

Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

International Journal of Educational Research

journal homepage: www.elsevier.com/locate/ijedures

Factors linked to cultivating successful readers: Evidence from rural China



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ARTICLE INFO

Keywords:

Reading skills
Family environment
School environment
Parental input

ABSTRACT

In China, education gaps exist not only between rural and urban students, but also within the population of rural students. Evidence points to poor reading skills development as one possible factor in this gap. If reading skills are moderating variations in academic performance among rural students, what factors in the home and school environment lead some students to develop strong reading skills? Using data from 1870 primary school students in rural China, the results show considerable variation in student reading skills. The home environment is strongly linked to reading skills, whereas school factors are not positively associated with reading skills. These findings suggest that policies and programs to support student reading skills are needed in rural China.

1. Introduction

Early reading skills have been shown to influence the academic achievement of children throughout the course of their educational careers (Harris & Sipay, 1971). Reading helps students to develop critical thinking and comprehension skills that are foundational to learning in all subject areas (Jordan, Hanich, & Kaplan, 2003; Rutherford-Becker & Vanderwood, 2009; Thurber, Shinn, & Smolkowski, 2002). Furthermore, research has found that students who do not develop strong reading skills early in their education tend to fall behind academically, leading to poor employment and social outcomes later in life (Good, Simmons, & Kame'enui, 2001; Slavin, Lake, Chambers, Cheung, & Davis, 2009; Whitehurst & Lonigan, 2001).

The development of reading skills may be particularly important for students in rural China, where research has documented both poor reading skills and poor academic performance. Students in rural China overall show low levels of reading skills compared to both urban Chinese students and students in other countries (Gao et al., 2018; Yi et al., 2018). Additionally, rural students in China have worse academic achievement and attainment than their urban peers (Liu, Liu, Chang, & Loyalka, 2016; Loyalka et al., 2013; Yi et al., 2012), and there is evidence that poor reading skills may be one cause of the rural-urban education gap (Wang et al., 2015).

However, not all rural students in China are poor students or poor readers. Although studies have found that rural students have poor reading skills on average, a closer look at the research reveals a broad distribution of reading skills within the population of rural students (Gao, Shi, Yi, Abbey, & Rozelle, 2017). In other words, even in areas where average reading skills are low, there are both strong and weak readers in China's rural primary schools. Considering that reading skills in primary school are closely linked to academic performance (National Reading Panel, 2000; Slavin et al., 2009), it is possible that differences in reading skills may account for the variation in academic performance among China's rural students.

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<https://doi.org/10.1016/j.ijer.2020.101636>

Received 3 August 2019; Received in revised form 3 April 2020; Accepted 3 June 2020

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Such research raises the following question: If reading skills are indeed a cause of variation in academic performance among rural students, what factors lead some students to develop strong reading skills while others do not? International research has found that both the home and school environments can influence the development of reading skills among children. Within the home environment, factors such as the availability of age-appropriate books in the home have been empirically shown to drive the development of reading skills (Rutter, Tizard, & Whitmore, 1970; TIMSS & PIRLS International Study Center, 2016; Zhang, Su, Wang, & Wen, 2014). Additionally, parental education and household wealth are strongly predictive of whether students develop an interest in reading (Issa, Aliyu, Akangbe, & Adedeji, 2012; Owusu-Acheaw & Larson, 2014), good reading habits (Wen, Liang, & Liu, 2016), and ultimately, strong reading skills (Nergis, 2013).

The school environment also has a strong influence on the development of reading skills among students. Studies have found that effective teaching and guidance in reading from teachers creates a positive schoolwide reading environment for students (Rosenshine & Stevens, 1995; Taylor, Pearson, Peterson, & Rodriguez, 2005) and encourages students to become motivated, lifelong readers (Lucas, McEwan, Ngware, & Oketch, 2014). In addition, cross-national studies have demonstrated that students with better reading skills tend to come from schools with more reading resources (Ogunrombi & Adio, 1995; TIMSS & PIRLS International Study Center, 2016).

Although past research has examined reading at home and in school, few studies have attempted to distinguish the relative importance of the home and school environments for the development of reading skills. Further, to our knowledge, no study has examined these factors in rural China, where socioeconomic and political trends may moderate the role of family and school factors commonly associated with student reading skills. First, the family environment may have different correlations with student reading skills due to the high prevalence of parental out-migration to urban areas. Because of policies that restrict migrant children from attending urban public schools, many children are "left behind" in their rural homes, typically in the care of their paternal grandparents, when their parents out-migrate for work (Li, Loyalka, Rozelle, & Wu, 2017; Mu & Hu, 2016). This leads to two competing effects: increased family income and decreased parental care. On the one hand, increased income from parental migration would allow rural families to invest in more books and reading resources for children. On the other hand, because rural grandparents are often less educated and unprepared to support children's learning (Mu & Hu, 2016), the effects of increased family income may be offset by decreased support for reading at home.

