

Influences of Family Environment on Students' Reading Ability: the Mediating Effects of Reading Interest, Reading Confidence and Reading Behaviour

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Abstract: Reading is the most important foundation of lifelong education. Based on this context, taking the improvement of children's reading ability in rural areas as the starting point, a field study was conducted on 9730 primary school students and their families in J Province to systematically and rigorously describe the status of children's reading ability. The influence of family environment on children's reading ability was analyzed by OLS regression in this research, and the intrinsic mechanism of family environment affecting children's reading ability was explored using structural equation models. The research results are as follows: First, the father's education level, the main caregivers' interest in reading, the family book collection, and the purchase of extracurricular books for children have significantly positive effects on children's reading ability. Second, the influences of family environment on children's reading ability are achieved through reading interest, reading confidence and reading behaviour. This research helps to fill the gaps in education, promote the improvement of the family environment, and provide an actionable empirical basis for improving the quality of rural children's education and ensuring their growth and development.

1. Introduction

In the process of China targeted poverty alleviation in education, it can be observed that the hardware facilities of schools and the economic environment of families have been significantly improved for the children in impoverished rural areas. But whether the investment and improvement of hardware is effective in enhancing students' learning ability and education quality? Therefore, this study focuses on the "reading ability" of children in impoverished rural areas and examines whether and how the family environment and school environment affect the reading ability of primary school students through a systematic and rigorous research.

Reading is the foundation and guarantee for learning other disciplines such as mathematics and science and is the necessity for the continued growth and development of human capital throughout one's life.^{[1][2][3]} Reading to extract information from text, gain value experiences, and form personal opinions also has a significant impact on the proper understanding and expression of mathematics and science.^{[4][5][6]} Reading during adolescence is particularly important while it directly influences students' independent learning ability and life-long learning ability, and even eventual educational attainment.^{[7][8][9][10]}

Reading ability is influenced by many factors. Some studies have shown that factors such as parents' education level, parents' occupation, parents' reading communication with their children, family income, family possessions, and family book collection all play an important role in the development of students' reading ability. Family environment is an important influencing factor for students' interest in reading, and the differences in family environment also have a great impact on students' reading habits.^{[11][12]} At the same time, students' reading confidence is closely related to their reading ability while the higher students' reading confidence is, the more they have stronger reading ability and more motivation to read and can continuously improve their reading ability.^[13-18] Personal interest in reading is also a direct influence factor on the development of reading ability.^[19]

Bradley and Corwyn’s study found that the family environment does not directly influence students’ development, but acts through a series of mediating variables.^[20] Patrick, Skinner, and Connell showed that individuals’ behaviour is more engaged when the social context supports the satisfaction of their psychological needs.^[21] Thus, reading confidence, reading interest, and reading behaviour satisfy the conditions for examining mediating variables,^[22] so it is especially important to explore the mediating role of reading confidence, reading interest and reading behaviour in the family environment and reading ability.

Therefore, this study intends to take primary school students in rural areas of China, and 9730 rural primary school students were selected to measure their family environment, reading confidence, reading interest, reading behaviour, reading ability and parents’ reading through a survey of students and parents. Firstly, this study is to describe the status of students’ reading ability. Secondly, the correlation between family environment and reading ability is analyzed using OLS regression. Finally, this study analyzes the intrinsic mechanism of family environment on reading ability by using the mediating effect method to explore the influential role of reading interest, reading confidence and reading behaviour in the relationship between family environment and reading ability.

2. Method

2.1 Sampling

In this study, each county in the sample area of J Province was ranked according to its 2018 per capita income value and the counties with the lowest ranking, which is the poorest counties, were selected as the sample counties. According to the list of all rural primary schools provided by the education department of sample counties, the sample schools were selected randomly. In the process of selecting the sample schools according to the project objectives, two conditions need to be observed: First, school located in counties or schools with students mainly from rural areas; Second, schools with less than 90 students were excluded from the sample. Ultimately, 118 sample schools were selected, of which 57 (48.30%) were located in sample County A, 33 (27.97%) were located in sample County B, and 28 (23.73%) were located in sample County C (See Table 1).

