigation of four vowel contrasts was considered to be adequate in achieving the aims of this study. The vowel

TABLE 1: Description of subjects

Schooling	Age	Exposure to EFL models	First language	Hearing	Previous Communication Difficulties
First time in Grade Eight	***Range:*** 12.3-15.8yrs ***Mean***: 13.7yrs	***< 6mnths*** : 11 subjects ***≥24mnths*** : 11 subjects	***Sotho***: 9 subjects ***Setswana***: 7 subjects ***Zulu***: 4 subjects ***Xhosa***: 2 subjects	Within normal limits	No problems reported

* n=22

contrast pairs were incorporated into single syllable words which were used as stimuli in all four tasks. As vowel context is known to affect its acoustic characteristics (Schoup & Pfeifer, 1976), the phonetic contexts in which the vowels were placed were varied i.e. between both voiced and voiceless consonants and in VC contexts. To ensure that the subjects would be familiar with the meanings of the stimuli, all the task stimuli were single syllable words with a semantic complexity not exceeding a Grade Three level (Schonell, 1992).

A summary of the four tasks is presented in Table 2.

- *Spelling Task* (Referred to as Task S)

The Spelling Task consisted of forty words presented in random order (Refer to Appendix B for word stimuli). Five minimal pairs reflecting each of the four vowel contrasts were included e.g. bad/bed; march/much; bent/burnt; it/eat. Subjects were required to write down each of the forty spelling words in response to the carrier utterance 'Spell the word ... after this' which was used throughout the task. One point was awarded for each correctly spelled word. Incorrectly spelled words were analysed to assess whether the incorrect spelling was the result of inaccurate or non-application of a spelling rule, (in which case the point was still awarded), or the inability to discriminate between the vowels (in which case the point was not awarded).

- *Auditory discrimination of real-words* (Referred to as Task T).

The purpose of this test is to assess vowel discrimination when the semantic representation of the word can also be accessed. This is in contrast to non-word discrimination where there is no semantic representation. By comparing the scores obtained on this task to those obtained on the Non-word Discrimination Task, it would be possible to determine whether the subjects' discrimination was aided by the semantic knowledge of real-words. This task

TABLE 2: Description of tasks

	Vowel Contrast	**Spelling (Task S)**	**Real-word Discrimination (Task T)**	**Non-word Discrimination (Task N)**	**Phonological Representation (Task R)**
Content	/ʌ/ & /a:/	5 minimal pairs ie.10 words (S1)	5 minimal pairs ie. 10 words (T1)	5 minimal pairs ie. 10 words (N1)	5 minimal pairs ie.10 picture cards (R1)
	/ɛ/ & /æ/	5 minimal pairs ie. 10 words (S2)	5 minimal pairs ie. 10 words (T2)	5 minimal pairs ie. 10 words (N2)	5 minimal pairs ie.10 picture cards (R2)
	/ɛ/ & /3:/	5 minimal pairs ie. 10 words (S3)	5 minimal pairs ie. 10 words (T3)	5 minimal pairs ie. 10 words (N3)	5 minimal pairs ie.10 picture cards (R3)
	/i:/ & /I/	5 minimal pairs ie.10 words (S4)	5 minimal pairs ie. 10 words (T4)	5 minimal pairs ie. 10 words (N4)	5 minimal pairs ie.10 picture cards (R4)
Foils	none	5 minimal pairs	5 minimal pairs: L1 vowels eg. peak/peck	5 minimal pairs: L1 vowels eg. luch/lech	5 minimal pairs: L1 vowels ie. 10 picture cards
			10 same word pairs: non L1 vowels eg. task/task	10 same word pairs: non L1 vowels eg. pap/pap	On each card: a third picture with same initial phoneme as minimal pair words eg. house with hut/heart
			5 same word pairs: L1 vowels eg. neck/neck	5 same word pairs: L1 vowels eg. wuk/wuk	
Total		40 stimulus words	40 stimulus pairs	40 stimulus pairs	50 stimulus picture cards
Response required		40 written words	40 verbal responses 'same / different'	40 verbal responses 'same / different'	50 pointing gestures
Scoring		* ***For each subject:*** a. /10 for each category (S1-4) b. /40 for total (sumS)	* ***For each subject:*** a. /5 or each category (T1-T4) b. /20 for total (sum T) * ***Foils*** a. /20 total	* ***For each subject*** a. /5 for each category (N1-N4) b. /20 for total (sumN) * ***Foils*** a. /20 total	* ***For each subject:*** a. /5 for each category (R1-R4) b. /20 for total (sumR) * ***Foils*** a. /10 total