Additionally, the low quality of teaching in China's rural schools may also change the relation of the school environment to student reading skills. Rural schools in China tend to have lower teaching quality than urban schools (Zhang & Campbell, 2015), and rural schools often struggle to retain quality teachers (Lei et al., 2018; Liu & Onwuegbuzie, 2012). Recent studies also suggest that rural teachers overall may not be equipped to teach good reading habits and skills to students (Gao et al., 2018; Yi et al., 2018).

At the same time, recent government investments promoting student reading may be gradually helping to improve reading skills among China's rural students. The "Standards for the Construction of Ordinary Primary and Secondary Schools in Rural Areas" (Ministry of Housing & Urban-Rural Development & National Development & Reform Commission of the People's Republic of China, 2008) stipulates that primary schools must have a library that can accommodate the number of classes and students in the school, with separate rooms for students to read and a large supply of books, magazines, and newspapers. However, to date, no research has addressed whether this increase in reading spaces and materials has been linked to improved reading skills among rural students. Understanding what factors may be linked to poor reading skills among students in rural China can help policymakers effectively allocate resources to improve reading skills and academic achievement.

In this paper, we compare the importance of family and school factors for the development of reading skills among students in rural China. Specifically, we seek to identify any differential effects of family and school characteristics on student reading skills. We hypothesize that both family and school characteristics will be significantly and positively correlated with student reading skills in rural China, with parental and teacher input playing important roles in reading skills development.

The remainder of the paper is structured as follows. Section 2 presents the methods used in the study, including sample selection, data collection, and statistical analysis. Section 3 presents and discusses the results of the study, focusing on the individual, family, and school factors that affect the development of reading skills among students in rural China. Section 4 concludes the paper.

2. Methods

2.1. Sampling

The data presented in this study were collected in four neighboring counties (Counties A, B, C, and D) within a northwestern province of China. This province is one of the poorest in the country, ranking 27 out of China's 31 provinces in terms of GDP per capita (National Bureau of Statistics of China, 2017). In 2016, the average per capita GDP of the four sample counties was \$4026 (RMB 26,733) (National Bureau of Statistics of China, 2017; Provincial Bureau of Statistics, 2017). This amount is lower than the national per capita GDP of \$8117 (RMB 53,899) (The World Bank, 2017). In addition, more than 80 % of the population of the four sample counties are rural residents (National Bureau of Statistics of China, 2017; Provincial Bureau of Statistics, 2017). For these reasons, the sample province and counties are relatively representative of poor rural areas across China.

We followed a two-step protocol to select our study sample. In the first step, we selected a representative sample of schools from the four sample counties. We obtained a list of all schools in County A from the local education bureau and randomly chose 30 schools for inclusion in our sample. Next, we obtained lists of schools in Counties B, C, and D and selected the 10 schools in each county that are closest to those of County A (which can be expected to have similar economic, cultural, and geographical characteristics to County A). In total, our sample included 60 schools in the four sample counties.

In the second step, we selected sample classes and students. We chose to conduct our study among Grade 5 students because the survey was conducted in September, which is the start of the new academic year; thus, Grade 5 students were recent Grade 4 graduates and therefore similar to the students in a previous Progress in International Reading Literacy Study (PIRLS). In each sample school, we selected one Grade 5 class, and all students in the class were included in our study sample. If the school had more than one Grade 5 class, one class was randomly selected, and all students in that class were included in the study sample. We also included all Chinese teachers in the sample classes. One teacher was excluded from the sample due to illness. Our final sample included a total of 1870 students and 59 teachers in 60 schools.

2.2. Data collection

Data were collected in September 2017, at the beginning of the 2017-2018 academic year. Our survey comprised four blocks. In the first block of the survey, students were administered a set of 30-minute standardized tests, all including a 30-minute standardized reading test, a 30-minute standardized mathematics test, and a 30-minute standardized Chinese test. Because the survey was conducted at the start of Grade 5, we use tests designed for students in Grade 4. All students were administered the reading test, which was designed by trained psychometricians and contained test items from PIRLS, an international test of reading comprehension used throughout the world (Caygill & Chamberlain, 2004; Cheung, Tse, Lam, & Ka Yee Loh, 2009; Mullis, Martin, & Gonzalez, 2004; Tunmer, Chapman, Greaney, Prochnow, & Arrow, 2013). The test questions were translated according to the PIRLS translation guidelines, and the content validity was reviewed by a panel of experts and local teachers with knowledge of China's education system. The translated reading tests then went through several rounds of pilot testing in classes in rural Chinese schools to validate the psychometric properties of the test and to ensure that the content was appropriate for the grade level of the sample students.

