The Accuracy of Phonological Decoding Skill
Among Japanese EFL Learners:
Evidence From a Lexical Decision Task

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Abstract
Phonological decoding skill has proved to be an important factor in word recognition. However, its accuracy in the field of second language acquisition has not been adequately investigated. This study examined the details of phonological decoding skill in English. Sixty Japanese undergraduate and graduate students judged the lexicalities of sixty target words (Consonant vs. Vowel vs. Nonword condition) in an assigned lexical decision task. The results showed that response times were significantly longer for Consonant and Vowel conditions compared to Nonword condition, confirming that the participants possessed phonological decoding skill of consonants and vowels and employed such skill when making their lexical decisions. The results also suggested that there was no significant difference in terms of accuracy between the participants’ phonological decoding skill of consonants and that of vowels. In addition, error analysis revealed a number of factors related to high and low error rates: (a) the influence of the romaji writing system, (b) English sounds that are not differentiated in Japanese (e.g., /t/ and /l/), (c) sounds with the same pronunciation but different spelling (e.g., /ce/ and /se/), (d) variation in the spellings of the schwa sound, (e) high level of word familiarity, and (f) ease of visual recognition.

Key Words: Word Recognition, Phonological Decoding, Lexical Decision Task

1. Introduction

1.1 Phonological Decoding Skill in Word Recognition
Learners often encounter the problem of seeing a certain spelling but being unable to identify its pronunciation or meaning. However, the acquisition of grapheme-phoneme conversion process leads learners into successful word recognition. Word recognition involves following three steps: (a) orthographic processing, which has been defined as the ability to employ the orthographic information in the orthographic structure of words when processing written symbols
(Wagner & Barker, 1994), (b) phonological decoding, which has been defined as the processes involved in accessing, storing, and manipulating phonological information (Torgesen & Burgess, 1998), and (c) accessing the meaning (Koda, 2005). Many research confirm that phonological decoding is as important as semantic access in word recognition (Koda, 2005). Especially, less proficient readers more rely on phonological mediation than proficient readers do whereas proficient readers can employ more direct print-to-semantic lexical access (Kato, 2009). Moreover, Kato found that even fairly well proficient readers are dependent on phonological decoding. Although phonological decoding has been widely demonstrated, it has not been adequately investigated in terms of accuracy and difficulty in phonological decoding. Therefore, the present study aims to examine what grapheme-phoneme relationships are accurate and the reasons why specific letters and sounds are difficult to decode for Japanese EFL learners.

1.2 Factors Affecting Phonological Decoding Difficulty

In word recognition, many learners, especially less proficient learners, have difficulty with phonological decoding. The following factors affect phonological decoding difficulty.

**Opaque letter-sound correspondence in English.** Alphabetic orthographies differ with respect to the transparency of their letter-sound mappings (Katz & Frost, 1992). For example, in Finish, letters correspond directly to phonemes (Cook, 2004). This type of writing system is called transparent. In contrast, the writing system of English is referred to as relatively opaque because it is less consistent, meaning that each letter or group of letters may represent different sounds in different words (Ellis et al., 2004). This opaque writing system is one of the factors that affects phonological decoding difficulty.

**L1-L2 orthographic distance effects.** The development of the second language (L2) word recognition efficiency could be facilitated by the extent to which the first language (L1) and L2 orthographic systems share the same structural properties (Koda, 1996). Muljani, Koda, and Moates (1998) examined the effects of orthographic distance by comparing lexical decision performance between two groups of English as a second language learners with related (Indonesian, Roman-alphabetic) and unrelated (Chinese, logographic) L1 orthographic backgrounds. The findings showed that Indonesian participants outperformed the Chinese in all conditions, demonstrating that L1-L2 orthographic similarity facilitates L2 lexical processing efficiency. As Chinese, Japanese does not share orthographic structural properties with English. Thus, it is conjectured that the English grapheme-phoneme correspondence is more difficult to process for Japanese EFL learners compared to EFL learners with alphabetic L1 background, and that the orthographic distance between English and Japanese is one reason for the difficulty that Japanese EFL learners experience in decoding English phonological information from print.

