First Language Orthographical Influence on Second Language Word Production

第二言語での単語の綴りへの母国語表記の影響

by

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Abstract

Even with the increasing popularity and importance given to EFL education in Japan, Japanese standards are seen to be lagging behind in East Asia. Taking a quantitative approach, this study focuses on the effect of first language (L1) Japanese orthographic influence on second language (L2) English word production in regards to which processing skills are relied on when producing unfamiliar words at a junior high school in Japan. Participants were given a spelling test of unfamiliar words prior to and following explicit spelling instruction in common spelling patterns. The results show that after being given explicit instruction in common L2 spelling patterns, students were able to more accurately produce unfamiliar words. However, contrary to the hypotheses, students had difficulty producing words that had a one-to-many grapheme-phoneme correspondence and a high rate of L1 influence. Explicit instruction did not show any significant effect of limiting L1 influences, despite a higher rate of successful productions.

Key Words: Japanese, cross-linguistic influence, orthography, spelling, EFL

1. Introduction

The term cross-linguistic influence has been applied to situations where the phenomenon of a learner's acquired language exerts an influence in the production and/or acquisition of another language. This is most commonly found in the transfer of a learner's first language (L1) skills to their second and third languages (L2 and L3), however, this can also occur in the opposite direction of transfer. This cross-linguistic influence can result in a positive or a negative transfer. This transfer may affect the rate of progress that a learner acquires another language (Ortega, 2009).

L1 influence is a major area of interest within the field of second language acquisition (SLA). Two key aspects of this area are orthography and phonology, which have been studied by many researchers, especially in regard to the degree of influence they exert on L2 acquisition (Fender, 2008; Hamada & Koda, 2008; Perry, Zeigler & Coltheart, 2002; Saigh & Schmitt, 2012). The aforementioned studies took a particular focus towards how varying degrees of difference between

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learners' L1 orthography and the target language (L2) orthography affected the progress of L2 word acquisition and recognition. Several studies investigating such degrees of difference have provided evidence of a general trend where the greater the difference between two orthographies, the greater the difficulty learners have in obtaining word acquisition and recognition skills (Hamada & Koda, 2011; Muljani, Koda & Moates, 1998; Koda, 1999; Randall, 1997; Wang, Koda & Perfetti, 2003). Two of the main associates contributing to the varying degrees of difference between orthographies are *Orthographic Representation* and *Orthographic Depth*. Whereas orthographic representation refers to "the linguistic unit that each graphic symbol denotes" orthographic depth refers to "the degree of regularity in symbol-sound correspondences" (Hamada & Koda, 2008: p4-5). Whilst it has been shown that orthography has an influence in L2 word recognition, L1 phonology has also been shown to exert an influence (Ortega, 2009; Chan, 2011; Randall, 1997; Mori, 1998). It is these influences that are the focus of this study.

2. Literature Review

Arab Learners

What we know about large orthographical differences between languages is mainly based upon studies that investigated word acquisition and recognition of learners. Two contexts of this research will be examined, that of Arab learners and Asian learners. Recent studies of Arab learners have highlighted some of the difficulties that they face due to the large difference in similarity between their L1 and L2 orthographies (Fender, 2008; Khan, 2013; Ryan & Meara, 1991; Saigh & Schmitt, 2012). The Arabic orthography bears very little resemblance to that of English, as is the similar case of the Japanese orthography, which is the focus of the study. It has an extremely different writing system and has a different set of rules accompanying it. As such, Arabic studies will be first introduced.

Ryan & Meara (1991) first coined the phrase *vowel blindness* in relating to Arab learners of English. Vowel blindness refers to the phenomenon of how cross-linguistic influence from Arabic transfers to English negatively. Arabic short vowels are not distinguished in written Arabic and as a consequence this process of not distinguishing these vowels transfers to the L2 English processing skills (Fender, 2008; Khan, 2013; Saigh & Schmitt, 2012). This can lead to the production of L2 word error in regard to vowels and is evidenced in recent research.

In a study conducted by Saigh and Schmitt (2012) Arabic speakers' noticing of English short and long vowels was investigated. Twenty four native Arabic speakers were shown 80 grammatically correct sentences. Some of these sentences had spelling errors regarding both short and long vowels in relation to vowel location and omission. Participants were asked to identify these errors and correct them. The findings showed that two thirds of the spelling mistakes were unnoticed and only about 60% of noticed errors were corrected. The participants noticed incorrect long vowels more than short vowels and noticed omitted vowels often. One reason put forward for this phenomenon is "Extensive reliance on phonological processing with 1:1 phoneme-letter representation as a result of the transfer of L1 Arabic's orthographic and literacy skills strategies" (Saigh & Schmitt, 2012: p32).