consisted of forty real-word stimuli pairs (Refer to Appendix B for stimuli word pairs). The subjects were required to judge the forty real-word pairs presented in a random order through earphones, as being the 'same' or 'different'. The researcher recorded the subjects' verbal responses by marking /D/ (different) or /S/ (same) on the answer sheet. One mark was awarded for every correct response to a stimulus word pair. The subjects obtained a score out of 5 for each vowel contrast category, and a total real-word discrimination score out of 20. One point was also awarded for a correct response to each of the foil items yielding a total out of 20.

- *Auditory discrimination of non-words* (Referred to as Task N)

The purpose of this task was to assess whether the subjects could discriminate between vowel contrasts in non-word contexts, where no semantic representations exist. This task consisted of forty single syllable, non-word stimuli pairs. (Refer to Appendix B for non-word stimuli). The stimuli were constructed to adhere to the phonetic rules of English. This task construction, administration and scoring was identical to the Real-word Discrimination Task apart from the use of non-word stimuli.

- *Phonological Representations* (Referred to as Task R)

The purpose of this task was to determine the status of the subjects' phonological representations of words containing the four vowel contrasts. The task consisted of 50 uniform, computer generated black and white pictures depicting the stimuli words. (Refer to Appendix B for the stimuli word pictures). Cards were presented in random order and subjects were required to point to the picture depicting the word heard in response to the pre-recorded stimulus sentence 'Show me .... after this'. One point was awarded when the pictures depicting **both** the words included in each minimal pair were correctly identified i.e. one point was awarded for the correct identification of both 'bed' and 'bird'.

DATA ANALYSIS

In order to determine whether there is a relationship between the ESL learners' spelling of South African English vowels and their input processing of words containing these vowels, a *Spearman rank order correlation* was performed on the sums of scores for each task (sumS; sumT; sumN; sumR) (McCall, 1986). This procedure was performed for the whole subject group (n=22), as well as for the two exposure groups:- Grp1 (n=11) and Grp2 (n=11).

In order to address the question relating to whether ESL learners' semantic knowledge plays a significant role in their auditory discrimination of native and non-native vowel contrasts, a *Sign test* was carried out on the scores obtained for the test and foil items on the Real and Non-word Discrimination Tasks (Task T and Task N). This test was performed for the whole subject group (n=22) as well as for both exposure groups: Grp1 (n=11) and Grp2 (n=11).

In order to establish whether increased exposure to EFL models has an effect on the subjects' spelling, auditory discrimination and phonological representation of English vowels, a *Mann-Whitney two-sample test* was performed on the sums of scores obtained by the exposure groups on each task and each vowel contrast category (sumS; sumT; sumN; sumR).

RESULTS

GENERAL TASK ANALYSIS

The mean scores obtained on all four tasks by the whole subject group as well as Grp1 and Grp2 are presented in Table 3.

The results in Table 3 show that all the ESL learners, regardless of exposure to first language models, experienced difficulties on all four tasks. As a group, the ESL learners obtained a low average of 41% on the Spelling Task, with subjects in Grp1 obtaining an extremely low mean score of 30%[1]. Subjects in Grp2 obtained a relatively higher, but still low average percentage of 52%. These confirm the impression of teachers that ESL learners experience significant difficulties with the spelling of English vowels that are not within their L1 system. Further, the fact that all the subjects experienced difficulties on all three of the input processing tasks suggests that their spelling problems cannot be attributed to one particular level of breakdown, but rather they are associated with breakdowns in both auditory discrimination and representation at the level of input processing.