**L1 transfer.** Spelling errors occur because of a lack of knowledge concerning the phoneme-grapheme relationship (Cunningham & Bowler, 1999). Thus, EFL learners’ spelling
errors reflect difficulties in acquiring phoneme-grapheme relationships in English. According to Cook (2004), spelling errors by EFL learners include common spelling errors that are unrelated to native language, but they also include spelling errors that reflect aspects of their respective native languages. Some of the latter type of errors can be attributed to the native language’s orthographic system and others to its phonemic system. As an example of the latter, Japanese native speakers are prone to errors concerning /r/ and /l/. This error can be attributed to the fact that the Japanese language does not differentiate between /r/ and /l/, and so the language does not contain these English phonemes (Okada, 2005).

**L1 transfer for Japanese EFL learners.** Okada (2005) outlined three types of spelling error that are peculiar to the Japanese. They are: (a) mixing up <l> and <r>, (b) mixing up <b> and <v>, and (c) inserting extra syllables (especially the vowels <o> and <a>). The first two errors can be attributed to the fact that Japanese phonetics do not differentiate between <l> and <r>, and <b> and <v>, respectively. As for the insertion of extra syllables, Okada points out that there is a major tendency among Japanese EFL learners to insert <u> in the word final position, a tendency that is related to the Japanese **romaji** transcription system. In addition, Okada has argued that when a learner’s mental lexicon does not clearly reveal how to properly represent the form of the word, he or she will be affected by romaji spelling. These spelling errors can be regarded as the result of insensitivity to English phonology or English letter-sound correspondence.

**Variation in spelling.** There are some spellings that prove difficult even to English native speakers who have identified the orthographic regularities. For example, the unstressed schwa sound poses a particular problem. The schwa sound occurs frequently in spoken language (Cook, 2004), but in written language it is spelled in three ways, <a>, <e>, <i> (Cook, 1997), which explains the prevalence of spelling errors like *syllabus* (*syllabus*) and *competence* (*competence*).

1.3 Overview of the Current Study

Although phonological decoding has been confirmed to be crucial in word recognition as mentioned above, what letter-sound relationship is difficult have not been adequately examined.

Therefore, in this study, I focused on phonological decoding skill of consonants and vowels. Specifically, I examined phonological decoding skill for consonants and vowels using a lexical decision task (LDT), which has been used frequently in word recognition research. The use of the LDT is based on the assumption that a participant’s response latency in performing the task indicates how fast he or she recognizes the words (Jiang, 2012). By examining the speed at which words are recognized, we can obtain insights into how lexical knowledge is accessed (Jiang, 2012). Many classic findings on word recognition have been gained through use of the LDT. One such finding is the pseudohomophone effect (Coltheart, Davelaar, Jonasson, & Besner, 1977). A pseudohomophone is a pseudo-word that sounds like a real word (Jiang, 2012; Transler & Reitsma, 2005). For instance, *brane* is a pseudo-word corresponding to the real word *brain*.
because it sounds like brain (Jiang, 2012). It was found that participants took longer to reject pseudohomophones than to reject non-pseudohomophonic nonwords (Coltheart, Besner, Jonasson, & Davelaar, 1979; Rubenstein, Lewis, & Rubenstein, 1971), and that pseudohomophones generally lead to more errors in LDTs (Coltheart et al., 1979). This is known as the pseudohomophone effect (Jiang, 2012), which is interpreted as evidence of the activation of phonological decoding processes during reading (Transler & Reitsma, 2005). It is assumed that if the reader activates the phonological form of a pseudohomophone, the phonological form of the corresponding real word is also activated, which provokes more errors and longer reaction times to reject the pseudohomophone compared to non-pseudohomophonic nonwords (Transler & Reitsma, 2005). Transler and Reitsma investigated pseudohomophone effects in lexical decision to clarify phonological coding in reading by deaf children. Sixteen pseudohomophones and 16 control pseudo-words were presented to hearing children and deaf children. Both groups of children made significantly more mistakes on the pseudohomophones than on the control pseudo-words. The pseudohomophone effect was larger for hearing than for deaf participants.