Khan (1997) found similar results where vowels were often omitted or in the wrong location. Khan followed the study up with remedial classes of explicit instruction of English vowels. A post-remedial test showed that students dramatically reduced their amount of spelling errors. These results show that although L1 influence exerted a negative influence initially, through explicit instruction and awareness, such negative productions in the L2 may be reduced.

These studies provide evidence of the concept of vowel blindness. Whilst Arabic learners had difficulty in vowel awareness within words, they performed the most poorly in regards to short vowel awareness. There is a high possibility that this is due to the relationships between orthographies, where the Arabic language does not distinguish short vowels in their L1, so therefore struggle to distinguish them in their L2. However, does orthographical difference only affect word recognition or does it affect other areas too? Fender (2008) investigated this with a study that compared Arab and Asian students.

Fender (2008) compared learners of varying L1 orthographic backgrounds, (Chinese, Korean and Arabic) in performance of spelling and reading comprehension and listening comprehension. The study found that Arab learners performed much more poorly in spelling than their Chinese and Korean counterparts but there was no significant difference in listening comprehension. Fender concluded that the Arab learners had a greater degree of difficulty in spelling where the words went beyond the basic 1:1 grapheme-phoneme correspondences. Whereas Arabic has regular grapheme-phoneme correspondences, i.e. a shallow orthography, English is much more complex, where there is a many-to-one grapheme-phoneme correspondence, i.e. a deep orthography. This study provides evidence that not just varying differences in orthographic representation, but also the varying depths of orthographies are an aspect in cross-linguistic influence.

In the research outlined above, in the Arabic context, the L1 orthography exerted a great influence on the production and recognition of L2 vocabulary. Differences of orthographic representation and depth were key factors. These hindered Arab learners in regards to vowels in reading and writing skills but not in listening skills. However, through explicit instruction, learners may overcome these hindrances and become more proficient in L2 word recognition and production.

East Asian Learners

Whilst research has highlighted some of the difficulties of Arab learners, various orthographies have also been investigated in the East Asian learners' context (Akamatsu, 2002; Hamada & Koda, 2008, 2011; Koda, 1998; Mori, 1998; Muljani et al., 1998; Randall, 1997; Wang et al., 2003).

Hamada & Koda (2008) investigated whether the similarity between L1 and L2 affects the proficiency of the extraction of phonological information from L2 vocabulary. Extracting this information greatly affects reading "... phonological decoding... is a critical component in early reading development because efficient decoding enables learners to connect written words with oral vocabulary..." (Hamada & Koda, 2008: p2). The Chinese and Korean participants were presented with regular and irregular pseudo words and were asked to pronounce them. Korean students, whose orthography depth is closely related to English, pronounced items much faster and more accurately on both the regular and irregular pseudo words. Students were also tested on the spelling of words. Again, the results showed that Korean students had higher accuracy in all spelling tests. These results suggest that for students with a more congruent orthography, phonological decoding is much higher. However, one major drawback of the spelling tests was that they were multiple-choice questions. This possibly does not show an accurate of account of students' knowledge of the pseudo words, as the answers may have been guessed or misinterpreted.

In a similar vein, Koda (1999) found that whilst Chinese and Korean students did not differ greatly in the decoding of high-frequency letter strings,

Korean learners rejected more unacceptable letter strings than that of their Chinese counterparts. Koda puts forward again that this is due to the depth of Korean orthography's closer resemblance to English than that of Chinese.

In an investigation of orthographic and phonological sensitivity between orthographies by Wang et al. (2003), results suggested that Chinese learners were more attentive to the orthographic information of a word and that Korean learners were more phonologically sensitive to words. However, challenging Wang et al. (2003), Yamada (2004) argues that it is not the L1 orthography that has a direct effect on word recognition but the L1 phonological system that plays a greater contribution. He puts forward that the phonological similarity of Korean and English and the difference of Chinese and English was more of a factor, in relation to the L1 phonology-effect hypothesis. In this he notes "Chinese speakers learning ESL tend to add a vowel after the coda stop or delete the coda stop" (Yamada, 2004: p129), thus Chinese students may take more time to process English words and not necessarily because Chinese and English orthographies have a greater degree of difference than Korean.