Once the sample schools were identified, the second step was to randomly select sample classes from the fourth and fifth grades in each sample school. Considering the project budget and field implementation constrains, a maximum of two sample classes were selected from each grade in sample schools. It means that if there were only two or less than two classes in the sample grades, then all classes were included in the sample; if there were more than two class in sample grades, then two classes were randomly selected. All students in the sample classes were included in the study sample.

Table 1. Distribution of sample (N=9730)

	Number of sample schools	Number of sample students
County A	57	4584
County B	33	3237
County C	28	1909
Total	118	9730

2.2 Data Sources

All sample students received a standardized reading test, which lasted 30 minutes. The test was administered using test questions common to The Progress in International Reading Literacy Study (PIRLS), which is an international test of reading comprehension widely used worldwide.^[23-26] The test questions were rigorously translated according to PIRLS translation standard and the content validity were reviewed by a number of domestic pedagogical professors and local teachers. This translated version of the reading test has been repeatedly tested and measured in rural China to make sure that the content was appropriate for the level of the sample students.

The student questionnaire consisted of two parts: individual information and family environment. The individual information included gender, age, school residence, reading confidence, reading

interest, and reading behaviour (whether they read more than 30 minutes per day). Among these, The Students Confident in Reading (SCR) scale from the TIMSS and PIRLS 2016 Context Questionnaire Scales was used to measure students' reading confidence. A total of 7 questions while each question has 4 answers (1=strongly disagree; 2=somewhat disagree; 3=somewhat agree; 4=strongly agree), and 4 reverse questions. The raw scores were calculated by summing the score of answers. The Students Like Reading (SLR) scale from TIMSS and PIRLS 2016 Context Questionnaire Scales was used to measure reading interest of students. A total of 8 questions, 1 of which were reversed. The answers and statistics are the same as those of the SCR scale.

Family questionnaire was completed by students, including parents' educational level (whether father/mother graduated from junior high school), whether the students were a left-behind student (both parents were working outside) and family assets^[27]. Besides, the number of extracurricular books in students' family, whether students' family bought books for him/her monthly and whether the primary caregiver enjoyed reading were also collected. Among them, durable goods (physical goods owned by the family such as vans, color TVs, washing machines, refrigerators, etc.) of the students' family were used as an indicator of the family's economic status.

The parent questionnaire was completed by the primary caregiver in the family. This study used the Parents Like Reading (PLR) scale from TIMSS and PIRLS 2011 Context Questionnaire Scales, which consists of 8 questions with 4 answers each (1=strongly disagree; 2=somewhat disagree; 3=somewhat agree; 4=strongly agree), with 2 reverse questions. The raw scores were calculated by summing the answers' scores. The answer to question 8 is the frequency option (1=every day or almost every day; 2=once or twice a week; 3=once or twice a month; 4=never or almost never). The statistics are based on the accumulation of the raw scores.

2.3 Empirical Strategy

After descriptive statistics of all pairs of variables involved in the research, OLS regression was used as the specific data analysis method in this study. The specific model settings are as follows:

$$R_{ij} = \alpha_0 + \beta_1 F_{ij} + \beta_2 S_{ij} + \varepsilon_{ij} \quad (1)$$

The dependent variable, R_{ij} , indicates the standardized reading score of the student i in school j . F_{ij} indicates the family characteristics variables, including the education level of the parents (equals 1 if the father/mother has graduated from middle school or above, and 0 if the father/mother has not graduated from middle school or below), whether the student is left-behind child (equals 1 if both parents migrate and 0 if either parent is at home), family assets index (family asset value), whether the mainly caregiver likes reading (equals 1 if likes reading and 0 if not); the number of children's books at school (equals 1 if more than 100 books and equals 0 if 100 books or fewer), whether the family has bought extracurricular books for the student (equals 1 if yes and 0 if no); whether discuss reading books with students (equals 1 if yes and 0 if no). S_{ij} represents student characteristics, including student gender (equal to 1 if the variable is male and 0 if it is female), student age (in years), boarding status (equals 1 if the student is boarding and 0 if the student is non-boarding), whether the student likes reading (equals 1 if yes and 0 if no), whether the student has confidence (equals 1 if yes and 0 if no), whether the student reads more than 30 minutes per day (equals 1 if yes and 0 if no).