This study uses the conceptual framework of the pseudohomophone effect in an LDT. Based on the framework, the following predictions were made. If a response latency of a pseudo-word was longer than that of nonwords, the result was interpreted to mean that the participant phonologically decoded the pseudo-word, indicating that he or she had phonological decoding skills for the particular letters and sounds. Thus, if a learner has phonological decoding skill of consonants and vowels, it will take him or her longer to determine that the pseudo-word is not a real word. Also, if a learner’s phonological decoding skill of consonants is more accurate than his or her phonological decoding skill of vowels, his or her correct response time will be longer under the Consonant condition compared to the Vowel condition. If his or her phonological decoding skill of vowels is more accurate, the reverse will occur. The research questions (RQs) are as follows.

RQ1: Which will have the longer correct response times: the pseudo-words with changed consonants/vowels or the nonwords?

RQ2: Which will have the longer correct response times: the pseudo-words with changed consonants or the pseudo-words with changed vowels?

2. Method

2.1 Participants

The participants comprised 60 Japanese undergraduate and graduate students recruited from a university. They had received more than six years of English education in Japan. Their English proficiency level was diverse based on their self-reports, and their vocabulary size was estimated with the Mochizuki vocabulary size test (Aizawa & Mochizuki, 2010). A total of 30 participants
were determined to have larger vocabulary size based on a median split for their performance on
the test. These 30 participants, labelled as the Upper group, showed substantially better
performance on the test ($M = 5547.44, SD = 601.61, Min = 5307.69, Max = 5807.69$) than the
other 30 participants categorized as the Lower group ($M = 3864.10, SD = 572.06, Min = 2615.38,
Max = 4615.38$), $t(60) = 11.11, p < .001, d = 2.87$.

2.2 Target Words

A total of 40 nouns with high frequency based on the $JACET 8000$ list (level 3 or below; $JACET$, 2003), high familiarity (Yokokawa, 2006), high imageability, and high concreteness
(Gilhooly & Logie, 1980) were selected (e.g., $apple$). These words were formed into three kinds
of target word: (a) pseudo-words comprising a real word (e.g., $apple$) with one consonant
exchanged for another (e.g., $appre$; Consonant condition), (b) pseudo-words comprising a real
word with one vowel exchanged for another (e.g., $applu$; Vowel condition), and (c) nonwords
comprising a real word with the letter order rearranged (e.g., $aelpp$). Each condition comprised 10
words. Twenty real words were selected as filler words to equal the number of yes- and
no-responses, respectively, in the LDT. The proportions of target words and filler words were each
determined based on previous studies that used LDTs (e.g., Conrad & Jacobs, 2004).

To provide counter-balance, four target word groups were established (see Appendix). The
lexical characteristics of familiarity, imageability, concreteness, neighborhood size ($Balota et al.$,
2007), and number of letters were unified among the target word groups. In addition, the
pseudo-words were prepared so that their pronunciation would resemble the words on which they
were based.

2.3 Procedure

In this study, a LDT was used in order to examine the details of phonological decoding skill,
specifically to determine whether lexical decision time is longer compared to that for the control
condition. The task was administered to individuals separately. The participants engaged in the
LDT while seated facing a PC monitor. They were instructed to provide a correct answer, in as
short a time as possible, as to whether the target word presented to them on the PC monitor was a
real word or a nonword (see Figure 1). Target words were presented consecutively on the PC
monitor.

After completing the LDT, the participants undertook the Mochizuki vocabulary size test
($Aizawa & Mochizuki$, 2010). Neither task had a time limit; the participants engaged with the tasks
at their own pace.