The subjects obtained the lowest mean percentage scores on the test items of the Phonological Representation Task (Whole subject Group - 23%; Grp1- 13%; Grp2-33%). It is not possible for these scores to be higher than those obtained

TABLE 3: Mean scores obtained on each task

TASK	GROUP MEANS					
	Exposure Grp 1		Exposure Grp 2		Whole Group	
	Test items	Foil items	Test items	Foil items	Test items	Foil items
Spelling (Task S)	30%		52%		41%	
Real-word Discrimination (Task T)	31%	93%	67%	85%	49%	88%
Non-word Discrimination (Task N)	25%	57%	45%	54%	35%	56%
Phonological Representation (Task R)	13%	69%	33%	85%	23%	77%

on the auditory discrimination tasks, as auditory discrimination precedes representation on the processing chain (Fig.1). However, as the scores obtained on this task (Task R) were substantially lower than those obtained on the discrimination tasks, they reflect the distinct lack of formation of clear, stable phonological representations for L2 sounds.

In terms of discrimination abilities, all the subjects experienced the least difficulty when discriminating vowels in real-word contexts. It is proposed that the presence of a semantic component inherent in this task, in contrast to non-words, accounts for this finding. Furthermore, the ESL learners experienced little difficulty on the foil items of this task, suggesting the absence of a general discrimination problem. Any discrimination problems on the Real-word Discrimination Task can thus be attributed to difficulties experienced with L2 vowels.

A more detailed analysis of the scores obtained on the foil items in the Non-word Discrimination Task is provided in Table 4 because these scores appeared to be relatively low in comparison to the other foil item scores for real-word discrimination. The scores may be interpreted in a number of ways. Firstly, all subjects experienced some difficulty on the foil items in the Non-word Discrimination Task. Seen together with the poor scores obtained on the non-word test items, there is some indication that a general breakdown in discrimination occurs due to the absence of a semantic component in non-word stimuli. This notion will be explored further under the comparison between real and non-word discrimination. Secondly, it is possible that the poorer scores obtained on the L1 and L2 same word pair items by Grp2, are the result of their significantly better auditory discrimination skills which may have facilitated the detection of slight differences in stimulus recording. Thirdly, the discrimination scores obtained on the non-word foil items were consistently higher than the scores obtained on the corresponding test items. This suggests that the presence of vowels not within the subjects' L1 repertoire makes discrimination more difficult than when L1 vowels are included.

Correlations between Spelling and Input Processing Tasks

Table 5 shows the Spearman rank order correlation results obtained for the whole subject group.

The high Spearman's rank order correlation values (rs) reflect a significant relationship between the ESL learners' spelling abilities (SumS) and their real and non-word discrimination abilities (SumR and SumN), as well as their phonological representations (SumT). The strongest correlation (rs=0.8; p<0.01) was found between the subjects' spelling (SumS) and non-word discrimination abilities (SumsN). This implies that the non-word discrimination skills of the ESL learners are the best predictors of their spelling difficulties in words containing vowel contrasts not found in their L1 repertoire. The subjects' abilities to discriminate between real- word minimal pairs (SumT) (rs=0.68; p<0.01) and to identify words containing these vowel contrasts (SumR)(rs=0.62; p<0.01) were also found to be strongly correlated with their English spelling difficulties.[1]

Since the numbers in exposure Grp1 and Grp2 are statistically small (n=11), it would be unusual to find significant correlations as the tabled value required to establish significance is higher than 0.685 (McCall, 1986). Therefore, it is not surprising that when considered separately, the only significant correlations found were between the spelling (SumS) and phonological representation (SumR) abilities (rs=0.73; p<0.01) of Grp1, and the spelling (SumS) and non-word discrimination (SumN) abilities of Grp2 (rs=0.67; p<0.05).

