The Relationship Between Chinese Reading Ability and English Reading Comprehension

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Abstract
This paper explores the relationship between Mandarin Chinese reading ability (L1) and English as a foreign language (FL) reading performance. Four issues are addressed: (a) the global relationship between Mandarin Chinese reading ability and English reading comprehension, (b) the existence of a language proficiency threshold, (c) the relative importance of Chinese reading ability and English proficiency on English reading performance, and (d) the influence of varying levels of cognitive complexity on the interaction of L1 and L2 reading comprehension.

Two hundred and fifty-two college students participated in the study. Three tests including an English proficiency test, a Chinese reading test, and an English reading test were developed to measure students’ language abilities. Pearson Product-Moment correlation and multiple regression analysis were used to demonstrate the statistical relationships. The results showed a weak but significant relationship between L1 and L2 reading abilities, and that a certain level of L2 proficiency had to be reached before language transfer could occur. L2 proficiency was consistently the better predictor variable. Meanwhile, the strength of the correlations decreased gradually as the levels of cognitive complexity increased, though the correlations between L1 and L2 reading abilities were positively related at different cognitive levels.

Key words: L1 reading ability, L2 reading comprehension, cognitive abilities, the linguistic threshold hypothesis
INTRODUCTION

The most important feature used to distinguish first language (L1) from second language (L2) learning is probably the fact that L2 learners, especially adults, usually have reached a certain level of L1 fluency before learning the L2. Hence, the question of how language learners’ first and second language reading abilities are related to each other or how L1 reading ability affects language learners’ second language performance has captured the attention of second or foreign language teaching community for years (Barnett, 1986; Fecteau, 1991; Upton & Lee-Thompson, 2001). It is meaningful for researchers or language teachers to explore the extent to which L1 reading ability may hinder or facilitate L2 reading competence in order to improve language learners’ learning performance. Toward this goal, this study intends to contribute more data to our understanding of the relationship between Mandarin Chinese (L1) and English reading abilities.

LITERATURE REVIEW

Hypotheses About the L1-L2 Reading Relationship

One of the major trends in the study of the relationship between first language reading and second or foreign language reading comprehension is guided by the question Alderson (1984) posed: Is second language reading difficulty the result of a reading issue or a language issue? This question implies that if the challenge of second language reading is a reading problem, the lack of adequate reading
skills in the L1 is the crucial cause of the reading problem in the L2. That is, if language learners have a sufficient number of reading skills in their L1, the problems encountered in second language (L2) reading would be reduced. On the other hand, if L2 reading is a language problem, language specific knowledge, such as L2 linguistic knowledge on vocabulary and syntactic structures, would play an important role in improving L2 reading comprehension.

Two hypotheses—the language interdependence hypothesis and the linguistic threshold hypothesis—are commonly employed by researchers examining the L1-L2 reading ability relationship. The language interdependence hypothesis (Cummins, 1981) states that students who have learned to perform academic tasks in one language have underlying cognitive skills which are transferable to other languages. Based on this viewpoint, research data (Buckwalter & Lo, 2002; Folkes, 1993; Gunderson & Clarke, 1998) has indicated that experience in a first or second language promoted the underlying interdependent proficiency base of both languages. The results of Flores’ long-term study (as cited in Frado and McGee, 1994, p.69) also showed that “students who had achieved literacy in one language achieved literacy skills more quickly and more completely in English (L2) than students who had not developed literacy skills in their first language.” Meanwhile, the linguistic threshold hypothesis (Clarke, 1979; Cummins, 1979), also called the short-circuit hypothesis, proposes that the transfer of L1 reading ability to L2 reading performance is possible only when L2 learners have a certain amount of L2 linguistic knowledge. In other words, a certain level of L2 linguistic ability must first be achieved in order for L1 reading ability to affect L2 reading performance.
Studies on L1 Reading Ability and L2 Reading Comprehension

Various studies have tried to justify these two hypotheses by comparing different pairs of first and second languages (Bossers, 1991; Lee & Schallert, 1997; Perkins, Brutten, & Pohlmann, 1989) and have examined the relative importance of L1 reading ability and second or foreign language proficiency in L2 reading competence (Bernhardt & Kamil, 1995; Brisbois, 1995; de Felix, 1988; Fecteau, 1999; Lee & Schallert, 1997; Pichette, Segalowitz, & Connors, 2003; Taillefer, 1996).

Bernhardt and Kamil (1995) conducted a study on the relative contribution of English (L1) reading ability and Spanish (L2) linguistic competence to L2 reading comprehension. In an attempt to control for extraneous variables that could contaminate the study, potential variables appearing in earlier studies such as size of sampling, the cognitive maturity of the subjects, instruments that have equivalent forms in two languages, passage types, data collection skills, and levels of native language were extensively discussed. Results showed that both English (L1) reading ability and the level of Spanish (L2) proficiency were significant predictors of Spanish reading comprehension. Compared with L1 reading ability, L2 proficiency was a more powerful factor influencing L2 reading performance. L1 reading ability accounted for 10% to 16% of the variance in L2 reading, and L2 linguistic knowledge accounted for 30% of the variance in L2 reading.