The studies presented thus far provide evidence that the degree of difference between orthographies, and in some cases phonology, exert a significant influence on the progress and acquisition of L2 vocabulary. In the context of Arab learners, vowel blindness was a significant factor in production and recognition errors in English. In the comparison studies of Korean and Chinese learners, Chinese learners whose orthography is more distant from English than that of Korean, performed more poorly. However, in the majority of the above studies, the focus was word recognition, rather than production, in particular, spelling. This is the main aspect of the current study.

The Japanese Orthography and Problems in the Current Climate

There are 3 main orthographic systems in Japanese, *Kanji* (logographic), *Hiragana* and *Katakana* (syllabic) (Appendix A and B). One other orthography that exists is that of *Romaji*, a representation of the pronunciation of Japanese utilising the Roman alphabet. The focus of this brief overview will be on the systems of *Katakana* and *Romaji*.

Katakana is mainly used for foreign words and loan words and as such is often implemented to help with the pronunciation of other languages, especially in the context of English. Students often implement the *katakana* system to help them with the pronunciation of English words that are difficult. This leads to English vocabulary losing its original phonology in favor of a phonology based upon the syllabic orthographic system of *katakana*. This may result in a transfer of the L1 syllabic system to the pronunciation of L2 words. The majority of these syllables are a combination of a consonant followed by a vowel. This results in such utterances as アイ ライク レッド (ai raiku reddo), *I like red*, or a phenomenon commonly known as *Katakana English*, the mapping of the most similar sounding syllable in the L1 to the L2. This can lead many learners to be reliant on using these mappings and produce L2 words that are incomprehensible and also has a further negative effect where they are unable to comprehend clearly pronounced utterances as they do not correspond to their L1 processing skills. Transfer of this type is not just restricted to pronunciation but also spelling. This study now attempts to investigate the relationship this may have on L2 word production skills.

3. Research Questions

In light of recent research on L1 orthographic and phonological influences, this study will focus

on the extent to which Japanese EFL learners' L1 influences their L2 word acquisition. Drawing on various studies (Khan, 1997; Perry et al., 2002; Wang et al., 2003; Akamatsu, 2002) the current study aims to investigate if learners' L1 orthographical processing skills have more influence on L2 word production than their L2 orthography processing skills.

The research questions are as follows:

1. To what degree do Japanese EFL learners' L1 and L2 based processing strategies affect L2 word form production of unfamiliar words?
2. To what extent does explicit instruction, which highlights differences between L1 and L2 patterns, influence this relationship?

Hypotheses

Drawing from evidence of the previously outlined research, the following results were predicted:

1. Leaners would rely heavily on the L1 processing skills when inferring the spelling of unfamiliar words.
2. Drawing from Khan (1997), explicit instruction would have a positive influence and result in an increased number of correct spellings.

4. Methodology

Participants

The participants were 37 Japanese junior high school students enrolled in their 2nd year of compulsory education in Japan. All participants had completed one year of English language instruction at junior high school as well as two years of communicative instruction that focused on listening and speaking at elementary school. They receive four fifty minute classes of English instruction each week, where the main medium of instruction is Japanese.

Materials

All materials were designed and administered by the author. Participants were provided a sheet of paper on which to write their answers for the first and second tests. The explicit instruction sheet (Appendix C) was provided to students after the first test and written in Japanese, whilst instruction was given in both Japanese and English. All examples in the instruction sheet were known to the students with the exception of the word *slope*.

The selections of the words to be used, shown in *Table 1*, were adapted from Perry et al. (2002). This study investigated general spelling patterns of learners and found that words that could only be spelt in limited ways, 1:1 sound-spelling correspondences, adapted for words 1-4, were easier to produce than those with many variations, one-to-many sound-spelling correspondences, adapted for words 5-8. The study also found that in the situation of rhyme patterns, students would rely on the highest frequency spelling pattern that they knew for that rhyme or pattern. Finally words 9-12 were chosen as a mix of factors for their length, frequency of spelling patterns and number of syllables to increase their spelling difficulty. This was to observe how students would process more complex words and to asses if the difficulty of the "task may limit people such that they tend to use the simplest form of sub-syllabic sound-spelling translations" (Perry et al., 2002: p65). All vocabulary items used were not covered in the learners' past, current or future textbooks.

