THE EFFECTS OF READING AMOUNT ON LETTER READING SKILL: A LONGITUDINAL SURVEY OF JAPANESE ELEMENTARY SCHOOLCHILDREN

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This is the study to report Japanese two-year longitudinal reading amount data using the Title Recognition Test (TRT) and school book borrowing (the number of books borrowed from a school library) as measures elucidating the relationship between reading amount and Japanese letter reading skill. We found separate, significant positive effects for the reading amount indices on letter reading skill both one and two years later. For the longer duration, both indices had almost the same effect. We concluded that extensive reading increases knowledge of Japanese letters (in particular, the knowledge of the connections between hiragana and kanji). In addition, distinctive features of both indices of reading amount—TRT and school book borrowing—are discussed; school book borrowing, in particular, has not been used as an index of reading amount in previous studies, so we assert its utility here.

Key words: letter knowledge, longitudinal studies, school libraries, print exposure, kanji

What is the best way for children to improve their literacy skills? Out of many methods, reading books is the most promising. Mol and Bus (2011) conducted a meta-analysis of 99 cross-sectional studies that addressed the relationship between reading amount [estimated by recognition methods like the Author Recognition Test (ART; Stanovich & West, 1989) and the Title Recognition Test (TRT; Cunningham & Stanovich, 1990)] and literacy skills (including letter knowledge, vocabulary, and reading comprehension). In terms of recognition methods, participants read real and fake author names and titles of books. They then selected the authors and titles they recognized. Participants gained points for correct choices, and lost points for incorrect ones. The meta-analysis discovered a mild to strong relationship between reading amount and vocabulary from students of preschool and kindergarten to the undergraduate and graduate levels of education. However, although the meta-analysis included a variety of non-English
languages (in 14 studies) there was surprisingly no study that involved Japanese. Only one of those studies examined a language that used a relatively similar orthography to Japanese. Namely, the study involved the Chinese language (McBride-Chang & Chang, 1995). As Mol and Bus (2011) point out, this reduces the generalizability of the results.

Even now, to the extent of our knowledge only three studies have addressed the relationship between reading amount and literacy skills in Japan (Takahashi & Nakamura, 2009; Inohara, Ueda, Shioya, & Osanai, 2015; Ueda, Inohara, Shioya, & Osanai, 2017). Takahashi and Nakamura (2009) found a significant and positive relationship between the time spent reading and scores on vocabulary and reading comprehension literacy tests. However, their study did not find a significant relationship between the number of books read and either vocabulary or general reading comprehension. The second study (Inohara et al., 2015) developed a version of the TRT for Japanese elementary schoolchildren by using schoolbook borrowing records as an index of reading amount. As a result of their survey of Japanese children from all elementary school grades, they found small to medium positive correlation coefficients between both reading amount indices (TRT and schoolbook borrowing) and literacy skills (vocabulary and general reading comprehension).

The two Japanese studies were cross-sectional. The longitudinal study method is important for the identification of causal relationships. For example, which is correct, that frequent reading improves literacy skills, or literacy skills promote reading? The longitudinal design allows us to infer that a past factor (e.g., the amount of reading children completed in the first grade) influences a present factor (e.g., the literacy test scores of these same children in the third grade). Furthermore, controlling the baseline performances (e.g., children’s literacy test scores in first grade) may allow us to better examine the causal relationships between reading amount and literacy skill improvement.

In light of these advantages, previous studies have used longitudinal approaches to investigate reading amount (Cain & Oakhill, 2011; Echols, West, Stanovich, & Zehr, 1996; Hood, Conlon, & Andrews, 2008; Lawrence, 2009; Sénéchal, 2006). The concurring results of these studies have revealed that past reading amount predicts the future ability of many schoolchildren’s literacy skills (letter knowledge, vocabulary, reading comprehension, and spelling) throughout the elementary school years. For example, a study by Echols et al. (1996) indicated that the TRT and ART scores of fourth graders in the United States significantly predicted their vocabulary and overall reading comprehension skills when they were in the fifth and sixth grades after controlling for both types of literacy skills in the fourth grade.

There has only been one Japanese-language longitudinal study into this issue (Ueda et al., 2017). In that study, two point-in-time surveys were conducted on participants when they were in the third and fourth grades of elementary school. The study used schoolbook borrowing frequency measurements as indices of reading amount, and vocabulary and reading comprehension as literacy skills. As a result, it was discovered that schoolbook borrowing in the nonfiction genre significantly explained changes in the reading comprehension skills of participants from their third to fourth grade year.