In Lee and Schallert’s study (1997), 809 Korean middle school and high school students were involved in an investigation of the relationship between Korean (L1) reading ability and English (L2) reading comprehension. Measures of L1 and L2 reading abilities comprised two narrative and two expository reading passages for each
language with five questions following each passage. Two proficiency tests were designed to gauge students’ English grammar and vocabulary knowledge. Ten levels of L2 proficiency with at least 70 students in each level were formed to identify the functions of L2 proficiency as a language threshold to facilitate the transfer of Korean (L1) reading ability to English (L2) reading performance.

Data showed that the Pearson correlation coefficient between L1 and L2 reading abilities was .55 and that between L2 proficiency and L2 reading comprehension was .75. Meanwhile, while both L1 reading ability and L2 proficiency were significant predictor variables of L2 reading comprehension \( (R^2 = .62) \), L2 proficiency accounted for 57% and L1 reading ability accounted for 30% of the variance in L2 reading performance respectively. Furthermore, the transfer of L1 ability to L2 reading performance was more likely to happen for students with higher levels of L2 proficiency. Therefore, findings from these two studies supported the language interdependence hypothesis and language threshold hypothesis and consistently showed that L2 proficiency was a more powerful predictor of L2 reading performance.

**Considering Levels of L2 Proficiency and Varying Cognitive Abilities**

However, not all studies on this topic have presented evidence for such transfer of literacy skills and, meanwhile, some studies have expanded the scope of study to examine certain specific aspects of the L1-L2 reading relationship. Two dimensions have often been investigated: the level of L2 proficiency and the complexity of cognitive abilities required by the given reading tasks (Aron, 1978; Bernhardt & Kamil, 1995; Fecteau, 1999; Perkins et al., 1989;

Considering L2 proficiency as a possible variable influencing the L1-L2 reading relationship, research findings revealed that L1 reading ability and L2 linguistic knowledge were both significant predictors of L2 reading comprehension, and L1 reading ability was the major contributor to L2 reading performance for learners with higher level L2 proficiency, and for the low L2 proficiency group, L2 proficiency was the better predictor of L2 reading comprehension (Brisbois, 1995; Pichette et al., 2003). More specifically, Brisbois’ study (1995) indicated that L2 vocabulary was the best predictor variable of L2 reading comprehension for language learners with a lower level of L2 linguistic knowledge. According to Brisbois, sufficient L2 vocabulary knowledge could facilitate the process of gaining in automaticity which might lead to the increased ability to use L1 skills in the understanding of L2 texts.

In Taillefer’s study (1996), two reading tasks using a scanning test and a receptive reading test were employed to measure participants’ French (L1) and English (L2) reading comprehension. The scanning test was assigned as a basic task and served to locate specific predetermined graphic symbols within a text. The more demanding receptive reading task required a higher level of cognitive ability referring to the process of discovering the authors’ viewpoint. Fifty-three adult learners of English with a similar level of French reading ability were divided into high-level and low-level groups based upon their English (L2) proficiency level.

Research outcomes showed that with the fifty-three participants as a whole, L1 reading ability and L2 proficiency were significant predictors of L2 reading comprehension for both the scanning and the receptive reading tests. And when compared with L2 proficiency, L1
ability was a better predictor of L2 reading comprehension for the basic scanning task. For the receptive reading task, L2 proficiency was a better predictor for the students’ performance. Thus, the relative contribution of L1 reading and L2 language proficiency in L2 reading varied with the cognitive complexity of the L2 reading tasks. However, when taking the L2 proficiency levels into consideration, for the low-level L2 proficiency group, both L2 proficiency and L1 reading ability were not significant predictors of L2 reading. For the high-level L2 proficiency group, L1 ability was a significant predictor of L2 reading comprehension in scanning (basic) reading tasks, and L2 proficiency failed to be significant in the L2 scanning reading task. Therefore, in Taillefer’s study (1996), the findings failed to assert that L1 reading ability became important when L2 proficiency increased toward the threshold level.