Table 1 - Test items

	Test 1 Vocabulary	Test 2 Vocabulary
1	fit	sin
2	slap	pest
3	blunt	smelt
4	gospel	fungus
5	flame	salute
6	maze	pope
7	grime	smite
8	spade	ignite
9	contraption	magnitude
10	sparkling	delectable
11	unforgiving	complicated
12	misunderstand	represent

5. Procedure

First test

Participants were told to spell the first set of vocabulary items and write them down. The author pronounced each item three times with a lapse of five seconds between each reading. Participants were not allowed to confer with peers, textbooks, or dictionaries. After the final item was given there was a period of 15 seconds for students to proofread, after which their sheets were collected.

Explicit Instruction

Explicit instruction sheets were then distributed. Students listened and repeated the author's pronunciation of the individual sounds of the alphabet together with example words that had a 1:1 mapping correspondence, adapted from Khan (1997).

Both sections relating to the different spelling patterns were introduced through a simple explanation followed by four examples for each rule. Learners' attention was brought to the differences of these spelling patterns to their L1 spelling patterns.

With the completion of the instructed sheet, students were immediately given another spelling test, in the same fashion as before, but the second set of vocabulary items were used.

6. Data Coding and analysis

Both tests were transcribed for data coding (Appendices D and E). Participants were marked on the number of correct spellings and the number of L1 influenced spellings. Spellings that were characteristic of the L1 orthography were considered to be L1 influenced spellings. Particular attention was paid to the spelling of words that directly map onto the L1 as a syllabic. An example of this would be where the word ***slap*** would be spelt as *surapu* as it would be written as the three syllables ス*su* ラ*ra* プ*pu* in Japanese. This example would be calculated as having 3 instances of L1 influence due to the added vowels after **s** and **p** and the use of **r** instead of l.

As shown in *Table 2*, *fit* and *gospel* were spelt correctly the most with the least amount of instances of L1 influence. As a class, there were 31 correct spellings out of a possible 444 (12 items for 37 participants), producing a mean score of 6.98%. There was a total of 369 L1 influences.

Table 2 - Number of correct spellings and L1 influence spellings (First Test)

Test 1 Vocabulary	Correct Instances	L1 Influence Instances
fit	16	0
slap	0	32
blunt	2	25
gospel	12	15
flame	0	45
maze	0	40
grime	0	43
spade	0	39
contraption	0	32
sparkling	0	21
unforgiving	1	42
misunderstand	0	32
Total	**31**	**369**

As shown in *Table 3* for the second test, the most

correctly spelt words were *pest* and *pope* and had the least amount of L1 influenced instances. A total of 60 words were produced correctly as a class, almost double that of the first test, the mean score increasing to 13.51%. However the most striking result to emerge from this data is that there was no significant difference in the number of L1 influenced spellings between the two tests.

Further analysis of data between the individual scores of correct spellings for each individual learner as shown in *Figure 1* below, provides strong evidence that after explicit instruction, the majority of learners' levels of accuracy increased as a total of 23 students obtained a higher score.

Table 3 - Number of correct spellings and L1 influence spellings (Second Test)

Test 2 Vocabulary	Correct Instances	L1 Influence Instances
sin	5	5
pest	25	1
smelt	6	25
fungus	2	54
salute	2	17
pope	10	5
smite	7	41
ignite	1	25
magnitude	1	44
delectable	1	61
complicated	0	58
represent	0	45
Total	**60**	**381**

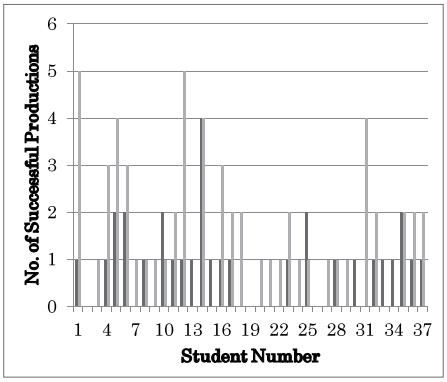


Figure 1 - Comparisons between the numbers of successful productions from Tests 1 and 2.

7. Discussion

This study set out with the aim of assessing the degree of influence processing skills across orthographies has on L2 spelling. For the first question in this study; To what degree do Japanese EFL learners' L1 and L2 based processing strategies affect L2 word form production of unfamiliar words?, results show that there are a significant number of instances of L1 influence within the spelling of unfamiliar words. These results corroborate similar results to previous research reviewed earlier. Learners have a tendency to rely on their L1 skills when processing unfamiliar words. In line with Perry et al. (2002), learners tended to have more difficulty in producing words that had a one-to-many grapheme-phoneme correspondence, as shown by the low rate of success of words 9-12 in both tests. Also coinciding with this students also had a pattern of breaking up longer syllabic words into sub-syllabic translations.