The tests in math and Chinese were carefully designed with assistance from educators in the local education bureaus to ensure compliance with the national curriculum. We pre-tested both exams multiple times to ensure their relevance and that time limits were appropriate. Within each school, we randomly assigned half of the sample students in each classroom to take the math test, while the other half of sample students took the Chinese test. In total, 958 students (51.2 %) took the reading and math tests, and 912 students (48.8 %) took the reading and Chinese tests. In our analysis, we normalized test scores for reading, math, and Chinese using the mean and distribution in the group. Estimated effects are therefore expressed in standard deviations (SD).

In the second block of the survey, we collected data on student individual characteristics. These characteristics included gender, age, and boarding status, as well as how much time each student spent on independent reading daily. To assess the amount of independent reading time, we asked students to select one of five answer options: 1) do not read books daily; 2) spend less than 30min on reading daily; 3) spend 30-59 min on reading daily; 4) spend 1-2 hours on reading daily, or 5) spend more than 2h on reading daily. For our analysis, we converted student responses into a binary variable of whether the student spent more than 30min on independent reading each day.

The third block of the survey measured the characteristics of sample households. Students were given a caregiver questionnaire and instructed to take the questionnaire home to be filled out by their primary caregivers. In this study, the primary caregiver is defined as the person in the family who is most often responsible for the child's care. In the case of left-behind children, whose parents had out-migrated to urban areas for work, the primary caregiver questionnaire was filled out by another family member, typically the child's grandparent. The caregiver questionnaire collected information on parental education levels (whether the each of student's parents graduated from middle school), left-behind child status (whether both parents had out-migrated for at least six of the past 12 months), the number of books in the home, whether the caregiver has ever bought books for the student, whether the caregiver discusses books with the student each month, and the value of family assets.

We also used the Parents Like Reading (PLR) assessment to collect information on whether the primary caregiver likes reading. The PLR was developed for the PIRLS test and the Trends in International Mathematics and Science Study (TIMSS). Both tests are well recognized as international comparative assessments of academic achievement (Mullis, Martin, Foy, & Drucker, 2012). Caregivers were given a list of seven statements about reading behaviors (see Appendix Table A1) and asked to respond to each statement using a 4-point scale (where 1 = strongly disagree and 4 = strongly agree). We then summed the scores for the seven statements to create a raw score for each caregiver's reading interest. The raw scores range from 0 (do not like reading) to 20 (strongly like reading). Based on the PIRLS cutoffs (TIMSS & PIRLS International Study Center, 2016), caregivers were considered to like reading if their raw scores were 8 points or higher.

The fourth block of the survey collected information on the characteristics of teachers and schools in our sample. We surveyed each Chinese teacher using the PLR to determine whether he or she likes reading. In addition, we collected data from school principals on the number of books in each school, whether students receive reading instruction, the school size and the pupil-teacher ratio.

2.3. Empirical strategy

We first run descriptive analyses of the student, family, and school background variables in our sample. Next, we describe the distribution of reading skills in the sample and conduct a *t*-test to compare the differences in academic performance between students who have strong reading skills and those who have weak reading skills. We also estimate the correlation between reading skills and academic performance (math and Chinese test scores) using ordinary least squares (OLS) as follows:

$$Y_{ij} = \alpha + \beta R_{ij} + \gamma C_{ij} + \varepsilon_{ij} \quad (1)$$

where Y_{ij} indicates the standardized math or Chinese score of student i in school j ; R_{ij} represents the standardized reading score of student i in school j ; and the vector represents student, family, and school characteristics described in our data collection subsection above. Student characteristics include gender, age in years, boarding status, and whether the student spends more than 30 min on independent reading daily. Family characteristics include the education level of parents, whether the student is a left-behind child, family asset index, whether the student's caregiver likes reading, number of children's books at home, whether caregivers have ever bought books for the student, and whether the student's family discusses books with the student monthly. School characteristics include whether the teacher likes reading, the number of children's book at school, and whether students receive reading instruction.