Figure 1. Presentation of target words in the LDT.
2.4 Analysis

First, in order to compare the correct response times for pseudo-words (Consonant condition, Vowel condition) and nonwords, a two-way mixed analysis of variance (ANOVA) was performed as follows: 2 (Vocabulary Size: Upper vs. Lower) x 3 (Target Words: Consonant vs. Vowel vs. Nonword). When the response latencies in the experimental conditions were longer than those in the control condition, it was interpreted that the participant activated phonological information from the target words in the experimental conditions but not in the control condition. Outliers were removed from the data; they constituted four percent of all the data of correct response times.

Next, an error analysis was performed in order to determine whether error rates vary depending on letters and sounds. The error rates were calculated as follows. First, the error rates of each target word (15 participants’ data per target word) were calculated because there were four sets of target words. Second, the target words were classified into groups that had the same letter substitution (e.g., brother ➔ *brther and company ➔ *campany; <o>➔<a> group). Finally, all the error rates in the groups were added together, and the average error rate was calculated. For example, *vois (original: voic) had a 40% error rate, and *fase (original: fac) had a 66% error rate in the <c>➔<s> group. These two percentages were added together, and the average error rate was calculated as 53%.

In order to take into account the trade-off between fluency and accuracy, z-scores for fluency (i.e., RTs) and accuracy (i.e., errors) were first calculated, and the strength of the correlation between a z-score for fluency and a z-score for accuracy was examined.

3. Results and Discussion

3.1 Correct Response Times

The correct response times in the LDT are shown in Table 1. According to the results of the two-way mixed ANOVA, the interactions and main effect of vocabulary size were not significant ($p > .05$), but the main effect of the target word was significant: $F(2, 116) = 48.07, p < .001, \eta_p^2 = .45$.

Multiple comparisons revealed that the Consonant condition and Vowel condition both had longer correct response times compared to the Nonword condition ($p < .001$). However, there was no significant difference between the Consonant condition and Vowel condition ($p < .05$).

The fact that response times were significantly longer for pseudo-words compared to nonwords implies that the participants possessed phonological decoding skill of consonants and vowels and employed such skill when making their lexical decisions (RQ1). The results also suggested that there was no significant difference in terms of accuracy between the participants’ phonological decoding skill of consonants and that of vowels (RQ2).

In order to consider the trade-off between fluency and accuracy, a correlational analysis was
carried out to examine the strength of the correlation between a z-score for fluency and a z-score for accuracy. The results showed there was no significant correlation between the z-scores \((r = -0.15, p < .05)\), which indicates that there was no trade-off.

Table 1

<table>
<thead>
<tr>
<th>Proficiency</th>
<th>Consonant</th>
<th>Vowel</th>
<th>Nonword</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(n)</td>
<td>(M)</td>
<td>(SD)</td>
</tr>
<tr>
<td>Upper</td>
<td>30</td>
<td>1143.54</td>
<td>355.33</td>
</tr>
<tr>
<td>Lower</td>
<td>30</td>
<td>1228.87</td>
<td>470.60</td>
</tr>
<tr>
<td>Total</td>
<td>60</td>
<td>1186.21</td>
<td>415.65</td>
</tr>
</tbody>
</table>

3.2 Error Analysis

An error in the LDT denotes that the participant’s phonological decoding skill regarding the real word on which the presented target word was based is hazy or non-existent. The target words used in the test could be divided into a number of categories, and so a comparison of error rates by category was conducted. A high error rate was interpreted as indicating that the phonological decoding skill of the relevant letter and sound was poor, and a low error rate was interpreted as indicating that such skill was accurate.

The mean overall error rate was 19%, with a standard deviation of 15. Looking at the results by consonant and vowel, the mean overall consonant error rate was 19%, and the mean overall vowel error rate was 20%. The following are considerations of the reasons for the error rates.