No other studies using a longitudinal design have been reported. The lack of Japanese-language longitudinal data makes it difficult to apply the findings of these studies to the
literacy education of Japanese schoolchildren. Thus, this study’s first objective is to report Japanese longitudinal data for three points in time that address the relationship between reading amount and literacy skills for first-grade students.

*Japanese Letter Reading Skills*

Out of all literacy skills, this study focuses on letter reading skills. This is because the act of learning Japanese letters is a demanding task for Japanese children. There are two reasons for this word choice. First, the Japanese language uses three types of letters. Those are hiragana, katakana, and kanji. This differs from English, for example, which uses alphabetic characters. Second, the sound system of kanji is based on ideographs adapted from Chinese. Hiragana and katakana have near-perfect letter-sound correspondence. For example, the hiragana い is pronounced as /i/ independent of its context. In contrast, kanji are pronounced in a variety of ways. For example, the kanji 会 should be read /kai/ in 大会 (／taikai/, “convention”). However, 会 should be read as /a/ in 会う (/au/, “meet”) and as /e/ in 一期一会 (/itɕiɡoitɕie/, “Live every day as though it were your last.”). The low level of consistency between letter and sound increases learning difficulty (Wydell & Butterworth, 1999). This is important because learning to recognize and read letters is a pressing issue for our participants (Japanese children in early elementary school), as well as their parents and teachers.

However, one unique feature of children’s books might facilitate the difficult learning process. That is, most of Japanese children’s books have furigana, meaning that hiragana are printed beside each kanji to help young children read them (for example, 大会 (/taikai/)). The furigana connect the kanji to the hiragana. As noted above, hiragana letters are consistently pronounced, meaning that children can increase their letter reading knowledge by observing these connections in various contexts while reading. The effects of furigana on Japanese children’s kanji reading have not been widely reported. However, Kirwan (2005) found that furigana promoted a learner’s inferences concerning kanji meanings at an Australian high school. Kondo-Brown (2006) also showed that a knowledge of kanji pronunciation aided in the successful comprehension of unknown kanji meanings. Thus, it is reasonable to assume that reading books produces a positive effect on the letter reading skills of early primary students that speak Japanese. The scientific reporting of such findings should be useful to those involved in early literacy education.

*School Book Borrowing as an Index of Reading Amount*

Recognition methods like ART (Stanovich & West, 1989) and TRT (Cunningham & Stanovich, 1990) have been frequently used to estimate reading amount (for a review, see Stanovich, Cunningham, & West, 1998). These methods are advantageous because they are easily administered, save time, and avoid social desirability bias (DeBaryshe, 1995).

However, these recognition methods also have an undesirable feature. That is, there is a weak causal connection between the scores they produce and scores concerning reading

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1 For the sake of simplicity, we use the term letter to refer to any written characters representing sounds or words.
amount. The TRT score is based on the number of book titles recognized by participants. TRT scores do not refer directly to reading amount. For example, it is possible to increase TRT scores by memorizing the information on book covers even though the child may not have read the books. On the other hand, this index may reflect the richness of the book environment in which a child lives. Martin-Chang and Gould (2008) have already noted this issue, which they controlled for by dividing ART into “primary print knowledge” (PPK; participants know the author’s name because they read the author’s book) and “secondary print knowledge” (SPK; participants know the author’s name even though they did not read the author’s book). Differentiating between PPK and SPK, however, relies on the conscious familiarity decisions that are made by the participants, not on their memories, as is the case with the recognition method. Participants who correctly recognize an author’s name can indicate that their selection is from PPK, which is more socially desirable than SPK, even if they did not read the author’s book. For that reason, the accuracy of the differentiation marker likely suffers from social desirability bias.

Schoolbook borrowing (that is, the number of books borrowed from a school library) is a measure that can compensate for the disadvantages of TRT. Many Japanese school libraries use computerized management systems to record the book borrowing activities of students. Thus, we were able to accurately determine the actual book borrowing behaviors of participants. The causal connection between this measure and actual reading behavior is closer than that of TRT because a participant’s intention (or at least their desire) to actually read a book is guaranteed by the school book borrowing index.