Third, we examine the relationships between reading skills and student, family, and school characteristics using the following OLS model:

$$R_{ij} = \alpha_0 + \beta_1 S_{ij} + \beta_2 F_{ij} + \beta_3 T_{ij} + \epsilon_{ij} \tag{2}$$

where R_{ij} represents the standardized reading test score of student i in school j ; S_{ij} is a vector that represents student characteristics; F_{ij} is a vector that represents family characteristics; and T_{ij} is a vector that represents school characteristics. All of these variables are consistent with the variables in Eq. (1). In Eq. (2), the coefficient β_1 represents the correlation between student reading skills and individual characteristics; β_2 represents the correlation between student reading skills and family characteristics; and β_3 represents the correlation between student reading skills and school characteristics.

3. Results

3.1. Descriptive statistics

Table 1 presents the summary statistics for students, families, and schools. The average age of students in the sample is 11 years. Slightly more than half (53 %) of the students are male, and 16 % board at school. One third (33 %) of mothers and 54 % of fathers graduated from middle school, meaning that the majority of parents have completed nine or fewer years of education. About 31 % of students are left-behind children (meaning both parents have out-migrated for work). Among caregivers, 57 % like reading, and 54 % discuss books with their child at least monthly. In addition, 79 % of families have bought books for their child, and 44 % of families have more than 10 children's books at home.

Regarding school characteristics, the vast majority (92 %) of teachers like reading. The reading resources in sample schools, however, are limited. Only 44 % of sample schools have more than 10 children's books, and only 60 % offer reading instruction for students.

3.2. Reading skills and academic achievement in Rural China

The data presented in Table 1 show that half (50 %) of the sample students spend more than 30 min on independent reading daily. However, we find that students in rural China exhibit low levels of reading skills compared to urban and rural students in other countries. Fig. 1 shows the reading skills of the sample students compared to students in the 44 countries and regions that participated in PIRLS. The students in our sample rank 39 out of 45, with reading skills equivalent to students in Qatar and Saudi Arabia.

Although our sample shows low levels of reading skills on average, we find considerable variation in reading skills within the

Table 1
Demographic Characteristics of the Sample ($N = 1870$).

Variable	Mean	Std. Dev.
Student		
Age (years)	11.00	0.86
Gender (1 = male)	0.53	0.50
Boarding status (1 = boarding at school)	0.16	0.36
Spends more than 30 min on independent reading daily (1 = yes)	0.50	0.50
Family		
Mother's education (1 = middle school and above)	0.33	0.47
Father's education (1 = middle school and above)	0.54	0.50
Left-behind children (1 = both parents migrated)	0.31	0.46
Family asset index	-0.01	1.09
Caregiver likes reading (1 = yes)	0.58	0.49
Number of children books at home (1 = more than 10 books)	0.44	0.50
Caregivers have bought books for the student (1 = yes)	0.79	0.41
Family discusses books with student monthly (1 = yes)	0.54	0.50
School		
Chinese teacher likes reading (1 = yes)	0.92	0.27
Number of children's books at school (1 = more than 100 books)	0.50	0.50
Students receive reading instruction (1 = yes)	0.60	0.49
School size (1 = larger than mean)	0.39	0.49
Pupil-teacher ratio(1 = larger than mean)	0.30	0.46

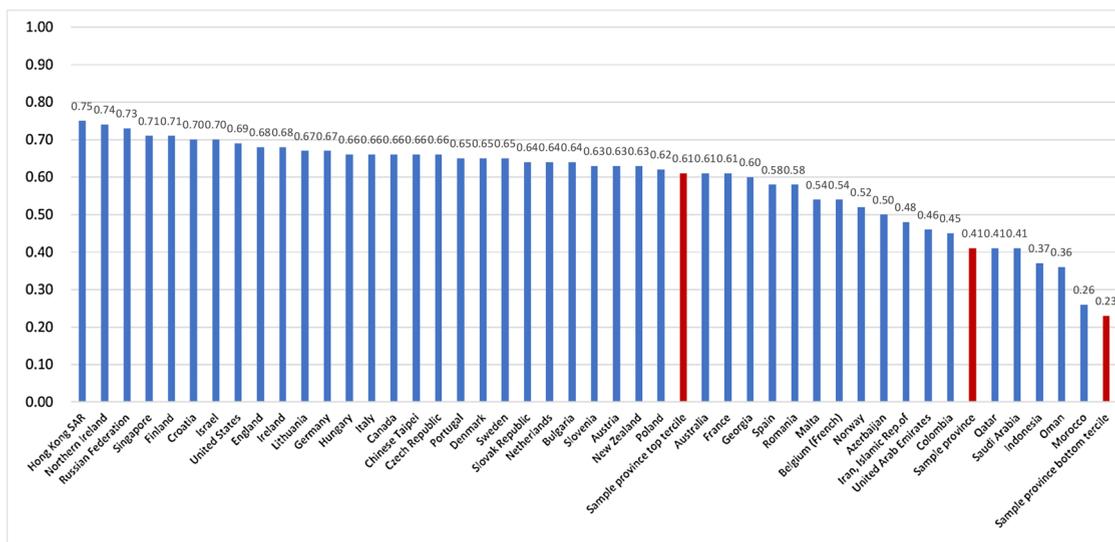


Fig. 1. Reading test scores of students from rural China compared to those of students from other countries/regions. *Note.* The reading scores were calculated using reading scores of Grade 5 students in a rural northwestern province of China. The results are drawn from the reading test items from the PIRLS study. Source: Progress in International Reading Skills (PIRLS) Study and authors' data.