Consonants. The average error rates of consonants in the LDT are shown in Table 2. The first focus is on target word groups that had a high error rate because a different letter had the same sound. The target word group that substituted \(<s>\) for the letter \(<c>\) (e.g., \(\text{face} \rightarrow *\text{fage}, \text{voice} \rightarrow *\text{voise}\)) had the highest average error rate at 53%. The target word group that substituted \(<k>\) for the letter \(<c>\) (e.g., \(\text{picture} \rightarrow *\text{pikture, accident} \rightarrow *\text{akcident}\)) had a much lower average error rate 2%. One possible explanation for the much higher average error rate of the \(<c> \rightarrow <s>\) group is that the spellings \(<ce>\) and \(<se>\) have the same pronunciation as the sound /s/. In addition, it is relevant that \(<c>\) and \(<s>\) have the same heights as a letter. These factors confused learners when they encountered target words that contained \(<ce>\). Contrary to the \(<c> \rightarrow <s>\) group, the lower average rate of the \(<c> \rightarrow <k>\) group was due to the ease of visually recognizing a nonword when viewing a target word that substituted \(<k>\) for \(<c>\) based on the word form.

The next focus was on the group that contains English sounds that are not differentiated in Japanese. This comprised a target word group that substituted \(<b>\) for \(<v>\) (e.g., \(\text{interview} \rightarrow *\text{intbiew, movie} \rightarrow *\text{mobie, cover} \rightarrow *\text{cobber}\)) and a target word group that substituted \(<v>\) for \(<b>\) (e.g., \(\text{brain} \rightarrow *\text{yrain, number} \rightarrow *\text{numyer, bath} \rightarrow *\text{yath}\)). The average error rate of the
In addition to groups that have the English sounds /v/ and /b/, groups with the English sounds /r/ and /l/ also had high error rates. The target word group that substituted <l> for <r> (e.g., *area→*alea, *bridge→*blidge, *record→*record) had an average error rate of 25%, and the target word group that substituted <r> for <l> (e.g., *letter→*letter, *apple→*appre, *smile→*smire) had an average error rate of 20%. These high error rates probably occurred because the Japanese language does not distinguish between the /r/ and /l/ sounds (Okada, 2005). The <l>→<r> group had a 5% lower average error rate than the <r>→<l> group. One possible reason for the low error rate in this group is that it is easier to recognize that the target word is strange when seeing it,
because the letter <l> has double the height of the letter <r>.

**Vowels.** The average error rates of vowels in the LDT are shown in Table 3. A number of factors caused high error rates in target word groups of vowels, one of which was the influence of the romaji writing system. The target word group that substituted <a> for <o> (e.g., brother➔*brather, company➔*cpany) had an average error rate of 30%. The letter <o> in the original words of this group had the sound /ʌ/. One explanation for this high error rate is the influence of the romaji writing system. Japanese EFL learners tend to connect the Japanese あ sound to the letter <a>, which represents あ in the romaji writing system. Even if the original letter <o> is replaced with <a>, it might be read quite naturally by Japanese EFL learners. In addition, the shapes of <o> and <a> are not so different, compared to <r> and <l>, in which the letter <l> has a double height. This may have led to the consequence that it was not so unnatural for Japanese EFL learners when they looked at the target words that substituted <a> for <o>.

One of the target word groups, which substituted <e> for <a> (e.g., brain➔*brian, area➔*area, station➔*ation), had an average error rate of 27%. The influence of the romaji writing system may be the cause of the high error rate in this group as well. Japanese EFL learners tend to connect the Japanese エ sound to the letter <e>, because <e> is used to represent the /e/ sound in the romaji system. In addition, the shapes of <e> and <a> are rather similar, compared to <r> and <l>, in which the letter <l> has a double height, and the replacement does not change the original word form to such a great extent. This may cause participants not to perceive target words with substituted <e> for <a> as being unnatural.