In an attempt to examine the relationship between Japanese and English reading abilities, Perkins et al. (1989) conducted research in terms of three levels of L2 proficiency and three levels of cognitive abilities: factual information, inference, and generalization. One hundred and fifty-eight Japanese university students formed three groups based on their scores on the TOEFL test. Results showed that no significant relationship existed in the fact, inference, and generalization abilities for the lowest L2 proficiency group. A weak but significant relationship existed in the fact and inference levels for the second L2 proficiency level. A much more significant relationship existed in inference and generalization for the highest L2 proficiency group. Therefore, the more L2 knowledge the students had, the more salient the relationship between L1 and L2 reading abilities. At this point, levels of L2 proficiency were an influencing variable that affected the transfer of varying-level cognitive abilities across languages.
Fecteau (1999) used two French (L2) literary texts and two English (L1) translation versions to measure American college students’ French reading comprehension. Two levels of cognitive complexity were involved in the tests: literal and literary comprehension. The former was related to the recall of the facts mentioned in the texts, and the latter was associated with the main idea or the underlying author’s viewpoint of the texts. Findings revealed that L1 literal comprehension ability accounted for approximately 30% of the variance in L2 literal comprehension performance, and L1 inferential comprehension ability accounted for 18% of the variance in L2 inferential comprehension ability. Furthermore, while L1 reading ability was a significant predictor variable for both L2 literal and literary reading comprehension, L2 proficiency did not emerge as a significant predictor of L2 reading comprehension in either the literal or the literary test. According to Fecteau (1999), the small size of the samples in the study ($N = 24$) was probably the main reason that led to the non-salient effect of L2 knowledge on L2 reading comprehension. Thus, the study failed to support the linguistic threshold hypothesis and implied that cognitive ability could be treated as a potential factor affecting the transfer of L1 reading ability to L2 reading comprehension.

Moreover, Wang and Qi (1991) conducted a study of one hundred and thirteen Chinese university sophomore EFL students to examine the relationship between Chinese (L1) and English (FL) reading comprehension. Reading ability in the study was divided into three components: reading comprehension, reading speed, and reading efficiency. Reading efficiency was defined as the combination of reading speed and reading comprehension. Overall, the correlation between L2 proficiency and L2 reading comprehension ($r = .37, p$
Yang: Chinese (L1) and English reading comprehension (L2)

< .01) was higher than the correlation between L1 reading and L2 reading comprehension (\(r = .27, p < .01\)). As to the dimension of reading comprehension, when the participants were divided into low and high groups of English proficiency, L1 and L2 reading comprehension did not show a statistically significant relationship. In other words, language transfer did not occur in either L2 proficiency group. Thus, the data failed to support the linguistic threshold hypothesis. Furthermore, since the correlations between L1 and L2 reading were high in the dimension of reading speed and no statistically significant relationship existed in the dimension of reading comprehension, Wang and Qi proposed that due to the effect of cognitive load on the reading process, reading tasks requiring lower level cognitive ability, such as reading speed, were more transferable than tasks requiring higher level cognitive ability, such as comprehension, inference, or evaluation.

In sum, while previous studies have found that L2 proficiency and L1 reading ability play important roles in L2 reading, research on levels of L2 proficiency, cognitive complexity of the given reading tasks, and investigation with different paired languages have shed new light on the relationship between L1 reading ability and L2 reading comprehension. However, the research outcomes are still perplexing especially when language learners’ L2 proficiency and level of cognitive ability were taken into consideration (Fecteau, 1999; Taillefer, 1996). No consistent conclusion can be made about the relative contribution of L1 reading ability and L2 proficiency to L2 reading comprehension at varying cognitive levels for students with different levels of L2 proficiency. Also, few studies (Aron, 1978; Perkins et al., 1989) have been designed to illustrate the relationship between L1 and L2 reading comprehension for various cognitive dimensions for
different levels of L2 proficiency. Meanwhile, research exploring the relationship between Chinese and English reading comprehension is rare and the results have failed to support the language threshold hypothesis (Carson, Carrell, Silberstein, Kroll, & Kuehn, 1990; Wang & Qi, 1991). Further studies are needed to understand the issue more thoroughly and comprehensively. It should also be noted that previous research in this area has yet to offer a rationale or theoretical base to clearly define the different kinds of cognitive abilities in reading and to describe the relations among these cognitive abilities.

Levels of Cognitive Abilities and Bloom’s Taxonomy

Irwin (1991, p. 5) defined the reading comprehension process as:

The process in which a reader understands and selectively recalls ideas in individual sentences, understands and/or infers relationships between clauses and/or sentences, organizes and synthesizes the recalled ideas into general ideas, and makes inferences not necessarily intended by the author...All these processes occur virtually simultaneously, constantly interacting with each other.