sample. When we divide sample students into terciles by reading skills, we find that students in the top tercile of reading skills are relatively strong readers. Compared to students in other countries in the PIRLS survey, students in the top tercile of our sample rank 28 out of 45, with the same levels of reading skills as students in France and Australia. In contrast, the bottom tercile of readers in our sample scored lower than students in all 44 countries assessed in the PIRLS survey.

Furthermore, students in the top tercile of reading skills have significantly better academic performance than do students in the bottom tercile (Appendix Table A2). We also conduct a multivariate analysis of the correlations between reading skills and math and Chinese scores, controlling for student, family, and school characteristics (Appendix Table A3). The results confirm that reading skills are significantly and positively correlated with academic performance even after controlling for potential confounders. This is consistent with much of the literature, which has found a close association between reading skills and academic performance (Clark & Rumbold, 2006; Cox & Guthrie, 2001; National Reading Panel, 2000; Slavin et al., 2009).

3.3. Correlates of reading skills in rural China

To determine which student, family, and school characteristics are correlated with reading skills among sample students, we first compare the characteristics of students in the top and bottom terciles of reading skills (Table 2). We find that female students are significantly more likely to be in the top tercile than are male students in our sample ($p < .01$). We also find that students in the top tercile of reading skills are significantly more likely to spend more than 30 min on independent reading per day ($p < .01$). When we examine this variable more closely, we find that students who do not read daily or who spend less than 30 min reading daily are significantly more likely to be in the bottom tercile of reading skills ($p < .10$, $p < .05$, respectively). In contrast, students who spend more than 2 h on independent reading daily are significantly more likely to be in the top tercile ($p < .05$).

We also find that several family characteristics are correlated with better reading skills. Students whose mothers and fathers have a middle school education or higher are significantly more likely to be in the top tercile of reading skills ($p < .01$), as are students from families with higher levels of family assets ($p < .05$). Students whose caregivers like reading are also more likely to be in the top tercile of reading skills ($p < .01$). In addition, students whose families have ever bought them books and students whose families discuss books with them are more likely to be in the top tercile of reading skills ($p < .05$, $p < .01$, respectively). In contrast, we find that only one school characteristic is associated with reading skills: Students who receive reading instruction are significantly more likely to be in the bottom tercile of reading skills compared to students who do not receive reading instruction ($p < .05$).

To further investigate these differences, we conduct a multivariate analysis to examine the correlations between student, family, and school characteristics and student reading skills (Table 3). Overall, the results of this analysis are the same as those in Table 2: Reading skills are significantly and positively correlated with being female and spending more than 30 min on independent reading daily, as well as with parental education, family asset index, caregiver likes reading, families have ever bought books for the student, and families discuss books with the student. Further, the results of our multivariate analysis find a significant negative correlation between left-behind child status and reading skills. Specifically, left-behind children score 0.11 SD lower in reading than do children with at least one parent at home ($p < .05$).

These results indicate the importance of the family environment, and particularly parental input, for the development of reading skills. Caregivers liking reading, buying books for their children, and discussing books with children, are all linked to significantly

Table 2
Characteristics of Students in the Top and Bottom Tertiles of Reading Skills.