The target word group that substituted <u> for <a> (e.g., family➔*family, camp➔*cump, bath➔*buth, breakfast➔*breakfust) had an average error rate of 13%. One of the reasons for this relatively low error rate is that the connection between the letter <u> and the sound オ is not very strong. The romaji writing system does not have a representation of <u> that is pronounced as オ. This might have had an influence on this low error rate.

The target word group that substituted <a> for <u> (e.g., number➔*numbre, subject➔*subect, lunch➔*lunch, nurse➔*nurse) had an average error rate of 23%. Once again, the high error rate was also probably due to the influence of the romaji writing system. Japanese EFL learners tend to connect the Japanese オ sound to the letter <a>. This writing system is very familiar to Japanese people. In addition, the original words of these target words are used as Japanese English. Thus, most Japanese EFL learners acquire the meaning of the words and Japanese English sounds that have vowel sounds after every consonant, which is different from the original English words.

The target word group that substituted <e> for <u> (e.g., building➔*beilding) had an error rate of 7%. One of the reasons for this low error rate was that it was difficult to retrieve the sound /bίldɪŋ/ from the original word building when participants saw the target word *beilding.

The next focus was the target word group that included the schwa sound. The group that substituted <a> for <e> (e.g., member➔*membar) had an average error rate of 28%, and the
group that substituted <i> for <e> (e.g., vegetable➔*vegitable) had an average error rate of 21%. Both groups substituted the unstressed schwa. These target words had a high error rate, probably because of the spelling complexity of the unstressed schwa sound, which can be written in three ways: <a>, <i>, and <e> (Cook, 1997).

However, the target word group that substituted <u> for the so-called magic <e> that is not pronounced in a word (e.g., magazine➔*magazinu) has an average error rate of 3%. This result is inconsistent with Okada (2005) who claims that Japanese EFL learners tend to make spelling errors whereby they add the letter <u> to the end of words, influenced by the romaji writing system, which adds vowel sounds after every word except for vowels themselves.

Table 3

<table>
<thead>
<tr>
<th>Original letter</th>
<th>Substitute letter</th>
<th>k</th>
<th>M</th>
<th>SD</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>o</td>
<td>a</td>
<td>4</td>
<td>.30</td>
<td>.12</td>
<td>company➔*campany</td>
</tr>
<tr>
<td>e</td>
<td>a</td>
<td>8</td>
<td>.28</td>
<td>.20</td>
<td>*membbar</td>
</tr>
<tr>
<td>a</td>
<td>e</td>
<td>3</td>
<td>.27</td>
<td>.22</td>
<td>*area</td>
</tr>
<tr>
<td>u</td>
<td>a</td>
<td>4</td>
<td>.23</td>
<td>.03</td>
<td>*subject</td>
</tr>
<tr>
<td>i</td>
<td>e</td>
<td>2</td>
<td>.23</td>
<td>.17</td>
<td>*accident</td>
</tr>
<tr>
<td>e</td>
<td>i</td>
<td>5</td>
<td>.21</td>
<td>.26</td>
<td>*vegetable</td>
</tr>
<tr>
<td>o</td>
<td>u</td>
<td>3</td>
<td>.16</td>
<td>.08</td>
<td>*black</td>
</tr>
<tr>
<td>a</td>
<td>u</td>
<td>4</td>
<td>.13</td>
<td>.11</td>
<td>*camp</td>
</tr>
<tr>
<td>u</td>
<td>e</td>
<td>1</td>
<td>.07</td>
<td>.00</td>
<td>*building</td>
</tr>
<tr>
<td>e</td>
<td>u</td>
<td>5</td>
<td>.03</td>
<td>.05</td>
<td>*magazinu</td>
</tr>
<tr>
<td>i</td>
<td>a</td>
<td>1</td>
<td>.00</td>
<td>.00</td>
<td>*design</td>
</tr>
</tbody>
</table>