In order to provide a theoretical base for the discussion of the relationships between L1 and L2 reading comprehension in terms of different levels of cognitive abilities, this study has adopted the concepts from Bloom’s taxonomy (Anderson & Krathwohl, 2001; Bloom, Englehart, Furst, Hill, & Krathwohl, 1956; Bloom, Hastings, & Madaus, 1971). The major purpose in constructing the taxonomy was to facilitate communication and to improve the exchange of ideas and materials among test developers, as well as persons who were concerned with educational research and curriculum development. According to estimates, there were 150 citations of the taxonomy in
The essential structure of the taxonomy was a cumulative hierarchy because the classes of objectives were arranged in order of increasing complexity, and each class of behavior was presumed to include all the behaviors of the less complex classes (Kreitzer & Madaus, 1994). This framework lies along a continuum and has six cognitive categories ranging from memory to higher-order operations: knowledge, comprehension, application, analysis, synthesis, and evaluation. Furthermore, each category contains several subcategories. For example, three subcategories of cognitive processing are included in the comprehension category. Translation, the first or easiest level, represents the ability to paraphrase information or to change a message into other languages, terms, or forms of communication. The second level is interpretation, which requires a reordering of the ideas presented in communication into a new configuration in the mind of the individual. Behaviors such as getting the general topic or main ideas of an article belong to this subcategory. The most demanding level in the comprehension category is extrapolation, which is related to the ability to make estimates, inferences, and predictions. As to the category of analysis, it is composed of the cognitive processes of differentiating, organizing, and attributing (Anderson & Krathwohl, 2001). In this category, learners need to break material into its parts and determine how the constituent parts are related to each other and to the overall structure. It is also associated with the ability to determine the point of view, purpose, and attitude of an author (Mayer, 2002).

The present study has tried to examine the transfer of Chinese (L1) reading ability to English (L2) reading comprehension based on the language interdependence hypothesis, the linguistic threshold
hypothesis, and Bloom’s cognitive taxonomy. The following four questions were addressed:

1. What is the global relationship between Mandarin Chinese (L1) reading ability and English (L2) reading performance?
2. Does an English (L2) language proficiency threshold (language competence ceiling) have to be attained before Mandarin Chinese (L1) reading ability begins to transfer to English (L2) reading competence?
3. What is the relative influence of Chinese (L1) reading ability and English (L2) linguistic knowledge on English reading comprehension?
4. How do the different levels of cognitive complexity at which the reading tasks were developed affect the interaction of L1 reading ability and L2 reading comprehension?

RESEARCH METHOD

Participants

Two hundred and sixty-five university-level EFL students in Taiwan participated in this research. Of the initial group, data from the 252 students that completed the study was analyzed. Although many subjects’ mother tongue was Min-nan, Mandarin Chinese is still regarded as the official language in Taiwan and also the dominant language used in school education; therefore, the author considered the selection of Mandarin as the learners’ L1 as appropriate.

Measures

*English proficiency test.* Following many of the research
designs exploring the relationship between L1 and L2 reading abilities (Lee & Schallert, 1997; Pichette et al., 2003; Taillefer, 1996; Yamashita, 2002), the construct of English linguistic proficiency in the current study was comprised of the knowledge of English vocabulary and grammar. Forty multiple-choice questions were selected from the TOEFL test and the General English Proficiency Test (GEPT).

The development of Chinese and English reading comprehension tests. Since few standardized or validated Chinese-English parallel reading tests have been developed, the researcher made two reading tests to measure students’ Chinese and English reading comprehension. Each test contained three expository reading passages. Forty multiple choice questions, with four options (each), were included in each test. Each correct response (out of 40) earned 2.5 points. In order to avoid the effects of extraneous variables caused by dissimilar test design, efforts were made to make the L1 and L2 reading tests as analogous as possible. Therefore, with the exception of the length of the Chinese readings which were longer than the English, the topics, article genres, test questions, and allotted time were consistent for both the Chinese and English reading passages.

The topics for both the Chinese and English reading passages were related to health, people, and the natural environment. Questions on both the Chinese and English reading comprehension tests were developed based on Bloom’s taxonomy. Two categories of cognitive abilities in the taxonomy, comprehension and analysis, were selected and three cognitive levels were developed to design the test. In Bloom’s taxonomy, three subcategories are included in the comprehension category: translation, interpretation, and extrapolation. In the current study, test items in the comprehension category were
attributed to two different levels. The first level contained items associated with the translation subcategory. The second level was composed of items related to the interpretation and the extrapolation subcategories of the comprehension category. The third level consisted of questions pertaining to the analysis category. The Chinese (L1) test contained 15 items in the first level, 17 items in the second level, and 8 analysis items in the third level. The English (L2) test contained 10 items in the first level, 23 items in the interpretation and extrapolation level, and 7 items in the analysis level.