TABLE 4: Non-word Discrimination Task - foil item results

FOILS	GROUP MEANS		
	Grp1 (n=11)	Grp 2 (n=11)	Whole Group (n=22)
5 L1 vowel minimal pairs	33%	47%	36%
10 L2 vowel same word pairs	70%	58%	64%
5 L1 vowel same word pairs	69%	56%	63%
OVERALL MEANS	57%	54%	56%

TABLE 5: Spearman rank order correlations for the whole subject group

SumR				
SumN	0.6 **			
SumT	0.48	0.82 **		
SumS	0.62 **	0.8 **	0.68 **	
	SumR	**SumN**	**SumT**	**SumS**

** = p< 0.01

TABLE 6: Sign Test results

	FOIL ITEMS: T & N	TEST ITEMS: T & N
Whole group (n=22)	p = 0.001 **	p = 0.032 *
Grp1 (n=11)	p = 0.0004 **	p = 0.5
Grp2 (n=11)	p = 0.0004 **	p = 0.001 **

* Statistically significant difference with p< 0.05
** Statistically significant difference with p< 0.01

1 For the purposes of this study, the terms 'good', 'low', 'very low' and 'extremely low' relate to the following classification: good → ≥ 60%; low → ≤ 60%; very low/poor → ≤ 50%; extremely low/poor → ≤ 40%

2 It is recognised that significant correlations were found between sum T, sum N and sum R. However, as the primary aim of this study was to determine the correlations between Task S and the three processing tasks – T, N and R, other significant correlations are not elaborated upon.

The Role of Semantics

Table 6 shows the results of the Sign test performed on the Task T and Task N scores.

Significant differences were found for the whole subject group, as well as for Grp1 and Grp2, on both the test and foil item scores for real (Task T) and non-words (Task N). The subjects thus performed significantly better in the Real-word Discrimination Task where both phonological and semantic representations contribute to the storing of words in the lexicon. It can thus be concluded that the inherent semantic value attached to real-words assists ESL learners in their discrimination of both L1 and L2 vowel contrasts. The non-significant result of the Sign test ($p=0.5$) on the test items for Grp1 suggests that these subjects, with limited exposure to EFL models, did not have sufficient semantic knowledge of English to aid their discrimination between minimal pairs containing L2 vowels.

Table 7 represents a summary of the above findings, reflecting a hierarchy of discrimination ease. Auditory discrimination is easiest when real-words containing L1 vowels are presented. Auditory discrimination becomes most difficult when ESL learners are required to discriminate between non-words containing L2 vowels.

Exposure to EFL Models

Table 8 shows the significant differences that were found between Grp1 and Grp2 on all tasks.

A Mann-Whitney two-sample test was performed on the overall mean scores obtained by exposure Grp1 and Grp2 on each task. As shown in Table 8, the means for the two exposure groups were found to differ significantly on all four tasks, with Grp2 consistently obtaining a higher mean score. These findings indicate that the increased length of exposure to EFL models by subjects in Grp2, had a positive effect on their spelling, discrimination and phonological representation abilities.

When analysing the individual vowel contrast categories, the subjects in Grp2 obtained significantly better scores for three out of the four vowel contrast categories in the Spelling, Real-word and Non-word Discrimination Tasks. However, they obtained a significantly higher score for only one vowel contrast category (/ʌ/ & /a:/) in the Phonological Representation Task ($p<0.05$). Furthermore, subjects in Grp2 obtained significantly higher scores on the Spelling, Real-word Discrimination and Non-word Discrimination Tasks ($p<0.01$), while a slightly lower p value of $p<0.05$ was obtained for the overall significant difference on Task R.

These findings suggest that increased exposure to EFL models has a significant effect on the spelling and auditory discrimination skills of the adolescent ESL learners, while the effect on the formation of phonological representations is less significant. This provides support for the notion of a critical period for phonological acquisition, after which the formation of phonological representations of new sounds, especially similar sounds, is extremely difficult (Flege, 1981).

DISCUSSION

The results of this study have implications in terms for our understanding of, and approach to the English spelling difficulties experienced by ESL learners.