In light of the *vowel blindness* highlighted earlier, results of the current study show a high frequency of an inversion of *vowel blindness* where students often added a vowel to consonants, as this is a common characteristic of their L1.

In some instances, no answers were written down. Whilst it is difficult to be certain of the reason for this without directly questioning the learner, the difference in orthography may have affected the time it took to process information. Due to the time limit, students may not have had time to answer (Akamatsu, 2002; Hamada & Koda, 2008, 2011; Perry et al., 2002; Wang et al., 2003). As can be seen from the table of answers, learners who did not provide an answer, often did so with the more complex words, but made attempts at simpler 1:1 spelling-sound pattern words.

However, the high number of instances of L2

processing skills across both tests, especially in the first, does not support some of the findings of previous research conducted (Hamada & Koda, 2008, 2011; Koda, 1999; Mori, 1998; Muljani et al., 1998; Randall, 1997; Wang et al., 2003). Students often broke longer words down into smaller units that often drew from previously learned L2 knowledge, e.g. *misunderstand* - **Ms. ander stand** and *unforgiving* - **an for giving**. These instances may be evidence that students tend to rely on L2 processing skills when producing more complex words, although there was a greater number of instances of L1 influenced spellings. Drawing from these results, in answer to the first research question, both L1 and L2 processing skills exert an influence, but L1 exerts the greater of the two thus proving the first hypothesis to be true.

The second question of this study sought to determine the degree of influence explicit instruction has on the relationship between learners' processing strategies. As can be seen from the results, the majority of students improved upon their scores from the first test. One reason for this could be due to the explicit instruction that was given. These results coincide with those found by Khan (1997). Whilst students did improve after instruction, it was surprising that there was no significant difference between the numbers of L1 influenced instances. It would seem that students were still relying on their L1 processing skills to a large degree but had an increased awareness of spellings. Generally, there were higher numbers of correct answers with low degree of L1 influence for the 1:1 mapping and rhyme patterns, but the opposite for more complex words. One possible cause for this could be that students applied knowledge where they thought they were able to from the explicit instruction but relied on L1 processing when this knowledge could not be applied. This trend supports Perry et al. (2002) where learners applied patterns to shorter words more successfully than longer more complex words with various sound-spelling patterns.

In answer to the second question, although explicit instruction did not exert a significant degree on the relationship of L1 and L2 processing skills, students improved on accuracy, thus proving the second hypothesis true.

8. Conclusion

The purpose of this study was to determine the magnitude L1 influence has on Japanese EFL learners and the effect that remedial instruction has on such influence. Whilst the results of the study produced similar findings to those of other studies of Arab and Asian learners, where L1 orthography processing skills directly transferred to the L2, there was contradictory evidence that students utilise L2 processing skills too, especially when encountering longer more complex words. In regards to instruction, although L1 influence was unaffected, students improved in accuracy of spelling.

9. Limitations of Study

Finally, a number of important limitations need to be considered. First, with regards to time restrictions and resources, only one class was included in the study, significantly limiting the number of participants and the number of exposures to explicit spelling instruction. An increase in the number of participants and the length of instruction could produce more accurate results that give a truer reflection of the effects of instruction.

Second, L1 influences numbers maybe distorted as what could be taken for a correct L2 process may have actually been an L1 process that coincidentally resembled a correct L2 instance, i.e. learners may have used an L1 process in an unexpected way but coincidentally appeared to be

an accurate L2 production. Questionnaires or interviews would provide more accurate data in this regard as learners would have a chance to explain why they chose to spell a word in the manner they did, possibly giving a more accurate number of L1 influences.

Finally, learners may have found the vocabulary of the second test much more easy or difficult, regardless of L1 and L2 processing skills. As a future improvement, the same words should possibly be used, as this would give a more accurate representation of whether explicit instruction did indeed have an effect on L2 production.

References

Akamatsu, N. (2002). A similarity in word recognition procedures among second language readers with different first language backgrounds. *Applied Psycholinguistics* 23, p117-133.

