Predicting Reading Ability Among Ten-Year Olds

***Christy Lao, Sy-ying Lee, Jeff McQuillan**, and **Stephen Krashen** assess the effects of poverty (negative), school libraries (positive), instruction (zero), and early literacy (zero)*

This is a report on the most recent of three similar studies. We present the results all three here in order to highlight the profound similarities. All three are analyses of the results of the PIRLS (Progress in International Reading Literacy Study), an examination given to 10-year-olds in 2006 (45 countries), 2011 (57 countries), and 2016 (61 countries) https://nces.ed.gov/surveys/pirls/countries.asp.

Sample sizes ranged from 3349 to 18,245 (see https://timssandpirls.bc.edu/publications/pirls/2016-methods/P16_MP_Chap5_Sample_Implementation.pdf).

PIRLS provided not only test scores, but also the results of extensive questionnaires given to teachers and parents, including student attitudes, student reading behavior outside of school, classroom practices, availability of a library, and socio-economic class. The items on the questionnaire relevant to this study and socioeconomic status (SES) statistics are available in the PIRLS report. We will not repeat them here as our focus in this report was only the relationship of reading test scores and certain predictors.

The PIRLS test attempts to measure both reading for literary experience and reading to acquire and use information (Mullis, Martin, Kennedy, and Foy, 2007). Students take the test in the national language of their country.

We present here a simple analysis of the effect of selected factors on PIRLS performance, analyzing only the results of one predictor to represent each factor we were interested in investigating. (In a previous paper, we reported that this simple analysis gave results very similar to a more elaborate analysis, based on factor analysis of nearly all the data provided by PIRLS; Krashen, Lee, and McQuillan, 2012).

THE FACTORS

SES: As measured by the United Nations HDI (Human Development Index), based on education, life expectancy, and wealth (UN Development Program, 2006; 2011; 2016).

The measure of independent reading used was the percentage of students who read independently in school every day or almost every day in each country. This predictor was only investigated in the 2006 study.

LIBRARIES: In the 2006 study, the library factor was represented by the percentage of school libraries in each country with over 500 books. In 2011 and 2016, the library factor was represented by the percentage of school libraries in each country with at least 5000 books.

INSTRUCTION: Based on the number of hours devoted to reading instruction in each country.

PARENTAL READING (included only in 2011 and 2016): The percentage of parents in each country who say they like to read "very much."

EARLY LITERACY: The percentage of parents who reported that their children were able to do three of the following five tasks well and others "moderately well" before starting school: (1) Recognize most of the letters in the alphabet, (2) Read some words, (3) Read sentences, (4) Write letters of the alphabet, (5) Write some words. In 2016, a rating of "very well" was also asked about "read a story" and the ability to do three other three tasks "moderately well."

CLASSROOM LIBRARIES: PIRLS provides data for each country on the presence of a classroom library with at least 50 books, three magazines, library use, and whether students could take books out, but does not provide details on how this data was used in the statistical analysis. *http://timssandpirls.bc.edu/pirls2016/international-results/pirls/classroom-instruction/classroom-libraries/*

The data was analyzed using a very useful statistical tool, multiple regression.

MULTIPLE REGRESSION

With multiple regression, a researcher can determine the impact of one variable, while holding the effect of other variables constant. For example, in the studies included here, we report on the impact of poverty and on the impact of having a school library. In the 2006 analysis, these two predictors were correlated: Schools with less poverty were more likely to have a school library with at least 500 books (r = .35). Multiple regression tells us the impact the library has "pretending" that poverty level and the presence of a library are not related. In statistical jargon, the impact of poverty is "controlled." This is reflected by the "beta" in table 1. "Beta" means the effect of a predictor on scores on the PIRLS examination uninfluenced by other predictors, those included in the table as well as others in the analysis.

Thus, multiple regression allows us to examine the effect of several predictors at the same time, while controlling for their effects on each other.

The r2 at the bottom of each table tells us the contribution of all predictors combined. In table 1, for example, r2 = .63. This means that if we know the contribution of all the factors listed (SES, SSR, library, instruction), this provides 63% of the information we need to predict their PIRLS scores.

Tables 1, 2 and 3 present the results of multiple regression analyses for 2006, 2011, and 2016.

Table 1: Predictors of PIRLS scores, 2006

Predictor	beta	P
SES	-0.41	0.005
Independent Reading	0.161	0.143
Library	0.346	0.005
Instruction	-0.186	0.085
r2 = .63		

Table 2: Predictors of PIRL scores, 2011

Predictor	beta	P
SES	-0.52	0.01
Library	0.2	0.08
Classroom Library	0.08	0.28
Parent Read	0.065	0.31
Early Lit	-0.26	0.4
Instruction	-0.061	0.5
r2 = .62		

Table 3: Predictors of PIRL scores, 2016

Predictor	Beta	P
SES	-0.54	0.000016
Library	0.26	0.004
Classroom Library	0.026	0.8
Parent Read	0.27	0.013
Early Lit	-0.12	0.21
Instruction	0.06	0.54
r2 = .56		

In all three cases, the impact of poverty (SES) is strong and negative, and the effect is nearly identical in all three. The presence of a school library has a consistently positive effect significant in two studies and falling just short of significance in the third. In 2006, the positive effect of having a library was nearly as large as the effect of poverty was negative. The amount of instruction in reading had no significant effect, and early competence in literacy, included in two studies, had a negative but statistically insignificant relationship with performance on the PIRLS test.

Discussion

Our results on the impact of libraries are highly consistent with studies reporting that library quality is a clear predictor of reading achievement (see especially Keith Curry Lance's school library impact studies, http://keithcurrylance.com/school-library-impact-studies/) as well as studies reporting that direct instruction in phonics and phonemic awareness has little or no effect of reading comprehension (Krashen, 2001, 2009; McQuillan, 2018; Bowers, 2020). The lack of support for early literacy reported here runs counter to common wisdom.

The negative effect of poverty on all aspects of student achievement has been reported consistently since it was first studied decades ago. Highly plausible explanations for the negative correlation with poverty includes lack of medical care and nutrition for children of poverty (e.g. Coles 2008/2009 on hunger). Another is a lack of reading material: children of poverty have fewer books in the home and attend schools with less reading material, and live in neighborhoods with less well-supported public libraries (Krashen, 2004).

The clear winner in boosting reading achievement appears to be providing access to books, which in turn helps create a pleasure reading habit, which in turn results in better scores on tests such as the PIRLS, and in turn contributes to school and life success.

Note. The correlation between amount of parental reading and SES was positive both times it was investigated, but this predictor survived the multiple regression only in the 2016 analysis. The reason for this is not yet clear.

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Christy Lao is associate professor, Graduate College of Education, San Francisco State University.

Sy-ying Lee is professor in Applied Foreign Languages at National Taiwan University of Science and Technology.

Jeff McQuillan is an independent researcher living in Los Angeles, California.

Stephen Krashen is professor emeritus, University of Southern California.