This study found the English spelling abilities of the ESL subjects to be strongly correlated with their input processing abilities. The centrality of speech processing to the development of spelling is thus emphasised and the

TABLE 7: Continuum of discrimination difficulty

L1 Vowels + Semantic Knowledge	Easiest to discriminate
L1 Vowels - No Semantic Knowledge	
L2 Vowels + Semantic Knowledge	
L2 Vowels - No Semantic Knowledge ▼	Most difficult to discriminate

TABLE 8: Significant differences established between exposure Grp1 and Grp2

VOWEL PAIR CATEGORY	Spelling (Task S)	Real-word discrimination (Task T)	Non-word disrimination (Task N)	Phonological Representation (Task R)
/ʌ/ & /a:/	**		**	*
/ɛ/ & /æ/	**	**	*	
/ɛ/ & /3:/		**	**	
/i:/ & /ɪ/	**	*		
TOTALS	**	**	**	*

* Statistically significant difference between Grp1 and Grp2 with $p<0.05$.
** Statistically significant difference between Grp1 and Grp2 with $p<0.01$.

importance of targeting these underlying skills in the assessment, remediation and teaching of spelling to second language learners, is highlighted.

In terms of assessment, an initial assessment of ESL learners' input processing skills would ensure a more relevant and in-depth analysis of their second language spelling abilities. The use of the type of task battery, such as the one designed in this study, allows for a performance profile of each ESL learner to be derived, outlining the specific speech processing strengths and weaknesses contributing to spelling performance. Where severe difficulties are identified, an individual intervention programme may be designed.

As this study revealed that *all* the ESL learners experienced speech processing difficulties to some degree, it is possible that a group approach to intervention may be adopted in the multilingual classroom. This may be seen as an innovative strategy in dealing with the acute lack of specialised resources available in multilingual classrooms the world over. Implementation requires no additional equipment or costly materials that may be difficult to obtain. In addition, as the skills of all ESL learners improve, the need for specialised intervention from various professionals may be reduced.

It is proposed that the input speech processing skills of second language learners be focused on routinely. Although input processing exercises may take many forms, the main objective should remain unchanged i.e. to develop meta-linguistic awareness. Traditional phonologically based therapeutic principles should be followed, whereby second language learners should not be expected to ignore their L1 phonological system, but rather be encouraged to become sensitive to the *differences* that exist between the sound system of English and their first language.

As the speech processing skills identified do not require the subjects to be literate, this study has implications for the pre-school population. These include the use of the assessment battery as a screening tool for the prediction of future spelling difficulties, and the development of phoneme awareness skills as a prerequisite to learning to spell. This would be followed through at primary school where the increased awareness of the differences between sound systems would facilitate a more conscious and successful approach to learning spelling.

The findings of this study also provide impetus for the adoption of an alternative approach to teaching spelling to second language learners. Issues to be considered include the following:

- the significant contribution of semantics to speech processing and hence spelling performance. The semantic acquisition of second language learners should therefore be viewed as an integral component of the development of their spelling skills. As this study has shown, ESL learners generally have a poor L2 semantic knowledge when entering an EFL educational environment and are therefore unable to draw on this knowledge to assist their auditory discrimination and hence spelling performance. It is therefore crucial that special attention should be paid to their acquisition of English semantics within semantically rich environments where they are continually exposed to new vocabulary within meaningful contexts. In line with this, it is suggested that teachers use semantics as a support when teaching new spelling words i.e. all words should be presented to second language learners within semantic contexts, as opposed to being taught in isolation, a method used extensively in South African schools.
- the particularly strong correlations that were found between the adolescent ESL learners' spelling and discrimination abilities. The teaching of English spelling can now extend far beyond the handing out of spelling lists, which have traditionally included semantically and phonologically unrelated words targeting the knowledge of a large number of spelling rules. A shift of emphasis is proposed whereby focus is taken off individual sounds in word lists, to teaching spelling within a contrasting phoneme or minimal pair framework. Here, second language learners would be encouraged to discriminate between sounds whilst being made aware of the semantic changes that occur as a result of phoneme variation. For example, by changing the vowel in 'sand' to /ɛ/ the word becomes 'send' and the meaning is altered. While such an approach has been investigated by Van Borsel and Demeulenaere (1998) with specific application to Dutch language-impaired pupils experiencing spelling difficulties, further research investigating the application of this approach to other second language learners with various L1 backgrounds, is recommended.