Three college Chinese instructors and three English teachers were invited to review the test questions and gave their expert opinions on the tests. And two college instructors with educational psychology background evaluated and gave advice on the attribution of question items to the appropriate cognitive levels in Bloom’s taxonomy. This evaluation process led to the different number of questions for each level between L1 and L2 reading tests. Then five university freshmen took the tests and were interviewed to find out if any items were confusing to them. Finally, a pilot testing procedure was administered to collect data from 87 students. Item analysis was employed to assess the usefulness of each item as a measure of individual differences in abilities in the two tests. Two statistical indexes, an item difficulty index (P), and an item discrimination index (D), were obtained. As suggested by Aiken (1988), the lower bound for an acceptable value of P in this current study is .30, and an item is considered acceptable if its D index is .30 or higher. Results derived from the above procedures were employed to reword, modify, or delete certain questions on the tests. Meanwhile, the Split-half reliabilities for the Chinese and English tests were .65 and .74 respectively.
Data Collection

Three tests were administered to 252 participants in three different sections during students’ regular class time. First, a 40-minute session was devoted to the assessment of students’ English proficiency—knowledge of English grammar and vocabulary. Then two separate 50-minute sessions were dedicated to the evaluation of students’ Chinese and English reading abilities. The Pearson Product-Moment correlation and multiple regression analysis were used to investigate the relationship between Chinese and English reading comprehension.

RESULTS

Descriptive Statistics for the Measures of L2 Proficiency, L2 and L1 Reading Abilities

Based on the scores of the English proficiency test, percentile norms were used to divide the subjects into four groups. Table 1 shows that students whose raw scores on the English proficiency test fell on or below the 25th percentile were placed in the first group (G1) \( (n = 70) \). Students whose raw scores fell within the 26th to 50th percentile joined the second group (G2) \( (n = 57) \). Students whose raw scores fell in the range of the 51st to 75th percentile were placed in the third group (G3) \( (n = 65) \). And, finally, participants whose raw scores fell between the 76th and 100th percentile comprised the fourth group (G4) \( (n = 60) \).
Table 1

English Proficiency Grouping

<table>
<thead>
<tr>
<th>Group</th>
<th>raw score</th>
<th>percentile</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td>0 - 27.5</td>
<td>1 - 25</td>
<td>70</td>
</tr>
<tr>
<td>Group 2</td>
<td>30 - 37.5</td>
<td>26 - 50</td>
<td>57</td>
</tr>
<tr>
<td>Group 3</td>
<td>40 - 52.5</td>
<td>51 - 75</td>
<td>65</td>
</tr>
<tr>
<td>Group 4</td>
<td>55 - 100</td>
<td>76 - 100</td>
<td>60</td>
</tr>
</tbody>
</table>

In Table 2, the mean scores of the 252 participants on the L1 reading test and the L2 reading test indicate that the Chinese reading test was easier for the students than the English reading test. For the four English proficiency groups, the mean scores on the L2 reading test revealed that students with higher English proficiency performed better on the English reading test than students with lower English proficiency. This trend was not obvious in the relationship between English proficiency and Chinese reading ability.

Table 2

Descriptive Statistics of English Proficiency, English Reading, and Chinese Reading

<table>
<thead>
<tr>
<th>Test</th>
<th>English Proficiency</th>
<th>English Reading</th>
<th>Chinese Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>Group 1</td>
<td>23.40</td>
<td>3.76</td>
<td>27.19</td>
</tr>
<tr>
<td>(n=70)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group 2</td>
<td>34.61</td>
<td>3.09</td>
<td>33.12</td>
</tr>
<tr>
<td>(n=57)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group 3</td>
<td>45.80</td>
<td>4.48</td>
<td>36.07</td>
</tr>
<tr>
<td>(n=65)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group 4</td>
<td>67.67</td>
<td>9.41</td>
<td>54.80</td>
</tr>
<tr>
<td>(n=60)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>42.25</td>
<td>17.38</td>
<td>37.39</td>
</tr>
<tr>
<td>(N=252)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The Relationship Between L1 Reading Ability and L2 Reading Comprehension

The results from Pearson Product-Moment Correlation showed that a moderate but positive and significant relationship existed between Chinese and English reading comprehension \((r = .334, p < .01)\). Furthermore, the same statistical computation process was used to closely examine the correlations between Chinese and English reading abilities at different levels of English proficiency. Correlations in Groups 1, 2, and 3 were not significant, and only the correlation in Group 4 was statistically significant \((r = .464, p < .001)\). Hence, it is likely that a certain level of English (L2) proficiency should be attained in order to make the transfer of L1 ability to L2 reading proficiency possible. It is worth noting that some extremely high scores may exist in Group 4, given that the variability and the range of scores in English proficiency are much larger for Group 4 than for other groups. Statistical evidence for the sample as a whole and for each group is reported in Table 3.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Total</th>
<th>Group 1</th>
<th>Group 2</th>
<th>Group 3</th>
<th>Group 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>(r)</td>
<td>0.334**</td>
<td>0.048</td>
<td>0.160</td>
<td>0.235</td>
<td>0.464**</td>
</tr>
<tr>
<td>(N)</td>
<td>252</td>
<td>70</td>
<td>57</td>
<td>65</td>
<td>60</td>
</tr>
</tbody>
</table>