Thus, the schoolbook borrowing index may capture a child’s actual reading behaviors more accurately than TRT scores. In addition, this method, like TRT, can avoid the social desirability bias that often becomes a problem with questionnaires. This is because it can be implemented over a long period (e.g., one school year), making it more difficult to deliberately manipulate. Furthermore, there is a practical advantage. The schoolbook borrowing assessment is a measure that schools typically record as a part of normal operation. The findings concerning the relationship between numbers of borrowed books and literacy skills should therefore be useful for teachers and schools that want to improve the literacy performance of students.

Study Purpose

As outlined above, this study has three objectives. The first is to investigate the relationship between reading amount and the letter reading skills among Japanese-language children in early elementary school. The second is to perform the investigation by using a longitudinal design that captures letter reading skills at one and two year periods. Third, schoolbook borrowing frequency measurements will be used along with TRT scores as indices of reading amount.
Method

Participants
A total of 64 first graders were recruited for this longitudinal study. They were selected from two classes at the same private school in Japan, and were each assessed at the first (G1: first grade attended; December 2012), second (G2: second grade attended; December 2013), and third time points (G3: third grade attended; December 2014). All participants were Japanese children whose native language was Japanese. By G3, 59 (92%; 27 boys and 32 girls) of the original 64 participants remained. Of the students who were not included in this study’s third-grade group, three had changed schools, and two were absent on the day our follow-up was conducted. We gained consent from the parents of all participants by contacting the school administration before administering the survey to any of the children.

Materials
To measure reading amount, we asked the participants to complete the TRT. We then gathered schoolbook borrowing data from the school’s records. We also conducted the Letter Reading Test, which is a part of the Reading-Test (Fukuzawa & Hirayama, 2009). The Letter Reading Test is a nationally standardized Japanese test used to measure the reading skills of children in elementary school.

Title Recognition Test. We used the Japanese version of the Title Recognition Test (TRT) for the first and second graders (Inohara et al., 2015). The TRT was used to estimate participant reading amount at G1. The test consisted of 15 correct titles of widely distributed books (targets) and 15 incorrect titles (fillers), which were all randomly sorted. The participants were asked to mark only targets. We calculated the TRT score as the false alarm rate (i.e., the percentage of selected fillers, or incorrect answers) subtracted from the hit rate (i.e., the percentage of selected targets, or correct answers). Cronbach’s α for this measure was 0.87.

Schoolbook borrowing (number of books borrowed from the school library). We counted the number of schoolbooks borrowed by the participants from the school library between April 1 (when the Japanese school year starts) and November 31 for the years of 2012 (when this study was conducted), 2013, and 2014. We then used that number as the schoolbook borrowing index at G1, G2, and G3. Each student was limited to borrowing five books at a time for a one-week period. Each book renewal counted the same as a new borrow.

Letter Reading Test. We took this test from the Reading-Test (Fukuzawa & Hirayama, 2009), which is a standardized test used to measure the literacy skills of Japanese children. The test has four subtests. Those are Letter Reading, Vocabulary, Syntax, and Reading Comprehension. We adopted the Letter Reading Test2, which measures the ability to provide hiragana, representing sounds and morae (timing units), for the kanji (e.g., すいえい/suie:/ for 泳き“swimming”). We used two versions of the Letter Reading Test. The first was used for the first and second graders, and the second was used for the third and fourth graders.

Procedure
At all time points (G1: December 2012, G2: December 2013, and G3: December 2014), the relevant homeroom teachers administered our survey to the participants. In addition, the school provided us with the schoolbook borrowing data at G1, at which point the TRT was conducted. The Reading-Test was conducted at all three time points.

Notably, at G2 the participants took the version of the Letter Reading Test that was established for one grade above their current grade level to avoid ceiling effects. That is, the first graders at G1 took the test meant for first and second graders, and second graders at G2 and third graders at G3 took the test version developed for third and fourth graders. At G1, the average correct score on the Letter Reading Test was 67%, which was a relatively high percentage considering the test was designed for first and second graders, and all the students were first graders. This was our reason for adopting the more difficult version of the test.

2 We used the remaining three subtests (Vocabulary, Syntax, and Reading Comprehension tests), as well as the Letter Reading tests. We reported only the data of the Letter Reading test because: (1) we aimed to elucidate the relationship between reading amount and letter reading skills in this study; and (2) the remaining three subtest scores showed a ceiling effect on at least one of the time points (G1, G2, or G3).
Results

To keep the comparison simple, we excluded participants for whom any TRT, schoolbook borrowing, or Letter Reading Test data were unavailable. Only one student was excluded according to these criteria. Thus, the data from 58 second graders (91% of the initial total; 27 boys, 31 girls) were retained.