2.4 Mediating Effect Model

Considering family environment as the independent variable X has a certain influence on the dependent variable Y , this paper assumes that "family environment" influences "students' reading confidence, reading interest, and reading behaviour", which then influences "students' reading ability". Therefore, the following regression model can be used to describe the relationship between the variables (Zhonglin Wen & Baojuan Ye, 2014):

$$Y = cX + e_1 \quad (2)$$

$$M = aX + e_2 \quad (3)$$

$$Y = cX + bM + e_3 \quad (4)$$

Among these models, the total effect of the independent variable X on the dependent variable Y is the coefficient c in equation (2); the coefficient a of equation (3) is the effect of the independent variable X on the mediating variable M ; the coefficient b of equation (4) is the effect of the mediating variable M on the dependent variable Y after controlling for the effect of the independent variable X ; the direct effect of the independent variable X on the dependent variable Y is the coefficient c' after controlling for the effect of the mediating variable M ; and $e_1 \sim e_3$ are the regression residuals. For such a mediated model, the mediating effect is equal to the indirect effect, which is equal to the product of coefficients ab , and it has the following relationship with the total and direct effects.^[28]

3. Results

3.1 Descriptive Statistics

Table 2 indicates the summary statistics about students and families in the sample. Slightly more than half (51%) of the students are male and 10% of them choose to board at school. Only 10% of mothers and 14% of fathers graduated from middle school, representing that most of parents have completed nine or fewer years of education. For 73% of students are considered left-behind children in that their parents have migrated for work. About students' mainly caregivers, 50% of them like reading and 36% discuss books with their children. In addition, 60% of families have purchased books for their children and only 32% have more than 10 books for children at home.

Table 2 Demographic Characteristics Of the Sample (n = 9,730)

Variable	Mean	Std. Dev.
Student		
Age(years)	10.86	0.84
Gender (1=male)	0.51	0.50
Boarding status (1=boarding at school)	0.10	0.30
Students' reading confidence (1=yes)	0.76	0.43
Students like reading (1=yes)	0.73	0.45
Students' reading beyond 30 minutes daily (1=yes)	0.65	0.48
Family		
Mother's education (1=middle school and above)	0.10	0.30
Father's education (1=middle school and above)	0.14	0.35
Left-behind children (1=both parents migrated)	0.73	0.44
Family asset index	-0.00	1.03
Caregiver likes reading (1=yes)	0.50	0.50
Number of children books at home (1=more than 10 books)	0.32	0.47
Caregivers have bought books for the student (1=yes)	0.60	0.49
Family discusses books with student (1=yes)	0.36	0.48

3.2 Correlates of Reading Ability in Rural China

This research conducts a multivariate analysis to examine the correlations between student, family and reading ability of student. Reading ability is significantly and positively correlated with family asset index, number of children's book at home, age, student spends more than 30 minutes on daily, student reading confidence, and student reading interest. Further, a significantly negative correlation between parental migration and reading ability is dig out in the results of multivariate analysis. Specially, male students 0.6227 SD lower in reading than female ($p < 0.01$), and whose mother has low education level 1.303 SD lower than other students ($p < 0.01$) (See Table 3).