CONCLUSION

This study has focused on the input speech processing in relation to ESL learners. Further investigation of the output level and the relationship of these two levels of speech processing is recommended in order to complete a comprehensive profile of the speech processing skills of this population group. Finally, these results provide impetus for further research into the relationship between the spelling and processing abilities of other second language learners with differing L1 phonological systems in order to build on the findings and applications of this study.

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Address for offprint requests:

Belinda Seeff
Department of Human Communication Science
University College London
Chandler House
2 Wakefield Street
London WC1N 1PG

APPENDIX A

Case History Questionnaire

Name of Child: Address:
Date of Birth Age:
School:

1. What languages are currently spoken in the home? .....
2. What, in your opinion, was your child's main language/s when s/he was growing up? .....
3.a. Please list the schools that your child has attended up to and including this time, and the age at which s/he entered each school. .....
3.b. Were any of the teachers, in the schools that you have listed, first language speakers of English? .....
4. Is this the first time that your child is in Grade Eight? .....
5. Has your child had any speech, language or hearing problem, or any severe attention difficulties? Please explain:
   Before five years old- .....
   After five years old- .....
6.a. Do you have a TV in your home? .....
6.b. What TV programmes are watched in English, as well as in your child's main language?.....

APPENDIX B

Spelling Task: Word stimuli

/ʌ/ & /a:/	/ɛ/ & /æ/
buck bark	sat set
duck dark	pat pet
tusk taskbad bed	
luck lark land lend	
much march	band bend

/ɛ/ & /3:/	/i:/ & /ɪ/
her hair it eat	
heard head	sick seek
nursed nest	lick leek
burnt bent	chick cheek
burst best	hip heap

Real-word Discrimination Task: Word pair stimuli

* *Test Items*

/ʌ/ & /a:/	/ɛ/ & /æ/
task tusk	tan ten
last lust	pack peck
mast must	pan pen
dark duck	bad bed
lark luck	land lend

/ɛ/ & /3:/	/i:/ & /ɪ/
nursed nest	it eat
burnt bent	hit heat
burst best	bick beak
her hair	pitch peach
turn ten	chick cheek

* *Foil Items*

5 minimal pairs: vowels in L1 repertoire -
peak peck
sea sue
ten tun
beak buck
bed bead

10 same word pairs: vowels not in L1 repertoire -
sick sick
turn turn
mark mark
pink pink
fan fan
sand sand
burnt burnt
task task
mat mat
ramp ramp

5 same word pairs: vowels in L1 repertoire -
cut cut
when when
seat seat
neck neck
rum rum

Non-word Discrimination Task: Word pair stimuli

* *Test Items*

/ʌ/ & /a:/	/ɛ/ & /æ/
larm lum	ras res
barp bup	fam fem
warf wuf	mack meck
sarb sub	yap yep
vark vuk	nash nesh

/i:/ & /ɪ/	/ɛ/ & /3:/
durb deb	lim leam
wurch wech	hif heaf
surm sem	fing feang
furk feck	hig heag
cursh cesh	ris reas

* *Foil Items*

5 minimal pairs: vowels in L1 repertoire -
lech luch
wees wes
leam lum
feep fep
besh bush

10 same word pairs: vowels not in L1 repertoire -

tarp tarp	lurt lurt
nas nas	fam fam
hig hig	tig tig
surb surb	rick rick
pap pap	burk burk

5 same word pairs: vowels in L1 repertoire -
yeap yeap
push push
seb seb
wuck wuck
mef mef

Phonological Representation Task: picture stimuli

* *Test Items*

/ʌ/ & /a:/	/ɛ/ & /æ/
barn bun bird	pan pen pig
cart cut clock	man men moon
heart hut hand	bag beg books
bark buck boy	band bend ball
dark duck dig	sad said snake

/ɛ/ & /3:/	/i:/ & /ɪ/
turn ten tap	chick cheek chair
burnt bent bike	hit heat horse
bird bed boxl	hip heap hat
nursed nest nose	lick leak light
heard head hand	rich reach rat

* *Foil Items*

hut heat house	beak buck bus
when one worm	bun bean box
sheep shoot shop	