Descriptive Statistics

We show the descriptive statistics for the data in Table 1. Mean correct percentages on the Letter Reading Test at G1, G2, and G3 were not near 100% (at G1, \( M = 0.67, \ SD = 0.14 \) for first and second graders; at G2 and G3, respectively, \( M = 0.60 \) and 0.82, \( SD = 0.21 \) and 0.12 for third and fourth graders). Although the mean Letter Reading scores at G3 were relatively high, the standard deviations at G1 and G3 were not so different, which suggests the successful avoidance of ceiling effects.

Correlation Coefficients

We calculated correlation coefficients for the data (Table 2), and found a significant positive correlation coefficient between TRT at G1 and all Letter Reading scores. We also found a significant positive correlation coefficient between schoolbook borrowing at G1 and Letter Reading at G3, and for schoolbook borrowing at G3 and Letter Reading at G1. We also found marginally significant positive correlations between schoolbook borrowing at G1 and Letter Reading at G2, and schoolbook borrowing at G3 and Letter Reading at G2. There were no significant correlations between the two reading amount measures or schoolbook borrowing and Letter Reading at G1.

Hierarchical Multiple Regression Analysis

At this point, we conducted hierarchical multiple regression analyses, as have been

Table 1. Descriptive Statistics

<table>
<thead>
<tr>
<th>N (boy, girl)</th>
<th>Mean age (SD)</th>
<th>Mean TRT scores at G1 (SD)</th>
<th>Mean Borrowing (SD)</th>
<th>Mean correct percentages of Letter Reading Test (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>58 (27, 31)</td>
<td>6.67 (0.47)</td>
<td>7.71 (0.46)</td>
<td>8.71 (0.46)</td>
<td>0.38 (0.21)</td>
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<td>217.12 (73.24)</td>
<td>147.34 (71.49)</td>
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<td></td>
<td></td>
<td></td>
<td>111.02 (57.00)</td>
<td>0.67 (0.14)</td>
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<td>0.60 (0.21)</td>
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<td></td>
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<td>0.82 (0.12)</td>
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Note. TRT = Title Recognition Test score, Borrowing = school book borrowing, G1 = time point 1 (first grade), G2 = time point 2 (second grade), G3 = time point 3 (third grade).

3 To enhance ease of understanding, we showed mean correct percentages in the descriptive statistics section. Thenceforth, we used “Letter Reading Test scores” in the correlational analyses because we used the raw or standardized Letter Reading Test scores. We also reported the mean raw scores (SD) on the Letter Reading Test: 31.98 (6.78) at G1 for the first and second graders, 28.74 (10.18) at G2 for the third and fourth graders, and 39.29 (5.94) at G3 for the third and fourth graders.
adopted in previous longitudinal studies (Cain & Oakhill, 2011; Echols et al., 1996; Hood et al., 2008; Sénéchal, 2006). We used the Letter Reading scores at G2 and G3 as the dependent variables. To examine the effect of both reading amount measures (TRT and schoolbook borrowing) after controlling for the other variables at G1, we constructed three models. The first shows the results of a simple regression analysis using the Letter Reading score at G1 as an independent variable. In the second, we put Letter Reading score at G1 first, and then added the TRT score, schoolbook borrowing at G1, and schoolbook borrowing at both G2 and G3, in that order. In the third model, we changed the order of the two middle independent variables. That is, we placed the Letter Reading score at G1, schoolbook borrowing at G1, then the TRT score, and schoolbook borrowing at G2 and G3, in that order. These three models make it possible to determine the predictive effects for Letter Reading scores at G2 and G3 as follows: (1) TRT, after controlling for Letter Reading score at G1 (Model 2); (2) school book borrowing, after controlling for Letter Reading score at G1 (Model 3); (3) TRT, after controlling for both Letter Reading score at G1 and schoolbook borrowing (Model 3); and (4) school book borrowing, after controlling for both Letter Reading score at G1 and TRT (Model 2).