Chan, A. Y. W. (2011). The perception of English speech sounds by Cantonese ESL learners in Hong Kong. *TESOL Quarterly* 45: 4, p718-747.

Hamada, M. & Koda, K. (2011). Similarity and difference in learning L2 word-form. *System* 39, p500-509.

Hamada, M. & Koda, K. (2008). Influence of first language orthographic experience on second language decoding and word learning. *Language Learning* 58: 1, p1-31.

Khan, M. F. (2013). Embedded vowels: remedying the problems arising out of embedded vowels in the English writings of Arab learners. *RELC Journal* 44: 2, p233-251.

Koda, K. (1999). Development of L2 intraword orthographic sensitivity and decoding skills. *The Modern Language Journal* 83, p51-64.

Mori, Y. (1998). Effects of first language and phonological accessibility on kanji recognition. *The Modern Language Journal* 82, p69-82.

Muljani, D., Koda, K. & Moates, D. R. (1998). The development of word recognition in a second language. *Applied Psycholinguistics* 19, p99-113.

Ortega, L. (2009). Understanding second language acquisition. Chapter 3. Routledge.

Perry, C., Zeigler, J. C. & Coltheart, M. (2002). A dissociation between orthographic awareness and spelling production. *Applied Psycholinguistics* 23, p43-73.

Randall, M. (1997). Orthographic knowledge, phonological awareness and the teaching of English: an analysis of word dictation errors in English of Malaysian secondary school pupils. *RELC Journal* 28: 2, p1-21.

Ryan, A. & Meara, P. (1991). The case of the invisible vowels: Arabic speakers reading English words. *Reading in a Foreign Language* 7: 2, p531-540.

Saigh, K. & Schmitt, N. (2012). Difficulties with vocabulary word form: The case of Arabic ESL Learners. *System* 40, p24-36.

Wang, M., Koda, K. & Perfetti, C. A. (2003). Alphabetic and non-alphabetic L1 effects in English word identification: a comparison of Korean and Chinese English L2 learners. *Cognition* 87, p129-149.

Appendices

Appendix A - Kana, 46 basic syllables.

ん ンn	わ ワwa	ら ラra	や ヤya	ま マma	は ハha	な ナna	た タta	さ サsa	か カka	あ アa
		り リri		み ミmi	ひ ヒhi	に ニni	ち チchi	し シshi	き キki	い イi
		る ルru	ゆ ユyu	む ムmu	ふ フfu	ぬ ヌnu	つ ツtsu	す スsu	く クku	う ウu
		れ レre		め メme	へ へhe	ね ネne	て テte	せ セse	け ケke	え エe
	を ヲwo	ろ ロro	よ ヨyo	も モmo	ほ ホho	の ノno	と トto	そ ソso	こ コko	お オo

Source: http://www.tanos.co.uk/jlpt/jlpt5/kana/

Appendix B - Kana Chart Continued

Source: http://www.tanos.co.uk/jlpt/jlpt5/kana/

Appendix C - Explicit Instruction Sheet

Somtue Spellingu Helpu

a b c d e f g h i j k l m

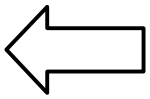
n o p q r s t u v w x y z

スペルの法則にいついて勉強します。 文字-音 と 子音+母音+子音+ e.

文字-音 これは、音と文字を組み合わせるときにできる.

For example:

dog  d - o - g

left  l - e - f - t

frog  f - r - o - g

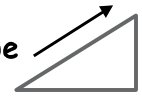
London  L - o - n - d - o - n

聞いた通り、又は、言った通りにつづります。

子音+母音+子音+ e - 母音は大文字の音 A,E,I,O,U と同じように発音します。A,E,I,O,U の次の子音に e を付ける。

late  l - A - t → late

bike b - I - k → bike

slope  s - l - O - p → slope

flute  f - l - U - t → flute

Appendix D – Test 1 Results

Student	fit	slap	blunt	gospel	flame	maze	grime	spade	contraption	sparkling	unforgiving	misunderstand
1	fit	slappe	brant	gospelt	frein	math	clain	spein	contraction	sporking	oneforkivin	ms ander stand
2	fitt	suurapp	Buront	Gosuperu	Fureimu	meiizu	kurain	speido	conturaccsunn	supaakuin	Anfokivieen	Msanderstand
3	fret	srattp		gosper		meis	crain	speid		spacrin		
4	fit	slup	blnt	gosper	flam	meas	quwim	spead	comtrpshon	sperclen	anforgiving	miss understant
5	fit	srap	brat	gospel	frame	mays	grain	spaid	comtraction	speakring	anforgiving	Ms. understand
6	fit	srapp	brant	gospel	fream	meis	kuwarm	spede	contrapsh	sparkring	anforgiven	misandastant
7	fath	slappe	vleit	gosip	friem	maes	griem	speed	compracsh	sporklin	au for kiden	ms. unde stand
8	fit	sranp	Brant	gosperu	flanm	mais	claim	speid	contrapsn	sparking	an for kevin	Ms. Ander Stant
9	fhit	slnp		Gospr		mers		sprd	compre	spereling	amforkivig	
10	fit	sorve	vorant	gospel	falein	Mayes	fulein	speit	contrakshon	sparkin	anforkiben	ms. Andastand
11	fit	srap	beaurnt	gospelt	shraim	meiji	urain	spead	contorpshon	sparkring	and for gibing	Ms. Ander stand
12	fit	slanp	bront	gospert	foreim	mays	culain	spey	contlakition	spaking	an for giving	Ms. Anderstan
13	heet	Surat	Barat	Gospel	Fulem	meji	quwnt	spein	kontrkk	sprkrn	I'm forr vin	Ms
14	fit	slup	blunt	gospel	fleam	mase	cwime	spead	contruption	spookrin	unforgiving	missunderstand
15	fit	surap	brand	gospl	flem	mese	guraim	spend	contracshon	spakling	anforgibing	Ms. Andastanda
16	fit	surap	brant	gosupuru	frun	meas	kuram	spai	kantrapshn	spakn	I for keben	Ms. Andstand
17	fit	surap	burant	gospeot	furein	meinzu	furain	supein	konkurakushyn	supakuin	anformukebin	misandastin
18	fite	sulap	varat	gospl	surein	meiz	karin	speik	contrackshy	spaking	an for demin	ms sandy stand
19	feit	slop	Blont	gosip	farein	meis	grin	speid	contakcion	sporkring	I'mforgiven	Ms. Anderstant
20	feit		Brnt		Freing	Meis	crain	sped				
21	fifth	surrn	varanth	gotsparu	tarin	mays	kuraim	spaind	kontrpash	spokun	anforkiveng	Ms anderstand
22	Fiute	surape	Braute	Gosper	frime	Mise	furain	speid	contrapshon	speking	ankfebin	mes and stup
23	fith	slac	brand	gospel	freim	mays	clamu	speid	contlakshon	sparklink	anforkibing	Ms. and a stan
24	fith	snap	Brant	Gosper	freim	meiz		speibo		spakulin		
25	fit	slup	blunt	goes pel	flent	mues	guloy	speid	comptpolkly	spark	and for giding	mees sandsstan
26									kaontorpsit	sprking	I am on Kevin	Ms andstand
27	fits	slape	blant	gusple	dream	meise	glaim	spaid	conflap	sparking		ms andr stand
28	fite	slump	bround	gospel	toreim	meize	flaym	spein	contorapsyon	supaclin	an forgiving	Ms. under stund
29	fith	surapu	branch	gosoek	furem	meiz	gureim	spein	can plashe	sparkren		mes andar stand
30	fits	srap	blant	gospel	trein	mays	claym	spein	contrapshn	spaking	unforkidin	Ms. Ander stand
31	fite	slape	Blate		playm	Meiste	traim	speed	com	spaaked	I for	
32	fith	sracp	blant	gospel	frim	meis	claim	spain	contulapshen	speakin	and for kibing	misanderstand
33	fit	surath	Brond	trein	tretn	mei	lien	speied		smoking		Mr. and stand
34	fett	srappu	farant	gospel	fureim	mees	gurine	speed	contraksyon	sparking	anforgiding	Ms undarstant
35	fit	sulup	blut	gospel	fream	midz	crym	spaed	contrpstion	spakyng	and for giving	miss understand
36	fith	surapp	blath	gospel		mays	guwaim	speid	contlakson	sparking	and for geven	miss ander stant
37	fit	srap	burnt	gospr	frein	meis	grein	speid	contrepsyn	sparkren		Ms, ander stund