Variable	Top Tertile (1)	Bottom Tertile (2)	Difference (1) - (2)	p-value
Student				
Age (years)	10.97 (0.74)	11.05 (1.02)	-0.09	0.10
Gender (1 = male)	0.47 (0.50)	0.59 (0.49)	-0.12***	0.00
Boarding status (1 = boarding at school)	0.19 (0.39)	0.16 (0.36)	0.03	0.12
Student spends more than 30 min on independent reading daily (1 = yes)	0.55 (0.50)	0.44 (0.50)	0.11***	0.00
Student does not read books every day (1 = yes)	0.08 (0.28)	0.12 (0.32)	-0.03*	0.08
Student spends less than 30 min on independent reading daily (1 = yes)	0.37 (0.48)	0.44 (0.50)	-0.08**	0.01
Student spends 30-59 min on independent reading daily (1 = yes)	0.37 (0.48)	0.30 (0.46)	0.07**	0.02
Student spends 1-2hours on independent reading daily (1 = yes)	0.09 (0.29)	0.08 (0.27)	0.01	0.53
Student spends more than 2h on independent reading daily (1 = yes)	0.09 (0.29)	0.06 (0.23)	0.03**	0.04
Family				
Mother's education (1 = middle school and above)	0.42 (0.49)	0.27 (0.45)	0.15***	0.00
Father's education (1 = middle school and above)	0.60 (0.49)	0.47 (0.50)	0.13***	0.00
Left-behind children (1 = both parents migrated)	0.29 (0.46)	0.33 (0.47)	-0.03	0.22
Family asset index	0.07 (1.11)	-0.07 (1.06)	0.13**	0.03
Caregiver likes reading (1 = yes)	0.62 (0.48)	0.49 (0.50)	0.13***	0.00
Number of children books at home (1 = more than 10 books)	0.46 (0.50)	0.44 (0.50)	0.03	0.35
Caregivers have bought books for the student (1 = yes)	0.81 (0.39)	0.76 (0.43)	0.05**	0.03
Family discusses books with student monthly (1 = yes)	0.58 (0.49)	0.50 (0.50)	0.08***	0.00
School				
Chinese teacher likes reading (1 = yes)	0.93 (0.25)	0.91 (0.28)	0.02	0.30
Number of children's books at school (1 = more than 100 books)	0.49 (0.50)	0.51 (0.50)	-0.01	0.67
Students receive reading instruction (1 = yes)	0.54 (0.50)	0.62 (0.49)	-0.08**	0.01
School size (1 = larger than mean)	0.93(0.25)	0.91(0.28)	0.02	0.30
Pupil-teacher ratio(1 = larger than mean)	0.49(0.50)	0.51(0.50)	-0.01	0.67

Note. Standard deviation in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

better reading skills among students in our sample. This is consistent with past research, which has found that family input in reading—such as investing in books, encouraging independent reading, and reading together as a family—significantly raises the reading skills of students (Campbell, Voelkl, & Donahue, 1997; Christenson, Rounds, & Gorney, 1992; Christian, Morrison, & Bryant, 1998; Davis-Kean, 2005; Sukhram & Hsu, 2012), and that having books and resources readily available provides students with opportunities to read and practice their skills at home (Morrow, 1999; Vanobbergen, Daems, & Van Tilburg, 2009; Weigel, Martin, & Bennett, 2006). A lack of family input in reading may also be driving the poor reading outcomes of left-behind children in our sample. International research indicates that left-behind children and students whose parents have lower levels of education are more likely to underperform in reading, suggesting that low parental input in reading, due either to low parental skill or parental absence, may limit students from developing strong reading skills (Mullis et al., 2012; National Center for Education Statistics, 2011; Pretorius & Currin, 2010; Stanovich, 2009; van Bergen, van Zuijen, Bishop, & de Jong, 2017).

Whereas family characteristics overall show significantly positive correlations with student reading skills, the relationship between school characteristics and reading skills is much less apparent among our sample. Only one school characteristic is positively correlated with reading skills in our multivariate analysis: After controlling for student, family, and school characteristics, we find that students whose Chinese teachers like reading score 0.17 SD higher in reading than do students whose Chinese teachers do not like reading ($p < .10$). This result is supported by past research, which has found teachers to be role models who can promote student reading skills (Lucas et al., 2014; Pierre, 2012; Rosenshine & Stevens, 1995; Taylor et al., 2005).

However, consistent with Table 2, we find that students who receive reading instruction score 0.13 SD lower in reading than students who do not receive reading instruction ($p < .01$). We also find no significant correlation between the number of children's books at school and student reading skills. These two findings contradict international research, which has overall shown positive correlations between school resources, classroom instruction, and student reading skills (Greenwald, Hedges, & Laine, 1996). The results are, however, supported by previous research of interventions promoting student reading in rural China, which have found that providing reading resources and instruction has no effect on student reading skills or academic achievement (Yi et al., 2018).

One possible reason for this noticeable lack of positive correlations between school reading resources and student reading skills is that age-appropriate reading resources are limited. As we see in Table 1, half of the schools in our sample have more than 100 children's books, and more than half of the sample schools provide reading instruction. Nevertheless, a study of schools in rural China by Gao et al. (2017) found that, although many rural schools have libraries and books, students often have limited access to books in school libraries, and most reading materials in school libraries are not age-appropriate for primary school students. Additionally, Gao et al. (2018) found that rural teachers often lack reading materials specifically tailored to the needs and interests of students, without which reading instruction may not be able to engage students well enough to improve their reading skills. Taken together with the findings of previous studies, our results indicate that although the school environment has the potential to improve student reading skills, schools in rural China do not have the resources to support reading skills development.