*Note. \(p < .05\), ** \(p < .01\)*
The Relative Contribution of L1 Reading Ability and L2 Proficiency to L2 Reading Comprehension

Multiple regression analysis was conducted to understand the influence of L1 reading ability and L2, or foreign language proficiency, on L2 reading comprehension. Chinese reading ability and English proficiency were the predictor variables and English reading comprehension served as the criterion variable in the study. The results indicated that both L1 reading ability and L2 proficiency were significant predictors of L2 reading comprehension. The squared coefficient of multiple correlation was $R^2 = .512$, confirmed by a significant F statistical figure, $F(2, 249) = 130.64, p < .01$. In other words, for the sample as a whole, fifty-one percent of the total variance of L2 reading comprehension could be accounted for by both independent variables. Meanwhile, the beta weights for L1 reading ability and L2 proficiency were $\beta = .156$ and $\beta = .657$ ($p < .01$) respectively. Compared to L1 reading ability, L2 proficiency was a much better predictor of L2 reading performance.

Next, in order to compare the results with previous studies, the researcher divided the 252 subjects into two groups according to subjects’ percentile norms on the L2 proficiency test. There were 127 subjects included in the low L2 proficiency group (LoL2) and 125 subjects in the high L2 proficiency group (HiL2). Multiple regression analysis was used in an attempt to clearly explore the relative importance of L1 reading and L2, or foreign language proficiency, for L2 reading in two L2 proficiency groups. The findings showed that L2 proficiency was significant for both low and high L2 proficiency groups ($\beta = .236$ and $\beta = .624, p < .01$), but L1 reading ability was only significant for the high L2 proficiency group ($\beta = .256, p$
L2 proficiency contributed more than L1 reading ability to L2 reading performance in the high L2 proficiency group. Table 4 displays the results of the multiple regression analysis.

Table 4  
Multiple Regression Analysis of L2 Reading Performance With Two Groups

<table>
<thead>
<tr>
<th>Variables</th>
<th>LoL2</th>
<th>HiL2</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1 Reading</td>
<td>0.012</td>
<td>0.256</td>
</tr>
<tr>
<td>L2 Proficiency</td>
<td>0.236*</td>
<td>0.624**</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.056</td>
<td>0.557</td>
</tr>
<tr>
<td>Adj $R^2$</td>
<td>0.041</td>
<td>0.550</td>
</tr>
<tr>
<td>$F$</td>
<td>3.710*</td>
<td>76.720**</td>
</tr>
<tr>
<td>$N$</td>
<td>127</td>
<td>125</td>
</tr>
</tbody>
</table>

Note. * $p < .05$, ** $p < .01$

The Relationship Between L1 Reading and L2 Reading Comprehension at Three Levels of Cognitive Complexity

Question items in both the Chinese reading test and the English reading test were divided into three cognitive levels based on the taxonomy proposed by Bloom et al. (1956). The first level (Level 1) was related to translation in the comprehension category, the second level (Level 2) was associated with interpretation and extrapolation in the comprehension category, and the third level (Level 3) was related to the analysis category. Within the 252 samples as a whole, the current research findings showed that a weak but significant relationship exists between L1 reading and L2 reading comprehension at all three cognitive levels. The statistical figures indicated that the correlations are $r = .280$, $p < .01$ for cognitive Level 1, $r = .208$, $p < .01$ for cognitive Level 2, and $r = .128$, $p < .05$ for cognitive Level 3.
It appears that the strength of correlations between L1 and L2 at cognitive Level 1, Level 2, and Level 3 decreased gradually though all the relations were positively significant.

Then the L1/L2 correlations at three cognitive levels in four L2 proficiency groups were examined. Statistical figures showed that the higher the level of L2 proficiency, the stronger the correlation between L1 and L2 reading abilities. In English proficiency Group 1 and Group 2, no significant relationship existed between L1 and L2 at any of the three cognitive levels. For English proficiency Group 3, a significant L1/L2 relationship only existed at cognitive Level 1 (r = .298, *p < .05). For English proficiency Group 4, a significant L1/L2 relationship existed at cognitive Level 1 (r = .465, **p < .01) and Level 2 (r = .326, *p < .05), but no significant relationship existed at the analysis level. Table 5 presents the correlation relationships between L1 and L2 reading abilities at three levels of cognitive abilities.