Appendix E - Test 2 Results

Students	sin	pest	smelt	fungus	salute	pope	smite	ignite	magnitude	delectable	complicated	represent
1	sin	pest	smelt	fungs	salt	pope	smite	ignate	magniturde	direkted	conprekatede	letpleaset
2	sene	pestu	smatu	fangasu	sarutu	poupu	smaitu	eignightu	Magunetiuzu	terecutebo	conproekiteellu	Rapriezentu
3	sing	pest	smert	fangis		pop	smile		magnetyud	dircto	conplekite	
4	sing	pest	smart	fungus	salt	pop	smite	ignight	maguniuers	delecber	comprited	grepleasent
5	sin	pest	smelt	fangasu	sarut	pop	smaitu	ignite	magnitudo	dilectebre	conpricated	reprizent
6	seng	pest	smeut	fangas	salute	pope	smaite	egnate	magnetus	drktivol	comprekitek	wepresent
7	seng	past	smert	faugus	salt	pope	smaite	iegnihte	maguichud	tlecktbe	complekite	repleaset
8	singe	paste	smarte	fangase	sarute	pope	smaite	igenaite	magunethude	direkterboode	conplete	Lepurizente
9	sige	pest	smet			polp	smit	Eign	mag		conpli	
10	sing	pest	smart	Fangast	salt	porp	smailt	itnaight	magnicheyd	drektgo	conpritieth	metprythent
11	sing	pest	smelt	fangas	sort	porp	smit	eignaight	magnithurd	direkterbl	conpiryket	lepulear
12	sane	pest	smeut	fungus	sarout	pope	smite	igniete	magnitude	tee lectebo	onply ceitet	leplysent
13	sind	test	sme	famdsku	srut	tork	smait		eed nito	Tiyei	magni	Derkutelo
14	sing	pest	smelt	fangus	salt	pop	smite	ignight	magnichude	delectable	completed	weprizent
15	sing	past	smert	fangs	slaut	pop	sumdit	iugnight	magunithudo	directbo	coplect	wahtprget
16	sine	pest	smelt	fngas	slute	pope	smait	ignight	magunichud	tlaftted	cnpurikeitd	bepuiyzete
17	sin	pest	sumeat	fandast	sarut	pop	sumaitu	igunain	magonehcu	direkutodoll	koupritetefu	ueprizuet
18	sing	pest	smatu	fangast	sarte	poke	smite	engnite		delktvo	co pletk	lep rinz
19	sing	paste	smelute	fangaste	solt	pop	smile	ingnight	magnetetube	dinrektobord	knprikite	replizent
20	sing	pest	sumeut	fanclass	salt	pop		ingnight				
21	sein	pest	smert	fandoes	sarut	pop	smit	ingnith	miguthod	serekutaball	konpurikuitel	retparryzen
22	singe	haste	smart	fangase	sarute	pope	smait	iegnaite	magunet cheu	bereupkuiepo	conpreteitok	Let we zet
23	sane	piste	smeoute	fanguse	salute	pope	smate	engnite	magunicude	telectebowe	conplitceltei	creplizent
24	sing	pest			sarte							
25	send	pest	smut	fungs	sulte	poupe	smit	iegniete	mugncyd	direktdu	comprekit	reitpexznt
26	seing	paste	smalte	fangast	salte	porp	smaill	ingnight	magnetues	derectball	konprekeint	blaikwezent
27	saind	pest	samale	fangus	salt	pop	smart	ingnighth	magunichud	direkutabl	complerkenth	Bark fveastens
28	suing	pest	fangast	fungo	saruto	pop	samaito	eignightu	magneto	De leftnoul	conpleyeight	peptopeonzen
29	sein	pest	smeluthu	fangast	saruth	pop	smaitu	eagnihte	magnithudo	de lecthbou	complekeite	lepulezent
30	sine	peste	smarte	fanguse	sarts	pop	smait	igunite	magunethude	delectbae	conprete	btsp pree zent
31	sin	pest	smi	fan gas	slet	pope	smite	igenaite	magn		comple	
32	sin	pest	smart	fangas	salt	pop	smait	ignight	magnet	directerb	complykeite	peptpezoh
33	sen		shot			pop	smit					
34	sink	test	smarto	fangasu	sarut	porku	sumait	egnait	magnetch	divektebov	conpreetike	rpleesent
35	sing	pest	sumelt	fangust	salt	pope	sumit	igg night	magnityud		comprykate	reprezent
36	sing	pest	smalth	fangas	salth	porp	smite	iggnight	magneturl		coplirkate	la prisent
37	sein	pest	smelt	famgs	sarut	pop	smait		maunitурd	direcutebr	compuyceiter	