Table 3
OLS Regression of Student, Family, and School Characteristics on Reading Skills.

Variable	Standardized Reading Test Score			
	(1)	(2)	(3)	(4)
Student				
Age (years)	-0.06** (0.03)			-0.03 (0.03)
Gender (1 = male)	-0.18*** (0.05)			-0.18*** (0.05)
Boarding status (1 = boarding at school)	0.12* (0.06)			0.08 (0.06)
Student spends more than 30 min on independent reading daily (1 = yes)	0.22*** (0.05)			0.23*** (0.05)
Family				
Mother's education (1 = middle school and above)		0.20*** (0.05)		0.19*** (0.05)
Father's education (1 = middle school and above)		0.19*** (0.05)		0.18*** (0.05)
Left-behind children (1 = both parents migrated)		-0.10* (0.05)		-0.09** (0.05)
Family asset index		0.01 (0.02)		0.01 (0.02)
Caregiver likes reading (1 = yes)		0.24*** (0.05)		0.23*** (0.05)
Number of children books at home (1 = more than 10 books)		0.03 (0.05)		0.01 (0.05)
Caregivers have bought books for the student (1 = yes)		0.16*** (0.06)		0.13** (0.06)
Family discusses books with student monthly (1 = yes)		0.19*** (0.05)		0.21*** (0.05)
School				
Chinese teacher likes reading (1 = yes)			0.14 (0.09)	0.17* (0.09)
Number of children's books at school (1 = more than 100 books)			-0.00 (0.05)	0.00 (0.05)
Students receive reading instruction (1 = yes)			-0.14*** (0.05)	-0.13*** (0.05)
School size (1 = larger than mean)			-0.05 (0.06)	-0.05 (0.05)
Pupil-teacher ratio (1 = larger than mean)			0.01 (0.05)	0.01 (0.05)
Constant	0.58* (0.30)	-0.51*** (0.07)	-0.02 (0.09)	-0.26 (0.32)
Observations	1870	1870	1870	1870
R-squared	0.025	0.051	0.005	0.078

Note. Standard deviation in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

4. Conclusion

This study examined the relative importance of the home and school environments for the development of reading skills among students in rural China. Using data from 1870 primary school students in rural northwestern China, we first described the overall reading skills of primary school students in rural China as well as the variation in reading skills and academic performance among sample students. We then conducted descriptive and multivariate analyses to identify correlations between family and school characteristics and student reading skills.

According to our data, primary school students in rural China, on average, have low levels of reading skills. However, we find that there is notable variation in reading skills, which corresponds to variations in academic performance. The family environment plays a significant role in the development of reading skills among students: reading skills are significantly and positively correlated with socioeconomic status, including parental education levels and family asset index, as well as parental input, including whether caregivers like reading, whether families have ever bought books for the student, and whether the family discusses books with the student. Reading skills also are negatively correlated with parental migration status, possibly due to reduced family input.

In contrast, the school reading environment is, overall, not positively correlated with student reading skills. This is an unusual finding, as most of the international literature has found that the school environment is positively linked to reading skills. Our results also show that there are negative correlations between school characteristics and student reading skills, which contradicts previous research. Although we cannot identify the cause of the insignificant and negative relationships that we observe, evidence from past

research in rural China suggests that this relationship may be due to a lack of age- and needs-appropriate reading resources for rural students (Gao et al., 2017, 2018; Yi et al., 2018), indicating a need for more investment in effective in-school reading materials and instruction.

In fact, China's government already has begun to take action to improve the school reading environment. In December 2016, the Chinese government issued its first National Development Plan for Reading during the 13th Five-Year Plan ("[National Development Plan for Reading](#)", 2016). This plan states that improving literacy among young children and reducing inequality in access to reading resources between rural and urban residents are national priorities. These policy efforts, including improving school libraries, are geared toward meeting the basic reading needs of all children, including low-income children ("[National Development Plan for Reading](#)", 2016).

Recent efforts will likely have a positive effect on the reading skills of students; however, we believe that our findings indicate a need for even more effective policies and greater investment to support student reading skills development in China, especially in rural areas. We recommend that policymakers work with educators and families to develop reading programs that increase age-appropriate books in schools and homes, create a supportive campus reading environment through engaging reading activities for students, and strengthen teacher training to improve teachers' abilities to teach reading skills at school. In addition, in consideration of the importance of the family environment in the development of reading skills, we recommend that rural schools implement programs for home-school cooperation to support family reading. Such programs could teach parents how to foster a family environment that encourages reading interest and good reading habits as well as how to choose age-appropriate books for children. The government should invest in providing more formal opportunities for caregivers and their children, starting with effective reading instruction, to raise academic performance and reduce the rural-urban gap in educational outcomes.