Table 5
Relationship Between L1 and L2 Reading Comprehension at Three Cognitive Levels

<table>
<thead>
<tr>
<th>Cognitive levels</th>
<th>Total</th>
<th>Group 1</th>
<th>Group 2</th>
<th>Group 3</th>
<th>Group 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1</td>
<td>0.281**</td>
<td>-0.002</td>
<td>0.194</td>
<td>0.298*</td>
<td>0.465**</td>
</tr>
<tr>
<td>Level 2</td>
<td>0.208**</td>
<td>-0.076</td>
<td>-0.009</td>
<td>0.156</td>
<td>0.326*</td>
</tr>
<tr>
<td>Level 3</td>
<td>0.128*</td>
<td>-0.004</td>
<td>0.079</td>
<td>0.093</td>
<td>0.130</td>
</tr>
</tbody>
</table>

*Note. N = 252, *p < .05, **p < .01
DISCUSSION

L1 Reading, L2 Proficiency, and L2 Reading Comprehension

The research findings from the Pearson correlation computation revealed that a weak but significant relationship exists between the L1 reading ability and L2 or FL reading comprehension. This evidence suggests the existence of a common underlying language proficiency across languages. Recently, arguments and evidence from previous research (Bernhardt, 2001; Upton & Lee-Thompson, 2001) have demonstrated that L1 knowledge provided a conceptual framework or cognitive resource for language learners to interpret L2 texts being read. This knowledge base might either compensate for the deficiency of L2 linguistic skills to enhance L2 reading performance or negate learners’ L2 language skills if the text didn’t match their knowledge base.

Meanwhile, contrary to the results obtained by the studies of Carson et al. (1990) and Wang and Qi (1991), in which Chinese was the L1 and English the L2, findings in the current study supported the language threshold hypothesis based on the results of the Pearson’s correlation between L1 and L2 reading abilities at four levels of L2 proficiency and the results of the multiple regression analysis for L2 reading performance with two groups. It is likely that second or foreign language learners need to establish a certain level of L2 knowledge before they can successfully draw on L1 reading ability to help with reading in the L2. Wang and Qi’s study revealed that language transfer did not occur between Chinese and English reading abilities for students with either good or poor English language proficiency. In Carson et al.’s research (1990), no decisive conclusion could be made because of the small sample size in the study.
Meanwhile, since correlation computation doesn’t provide information on cause-effect relationships, further studies are required to confirm the phenomenon.

With regard to exploring the issue of relative effects of L1 reading and L2 proficiency on L2 reading comprehension, the findings of the this study are that both L1 reading and L2 proficiency are significant predictors of L2 reading performance, and L2 proficiency is much more important than L1 reading ability as a factor influencing L2 reading performance. This conclusion is consistent with the findings in Bernhardt and Kamil’s (1995), Lee and Schallert’s (1997), and Yamashita’s (2002) studies.

Two possible explanations could be given to explain the phenomenon. Firstly, based on Cowan’s parallel processing theory of reading (Cowan, 1976), increasing the knowledge of the foreign or second language would significantly enhance the ability to read in L2 for languages that are very different from each other, such as Chinese and English. Therefore, the greater the difference between L1 and FL, the higher is the importance of L2 proficiency. Meanwhile, a more plausible explanation for the importance of L2 proficiency might be the level of difficulty of the L2 reading text in the current research. Alderson indicated,

In the reading of easy texts, one might expect first-language reading ability to be more important. As the linguistic or conceptual difficulty of the text increases, the importance of foreign language proficiency increases and that of first-language reading ability reduces. (Alderson, 1984, p.14)

The mean and standard deviation of the L2 reading comprehension test in the current study were $M = 37.53$ and $SD = 15.72$ respectively.
(full score = 100). The level of difficulty of the text seemed to be high for many of the subjects involved. Therefore, the statistical evidence is in accordance with the explanation from Alderson’s statements.

**Levels of L2 Proficiency and Cognitive Abilities**

With respect to the issue concerning the relationship between L1 reading ability and L2 reading comprehension at three levels of cognitive complexity, three main points need to be discussed here. First, positive correlations between L1/L2 reading abilities existed only at cognitive level 1 in L2 proficiency Groups 3 and 4, and at cognitive level 2 in L2 proficiency Group 4. Presumably, the phenomena indicated that L2 learners need to be equipped with good vocabulary and grammar knowledge to engage in higher-order thinking in L2 reading. Had the research included participants with higher L2 proficiency, L1/L2 reading abilities might have been significant at cognitive level 3. Further research is necessary to confirm this speculation.

Second, with 252 valid samples, the correlations between L1 and L2 reading abilities were positively related to each other at all three cognitive levels. This implies that different cognitive abilities transfer across languages. However, the correlations between L1 and L2 reading abilities decreased gradually when the levels of cognitive complexity of the given reading tasks increased. The strength of the L1/L2 correlation was stronger at the lower cognitive levels than at the higher cognitive levels. One possible explanation of the phenomenon is the lack of emphasis on higher-order thinking in EFL.
English reading classes. According to Anderson (1994), teachers’ use of higher-order questions or tasks can facilitate students’ higher-level thinking. The author speculates that the lack of opportunities for exposure to higher-order thinking such as analytical ability presented in Bloom’s taxonomy may hinder students’ performance in this area. In fact, compared to their L1 learning experience, students of L2 reading courses in Taiwan’s high schools are primarily confined to low-order learning where L2 vocabulary and grammar study form the most significant portion of the curricula. For example, students are usually focused either on the knowledge or comprehension level of material and few questions or tasks assigned by English (L2) teachers require students to engage in higher-order thinking. Therefore, the cognitive development in first and second languages may be influenced by students’ classroom experiences, and the assessment of students’ second or foreign language performance at the more complex cognitive levels may be more obscure.