I will discuss the reasons for low error rates in the following. The target word group that substitutes <u> for <o> (e.g., lesson➔*lessun 7%, movie➔*movie 1%) had an average error rate of 16%. The target words in this group have each feature. Thus, I will consider each reason for the error rates in the following. First, the target word *lessun (original word; lesson) had an average error rate of 7%. One of the reasons for this low error rate is that the original word lesson has high familiarity for Japanese EFL learners at a familiarity point of 6.42 out of 7 points (Yokokawa, 2006). This means that Japanese EFL learners often see this word in their daily lives, which makes it easy to respond correctly to the target words visible in a LDT. Second, the target word *movie had an average error rate of just 1%. The word movie also has high familiarity at a familiarity point of 6.69 out of 7 based on Yokokawa, which caused the low error rate.

Thus, a number of factors are related to high error rates: (a) the influence of the romaji writing system, (b) English sounds that are not differentiated in Japanese (e.g., /r/ and /l/, /v/ and
sounds with the same pronunciation and different spelling (e.g., /ce/ and /se/), (d) variation of spelling of schwa sound. In contrast, the reasons for low average error rates are as follows: (a) high word familiarity and (b) ease of visual recognition of the target word.

4. Conclusion

The present study examined the details of phonological decoding skill, which has proved to be important in word recognition, but its accuracy in the field of second language acquisition has not been adequately investigated. In this study, I examined the phonological decoding skill of consonants and vowels by means of an LDT.

Consequently, the fact that response times were significantly longer for pseudo-words compared to nonwords implies that the participants possessed phonological decoding skill of consonants and vowels and employed such skill when making their lexical decisions (RQ1). The results also suggested that there was no significant difference in terms of accuracy between the participants’ phonological decoding skill of consonants and that of vowels (RQ2).

Error analysis revealed some factors related to high and low error rates: (a) the influence of the romaji writing system, (b) English sounds that are not differentiated in Japanese (e.g., /r/ and /l/, /v/ and /b/), (c) sounds with the same pronunciation and different spelling (e.g., /ce/ and /se/), (d) variation of spelling of schwa sound, (e) high word familiarity, and (f) ease of visual recognition of the target word.

One implication of this study is that special attention must be given during instruction with regard to the letters and sounds, whether consonant or vowel, that were associated with a high error rate. For instance, special care must be taken when providing instruction on words with <r>, or <l> letters representing, respectively, the /r/ and /l/ sounds (e.g., holiday, bridge).

While this study has provided suggestions regarding the details of phonological decoding skill among Japanese EFL learners and the application thereof in educational settings, it still has a number of limitations. First, a statistical analysis was conducted in a vowel and consonant framework, but no statistical analysis was conducted on individual letters. In order to specify more precisely the letters and sounds for which phonological decoding skill is accurate and poor, it will be necessary to establish and evaluate a study design that allows statistical analysis by letter. Second, the position of the switched letter may have affected correct response times. Therefore, future studies need to control for the position of the switched letter. Third, future research should lower participants’ proficiency level or age, and investigate how well phonological decoding skill is acquired or not at a certain level or age. Furthermore, although this study analyzed data on the phonological decoding skill itself, future research can examine a specific teaching method or hypothesis such as the self-teaching hypothesis (Share, 1995), which proposes that phonological decoding functions as a self-teaching mechanism by which the learner acquires detailed knowledge of grapheme-phoneme relationships (Cunningham, 2006).
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References


# Appendix

## Target Words of a Lexical Decision Task

<table>
<thead>
<tr>
<th>Original</th>
<th>Consonant</th>
<th>Vowel</th>
<th>Nonword</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Set A</strong></td>
<td><strong>Set B</strong></td>
<td><strong>Set C</strong></td>
<td><strong>Set D</strong></td>
</tr>
<tr>
<td>movie</td>
<td>voice</td>
<td>family</td>
<td>member</td>
</tr>
<tr>
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## The Accuracy of Phonological Decoding Skill Among Japanese EFL Learners: Evidence From a Lexical Decision Task