This study makes two contributions to the literature. First, ours is the first study to examine factors linked to the development of reading skills in the context of rural China. Second, this study compares the correlations between family and school factors and student reading skills to understand how each environment relates to student reading skills development. Few studies have examined the relative important of the family and school environments for the development of student reading skills in any environment. While our finding that the family environment is positively linked to better reading skills is consistent with the literature, our finding that the school environment is overall uncorrelated with student reading skills is surprising and points to a need for more research into ways that schools in rural China can effectively support student reading.

Finally, we also acknowledge two limitations to this study. First, as this study draws on cross-sectional data, we are unable to identify causal relationships between family and school factors and student reading skills. Additionally, our data focus on a relatively narrow age range in rural northwestern China, meaning that our findings are not necessarily generalizable to other contexts or age groups. Future research should use large-scale panel data to identify broad trends and causal relationships between the family and school environments and student reading skills across rural China.

Acknowledgement

The authors are supported by the Fundamental Research Funds For the Central Universities [2017TS053] and 111 Project [B16031].

Appendix A

Table A1
PIRLS 2011 Parents Like Reading Scale.

Item	Strongly agree	Somewhat agree	Somewhat disagree	Strongly disagree
A-1 I read only if I have to	1	2	3	4
A-2 I like talking about what I read with other people	1	2	3	4
A-3 I like to spend my spare time reading	1	2	3	4
A-4 I read only if I need information	1	2	3	4
A-5 Reading is an important activity in my home	1	2	3	4
A-6 I would like to have more time for reading	1	2	3	4
A-7 I enjoy reading	1	2	3	4

Table A2
Difference in Academic Performance between Top and Bottom Tercile Readers.

Academic Performance	Top Tercile	Bottom Tercile	Difference	p-value
Math test score (standardized)	0.74 (0.13)	0.55 (0.17)	0.20	0.00
Chinese test score (standardized)	0.67 (0.15)	0.38 (0.19)	0.30	0.00

Table A3
Relationship between Reading Skills and Academic Performance ($N = 1870$).

Variable	Math Test Score (Standardized)		Chinese Test Score (Standardized)	
	(1)	(2)	(3)	(4)
Standardized reading test score	0.53*** (0.03)	0.52*** (0.03)	0.63*** (0.03)	0.59*** (0.03)
Age (years)		-0.02 (0.03)		-0.04 (0.03)
Gender (1 = male)		0.19*** (0.06)		-0.38*** (0.05)
Boarding status (1 = boarding at school)		-0.02 (0.08)		-0.00 (0.07)
Student spends more than 30 min on independent reading daily (1 = yes)		0.02 (0.06)		0.07 (0.05)
Mother's education (1 = middle school and above)		-0.06 (0.06)		0.06 (0.06)
Father's education (1 = middle school and above)		0.10* (0.06)		0.05 (0.05)
Left-behind children (1 = both parents migrated)		-0.02 (0.06)		0.03 (0.05)
Family asset index		0.06** (0.03)		-0.03 (0.02)
Caregiver likes reading (1 = yes)		0.14** (0.06)		0.11*** (0.05)
Number of children books at home (1 = more than 10 books)		-0.09 (0.06)		-0.01 (0.06)
Caregivers have bought books for the student (1 = yes)		0.23*** (0.07)		0.25*** (0.07)
Family discusses books with student monthly (1 = yes)		0.16*** (0.06)		-0.04 (0.05)
Chinese teacher likes reading (1 = yes)		-0.10 (0.11)		-0.20* (0.10)
Number of children's books at school (1 = more than 100 books)		0.05 (0.06)		0.02 (0.05)
Students receive reading instruction (1 = yes)		0.08 (0.07)		0.08 (0.06)
School size (1 = larger than mean)		0.06 (0.06)		0.04 (0.05)
Pupil-teacher ratio (1 = larger than mean)		-0.01 (0.06)		0.11** (0.06)
Constant	0.01 (0.03)	-0.17 (0.38)	-0.02 (0.03)	0.39 (0.36)
Observations	958	958	912	912
R-squared	0.288	0.327	0.389	0.453

Note. All sample students ($N = 1870$). Sample students took either the standardized math ($n = 958$) or Chinese ($n = 912$) exam. Standard deviation in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

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