Third, according to the statistical figures in this part of the research, when the calculation involved all the subjects as a whole, the L1/L2 relationship was significant at the analysis level ($r = .128$, $p < .05$). However, no significant relationship existed between L1/L2 reading abilities at the analysis level in the four English proficiency groups. One possible explanation is that the sample sizes in the four individual L2 proficiency groups were not large enough to statistically demonstrate a significant relationship when the correlation significance between these two variables was low with 252 valid samples. Further research exploration is required to confirm the relationship between L1 reading ability and L2 reading comprehension for this dimension.
CONCLUSION

The implications of the results for classroom teaching are worthy of attention. First of all, from a statistical perspective, L1 reading ability is a factor moderately affecting L2 reading performance. However, from a learning perspective, with so many potential elements actually impacting learners’ learning outcomes, such as parental expectations, family background, teachers’ teaching styles, learners’ beliefs and aptitude, background knowledge on L2 culture and different topics, learning attitudes, etc., a predictive factor like L1 reading ability which can account for 10% to 20% variance of learning performance in general is not negligible. Especially, L1 reading ability is of benefit to L2 reading performance after a certain level of L2 proficiency is reached.

Second, English reading is taught as a major subject in classroom settings from elementary schools to colleges in many countries in which English is regarded as the most important FL. Regular duration of English learning in formal education settings can be as long as eight to twelve years. Due to the fact that vocabulary and grammar are essential in constructing meaning in reading and also the base for L1 reading ability to operate and facilitate L2 reading, the lack of vocabulary and grammar abilities may cause poor reading performance. Over time, negative feelings such as frustration or helplessness toward English reading may lead to serious learning problems. This phenomenon is not uncommon in many EFL classes. Therefore, how to improve linguistic abilities becomes an important question. It will be beneficial if vocabulary and grammar knowledge obtained from linguistic and educational research can be incorporated
into ESL/EFL teacher training programs to help teachers or educators build up a systematic and solid base for vocabulary and grammar teaching in their curriculum. For example, concepts like collocation, lexical access including phonological and orthographic processing skills, and the impact of these operations on L2 reading may help to identify and gain insight into students’ reading problems. This echoes comments by Bernhardt (2001) who has emphasized the importance of research-based curricula in in-service and pre-service teacher training programs. Also, it is suggested that different methods for vocabulary and grammar learning such as intensive reading or even rote memory skills be provided to students to match their individual learning preferences and beliefs.

The current study has attempted to explore relationships between L1 and L2 (or FL) when L1 is Mandarin Chinese and L2 is English. The understanding of the relationships may offer classroom teachers greater knowledge in handling the complicated second (or foreign) language learning process and hence improve students’ language-learning outcomes. Evidence in the current research confirmed the existence of the language threshold hypothesis and language interdependence hypothesis. Meanwhile, as a new dimension of exploration, further research is needed to examine the transfer of cognitive abilities across languages in terms of the hierarchical levels of cognitive complexity.

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中文閱讀能力與英文閱讀理解力之相關性

摘要
本研究旨在探究國內大學生的中文閱讀能力及其英文閱讀表現之相關性。研究目的有四：(1) 了解學生整體的中英文閱讀能力相關性；(2) 探究「語言基本能力門檻」的假設，是否存在於中英文閱讀能力的關係之中；(3) 中文閱讀能力與英文單字文法能力對學生英文閱讀能力的相對影響力；(4) 針對一般英文閱讀課程所著重的內容，探究在知識、理解、分析的認知層面上，中、英文閱讀能力的相關性。同時，本文亦就與研究主題相關之重要文獻作探討及分析。研究對象為252位大學一年級學生，施測英文單字文法、英文閱讀及中文閱讀共三項測驗，以了解其中、英文語言能力，並使用皮爾森相關及複回歸分析做為統計分析之工具。研究結果顯示：(1) 中、英文閱讀能力呈顯著低中度相關；(2) 當學生具備某種程度的英文單字文法能力，中、英文閱讀能力即呈正相關；(3) 中文閱讀能力與英文單字文法能力，均為影響英文閱讀表現之顯著因素，但英文單字文法能力之影響力大於中文閱讀能力；(4) 在不同的認知層面上，中英文閱讀能力均為顯著相關，但相關程度隨著認知能力之複雜程度而遞減。

關鍵字：中文閱讀能力 英文閱讀能力 認知能力 語言基本能力門檻假設