The results are summarized in Table 3 (Model 2) and Table 4 (Model 3). The Letter Reading score at G1 explained a large amount of the variance in the Letter Reading scores at G2 and G3 ($R^2 = 63.6\%$ and $29.4\%$, respectively). The first two reading amount variables (TRT and schoolbook borrowing at G1) also (marginally) significantly explained the remainder of the variance. TRT significantly predicted Letter Reading score at G2 after controlling for Letter Reading score at G1 ($R^2$ changes $\Delta R^2 = 6.8\%$) at step 2 in Model 2, and after controlling both Letter Reading score at G1 and schoolbook borrowing ($\Delta R^2 = 5.5\%$) at step 3 in Model 3. The Letter Reading score at G3 was significantly predicted by TRT after controlling for the Letter Reading score at G1 ($\Delta R^2 = 5.7\%$) at step 2 in Model 2. After controlling for both Letter Reading score at G1 and schoolbook borrowing, this prediction remained marginally significant ($\Delta R^2 = 4.1\%$) at step 3 in Model 3.
Schoolbook borrowing also significantly predicted Letter Reading score at G2 after controlling for Letter Reading score at G1 ($\Delta R^2 = 3.3\%$) at step 2 in Model 3. However, this effect was only marginally significant after controlling for both Letter Reading score at
G1 and TRT ($\Delta R^2 = 1.9\%$) at step 3 in Model 2. The same pattern was obtained for Letter Reading score at G3. Schoolbook borrowing also had a significant influence after controlling for Letter Reading score at G1 ($\Delta R^2 = 5.6\%$) at step 2 in Model 3, although this effect was only marginally significant after controlling for both Letter Reading score at G1 and TRT ($\Delta R^2 = 3.9\%$) at step 3 in Model 2. By comparing TRT and schoolbook borrowing, we can see that the prediction performance of TRT was better than that of schoolbook borrowing in explaining Letter Reading Test results at G2 (one year later). However, schoolbook borrowing was almost equivalent to TRT in explaining Letter Reading Test scores at G3 (two years later).

The results of Model 2 and 3 were almost the same at step 4 (when schoolbook borrowing was examined at G2 and G3). As well, the standardized partial regression coefficients of the schoolbook borrowing measurements at G2 and G3 at step 4 in Models 2 and 3 were not significant. This means that recent schoolbook borrowing did not significantly predict a change in Letter Reading scores.

**Discussion**

The goal of this study was to longitudinally examine whether reading amount, as measured by TRT (Title Recognition Test), and schoolbook borrowing (the number of books borrowed from the school library), promotes the letter reading skills of Japanese schoolchildren.

**Relationship Between Reading Amount and the Letter Reading Skills of Japanese Schoolchildren**

In the hierarchical multiple regression analyses (Tables 3 and 4), we placed the Letter Reading score at G1 first to control the participants’ baseline letter reading skills. Our results indicated that the Letter Reading score at G1 predicted Letter Reading scores at G2 and G3 ($R^2 = 63.6\%$ and $29.4\%$, respectively) well. This is not surprising given prior findings concerning the accuracy of past literacy skills in predicting present literacy skills (Verhoeven, van Leeuwe, & Vermeer, 2011).

During our main analysis, we found that both measures of reading amount (TRT at G1 and schoolbook borrowing at G1) significantly predicted Letter Reading scores at G2 and G3 after partialling out the baseline (G1) Letter Reading score. This suggests that, in line with previous longitudinal studies involving children who speak languages other than Japanese (Cain & Oakhill, 2011; Echols et al., 1996; Hood et al., 2008; Sénéchal, 2006), extensive reading during a student’s first grade year promotes literacy skills (in this study, letter reading skills) at intervals of one or two year later. On the other hand, schoolbook borrowing at G2 (when participants were second grade students) and G3 (when participants were third grade students) did not significantly explain future letter-reading skills at G3 (Tables 3 and 4). Interestingly, a recent longitudinal survey indicated similar results (Ueda et al., 2017). Ueda et al. (2017) conducted the survey for schoolbook borrowing and changes in the reading comprehension skills of participants between their third and fourth grade years. As a result, it was discovered that schoolbook borrowing (in the nonfiction
genre) before the third grade year significantly explained changes in reading comprehension skills. However, schoolbook borrowing between the third and fourth grade years of participants did not significantly explain reading comprehension skill changes. That is, a time-lag effect was observed in this study. Further study of the time-lag effect on the relationship between schoolbook borrowing and literacy skills is needed.