Table 3 Ols Regression of Family and Students Characteristics on Reading Ability

Variable	Standardized Reading Test Score		
	(1)	(2)	(3)
Family			
Father's education (1=middle school and above)	-0.5992*** (0.2202)	-0.2382 (0.1920)	-0.2797 (0.1855)
Mother's education (1=middle school and above)	-1.8886*** (0.2524)	-1.3124*** (0.2468)	-1.3037*** (0.2356)
Caregiver likes reading (1=yes)	-0.3074** (0.1411)	-0.1280 (0.2104)	-0.4376 (0.1990)
Family asset index	0.1091 (0.0698)	0.3187*** (0.0822)	0.2764*** (0.0796)
Number of children's book at home (1=more than 10 books)	1.7846*** (0.1534)	1.5617*** (0.1938)	1.3415*** (0.1763)
Caregivers have bought books for the student (1=yes)	0.2328 (0.1483)	0.1550 (0.2013)	-0.1104 (0.1972)
Family discusses books with student (1=yes)	-0.0230 (0.1521)	0.1464 (0.1944)	-0.2767 (0.1840)
Students			
Age (years)		3.0486*** (0.1180)	3.0228*** (0.1220)
Gender (1=male)		-1.0056*** (0.1523)	-0.6227*** (0.1473)
Boarding status (1=boarding at school)		-0.2546 (0.3505)	-0.1918 (0.3324)
Left-behind children (1=both parents migrated)		-0.0538 (0.1623)	-0.0043 (0.1544)
Student spends more than 30 minutes on daily (1=yes)			1.0182*** (0.2126)
Student has confidence in his/her reading ability (1=yes)			2.2596*** (0.1685)
Student likes reading (1=yes)			1.4797*** (0.1951)
Strata (county) Fixed Effect	No	No	Yes
Constant	10.7921*** (0.1384)	-21.9069*** (1.2525)	-25.1876*** (1.2864)
Observations	9,730	9,730	9,730
R-squared	0.0231	0.1561	0.2041
Note: *** p<0.01, ** p<0.05, * p<0.1			

3.3 Multiple Mediation Models

In order to explore intrinsic mechanisms of influence, multiple mediating variables need to be examined to clearly reveal mechanisms by which family environment influences reading ability. Therefore, the hypothesis of the study was that reading confidence, reading interest, and reading behaviour play multiple mediating roles in family background and reading ability. According to the test procedure for mediating effects,^{[29][30]} AMOS 26.0 was used to construct the model and conduct the data analysis.

In the model analysis, χ^2 , CFI, TLI, and RMSEA indicates the fit indices of the model. The larger the value of χ^2 , the worse the fit, and the smaller the value of χ^2 , the better the fit; the closer the CFI and TLI are to 1, the better the fit; the upper limit of RMSEA should be less than 0.08 (Wang at el., 2012; Bentler, 1990). The analysis of the results found that $\chi^2 = 1439.4$, $df = 51$, $\chi^2 / df = 28.22$ ($p < 0.001$), TLI = 0.941, CFI = 0.962, and RMSEA = 0.066. The path model is shown in Figure 1.

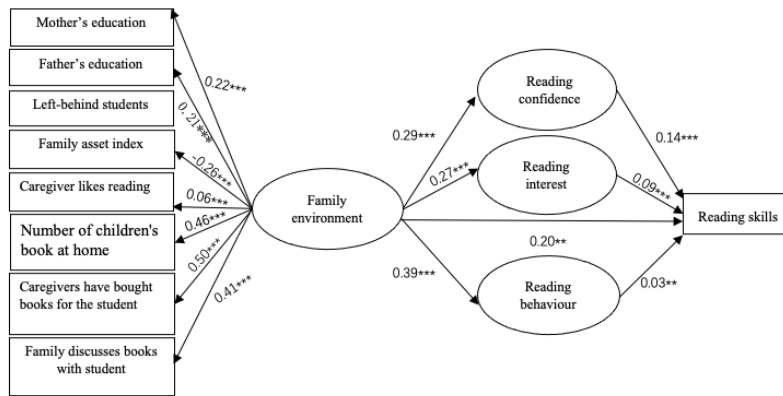


Fig.1 Mediation Model of Reading Confidence, Reading Interest, and Reading Behaviour on Family Environment and Reading Ability

According to the mediation model Figure 1, it was found that the family environment realized the effect on reading ability through the mediation of reading confidence, reading interest and reading behaviour, and all of them were significant. The family environment had a significantly positive effect on reading confidence, reading interest and reading behaviour (the effect coefficients were 0.29, 0.27 and 0.39, respectively). The mediating effect effects of the model are detailed in Table 4.