Various mechanisms behind the relationship between reading books and the promotion of letter-reading skills can be supposed. For example, the presence of *furigana*, as described in the introduction, may be one of the factors accounting for the success of our study. In the case of *furigana*, children can train themselves by using a simple paired-associates form of learning. That is, they can recognize correct kanji-pronunciation (e.g., 大会; /taikai/) through the use of kanji that is paired with *furigana* (大). It is also possible that reading activity might encourage children to speak to their parents or teachers about letters, which will further increase their letter knowledge (Sénéchal, 2006; Sénéchal & LeFevre, 2002). This may help to explain the results of this study, and future studies should further examine these two possibilities.

**Comparison of Schoolbook Borrowing and TRT**

One of this study’s important contributions to education and psycholinguistic research is its use of schoolbook borrowing as a measure of reading amount, as well as its comparison to TRT, which has been used with elementary school students in many previous studies (Cunningham & Stanovich, 1990; Echols et al., 1996; Korat & Schiff, 2005). The correlation between these variables was positive, but it was relatively small and not significant, \( r = .18 \) (\( p > .10 \)). This result suggests that both measures capture quite different components of reading amount. This idea was supported by the hierarchical multiple regression analyses (Table 3). Even after controlling the reading amount measures (TRT in Model 2 and schoolbook borrowing in Model 3), each measure that was added (schoolbook borrowing in Model 2 and TRT in Model 3) either significantly or marginally significantly predicted Letter Reading scores at G2 and G3. In Model 3 in particular, TRT significantly predicted the Letter Reading score at G2 (\( \Delta R^2 = 5.5\% \)), even after the significance of the schoolbook borrowing explanation (\( \Delta R^2 = 3.3\% \)). These results suggest that a combination of TRT and schoolbook borrowing measurements improves accuracy when gauging the reading amount of children.

As a construct, schoolbook borrowing has several features that differentiate it from TRT or questionnaire indices of reading amount. First, it captures the book borrowing activity of participants rather than merely relying on their memories or questionnaire answers, which are both subject to biases. Second, the risk of bias is decreased because these data are recorded cumulatively over a long period. Third, it is easy for teachers to use, because the data are easily accessible in the school library. These features should make the assessment of schoolbook borrowing an appealing tool for use in literacy research. Nevertheless, no previous study has used schoolbook borrowing to elucidate the relationship between reading amount and literacy skills. Thus, our finding that schoolbook borrowing has unique predictive capacity in terms of examining future literacy skills (specifically, Letter Reading scores) contributes greatly to the existing research.
Furthermore, an interesting tendency is visible in the hierarchical multiple regression analyses (Table 3). For predicting the Letter Reading score at G2, TRT scores were superior to schoolbook borrowing. In contrast, for the Letter Reading score at G3, TRT performance and schoolbook borrowing frequency were almost identical, which indicates that schoolbook borrowing is a promising new index for predicting the long-term letter reading skill improvement of children. This finding has great implications for schoolteachers as they consider the schoolbook borrowing data and literacy skills of their students. Children who read more books are more likely to become good readers, even if teachers find no relationship between the numbers of books the children read and their literacy skills at that time.

Limitations

This study has three main limitations. First, this study was not able to measure some of the influential variables that might explain our results. For example, the home literacy environment can explain language development (Sénéchal, 2006; Sénéchal & LeFevre, 2002). If the participants of this study often read books because it was encouraged in the home, then it is possible that the learning of letters in a rich home literacy environment (not the reading books itself) was directly causal to the promotion of Letter Reading scores in this study. Of course, a rich home literacy environment usually involves reading activity, as was discovered by previous studies that measured the home literacy environment by using questionnaires that included questions about reading activity (e.g., Baker, 2013; Sénéchal, 2006; Sénéchal & LeFevre, 2002). However, we need to separate the learning of letters from “reading books” and “family education” in questionnaires for parents in future studies.

Furthermore, recognition skills are a covariate of TRT scores. TRT scores become high when the participants have high recognition skills, as well as if they have read many books. In order to resolve this problem, it may be effective to simultaneously measure TRT scores and recognition skills in the same survey. This is the platform of our future study.

The second limitation relates to the participants. As described in the “Descriptive Statistics” section, our participants are generally high achievers. This narrows the generalizability of our results for children at a lower achievement level. Therefore, we need to more sensitively analyze the effects of achievement level and education in future studies.

The third limitation is that this study considered only letter reading, not reading comprehension or other reading skills (e.g., vocabulary, syntax, spelling, and writing). To adequately reflect the effect of book reading on reading skill development, we will need to use these additional measures in future studies.

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