Table 4 Summary Table of Multiple Mediation Effects

	Estimate	BC 95% Confidence Interval		Decision
		P value	BC	
Indirect effect				
Family environment → Reading confidence → Reading ability	0.041*	0.001	0.033~0.050	established
Family environment → Reading interest → Reading ability	0.023*	0.001	0.016~0.030	established
Family environment → Reading behaviour → Reading ability	0.013*	0.030	0.002~0.025	established
Direct effect				
Family environment → Reading ability	0.191*	0.001	0.147~0.235	
Total effect				
Family environment → Reading ability	0.304*	0.001	0.232~0.304	

Note: *** p<0.01, ** p<0.05, * p<0.1

According to Table 4, the standardized indirect effect values of reading confidence, reading interest, and reading behaviour on family environment and reading ability were 0.041, 0.023, and 0.013 respectively, and the 95% confidence interval of Bias-corrected did not contain 0. The p_value of 0.001, 0.001, and 0.030 for the three were less than 0.05, all of which were significant. Meanwhile, the standardized direct and total effects of family environment on reading ability were 0.191 and 0.304 respectively, and the 95% confidence interval of Bias-corrected did not contain 0. The p_value of 0.001 and 0.010 respectively, were less than 0.05, both of which were significant. Therefore, it indicates that reading confidence, reading interest and reading behaviour are positive partial mediating roles between family environment and reading ability, i.e., family environment improves reading confidence, reading interest as well as increases reading behaviour, which in turn promotes the development of reading ability.

4. Summary

A study of 118 rural primary schools in three counties in the sample area was conducted to analyze the factors and the intrinsic mechanisms of the influence of family environment on rural primary school students' reading ability. First, a least squares regression analysis was used to find that family environment was related to reading ability of primary school students and had a significantly positive effect on reading ability. After that, the study explored the underlying influence mechanism between family environment and reading ability by establishing a mediating effect model from the perspective of individual characteristics. It was found that family environment influences the development of reading ability through the mediating effects of reading confidence, reading interest and reading behaviour. The specific findings are as follows:

(1) The level of parental education in the family environment, the family assets index and number of children's books at home had a significantly positive effect on the development of reading ability in rural primary school students.

(2) The influence of family environment on reading ability is achieved through a partial positive mediating effect of reading confidence, reading interest and reading behaviour, which means that rural students' family environment enhances students' personal reading confidence, reading interest as well as increases reading behaviour, which in turn promotes and facilitates the development of students reading ability.

Based on the data analysis and its results, emphasis should be placed on the cultivation of reading confidence and reading interest among primary school students and prolonging their reading behaviour in rural families, the cultivation of reading habits among family members should also be emphasized, and the family's investment in reading should be increased by purchasing extracurricular books, increasing the family's book collection, increasing parent-child reading interaction, and so on. In the long term, helping primary school students build reading confidence, cultivate reading interest and prolong reading behaviour on the basis of improving family investment in reading can effectively improve the level of reading in rural primary school and promote students' development of reading ability.

In addition, this research has some limitations that need to be further improved in future studies. Firstly, the research uses cross-sectional data, but the results are limited to correlation studies and do not indicate causal relationships. Secondly, the study used a multiple mediated effects analysis model, which did not analyze the interactions between multiple mediating variables, and the interactions between multiple mediators could be discussed in a hierarchical manner in future studies.

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