

An Analysis of the PIRLS (2006) Data: Can The School Library Reduce the Effect of Poverty on Reading Achievement?
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It has been firmly established that more reading leads to better reading (and writing, spelling, vocabulary and grammar), and that more access to books results in more reading (Krashen, 2004). It is thus reasonable to hypothesize that more access to books is related to better reading. This prediction has been confirmed by a number of studies showing a positive relationship between library quality and reading achievement (McQuillan, 1998; Lance, 2004, and studies reviewed in Krashen, 2004).

PIRLS

PIRLS (Progress in International Reading Literacy Study) administered a reading test to fourth graders in 40 countries (Mullis, Martin, Kennedy, and Foy, 2006). PIRLS provides not only test scores, but also the results of an extensive questionnaire given to teachers and students, including attitudes, reading behavior outside of school, and classroom practices. PIRLS also supplies data on socio-economic class.

We present here an analysis of the PIRLS 2006 data, selecting a few factors that theory predicts will be important predictors of reading achievement. We only included countries for which complete data was available for all factors. Most countries tested about 4000 students from about 150 schools.

Countries included in the analysis were: Austria, Belgium (both French and Flemish), Bulgaria, Canada (5 provinces analyzed separately), Taiwan, Denmark, France, Georgia, Germany, Hong Kong, Hungary, Iceland, Indonesia, Iran, Israel,

Italy, Kuwait, Latvia, Lithuania, Republic of Macedonia, Republic of Moldova, Morocco, Netherlands, New Zealand, Norway, Poland, Romania, Russian Federation, Singapore, Slovak Republic, Slovenia, South Africa, Spain, Sweden, Trinidad and Tobago.

READING TEST

The Reading Test consisted of five literary passages and five informational passages, with each passage followed by approximately 12 questions, half multiple-choice and half requiring students to write their own answers. The tests were originally written in English and then translated into 45 languages.

PREDICTORS

Socio-economic class (SES): SES has a profound effect on reading development, as well as on school performance in general (e.g. White, 1982). To measure SES, the Human Development Index, developed by the United Nations, was used. The Human Development Index is an average of three factors: education (adult literacy rates, school enrollment), life expectancy, and wealth (logarithm of income) (<http://hdr.undp.org/en/statistics/indices/hdi/>.) Higher SDI means higher literacy, life expectancy, and wealth.

SSR: There is abundant evidence that self-selected reading done in school is effective in increasing reading proficiency (Krashen, 2004). The SSR (sustained silent reading) predictor used in this study was the percentage of students who read independently in school every day or almost every day in each country.

Library: As noted earlier, a number of studies have shown that library quality is related to reading achievement. In this study, the library factor was represented by the percentage of school libraries in each country with over 500 books.

Instruction in reading, assumed to be effective, was represented by the average hours per week devoted to reading instruction in each country.

INTERCORRELATIONS

Table 1 presents the inter-correlations among all the variables (means and standard deviations are presented as table A1 in the Appendix, below). As is always the case of studies of this kind, children from SES backgrounds had higher scores on the reading test ($r = .71$). Both independent reading in school and access to a school

library with over 500 books were positively related to reading performance. Amount of instruction was negatively correlated with reading test scores: Those with more instruction did slightly worse on the reading test ($r = -.26$).

Table 1: PIRLS: Inter-correlations

	Read Prof	SES (HDI)	SSR	Sch. Lib.
SES (HDI)	0.71			
SSR	0.49	0.43		
Sch Lib	0.56	0.37	0.51	
Instruction	-0.26	-0.4	0.18	0.17

HDI = Human Development Index (based on life expectancy, education, wealth)

Inspection of table 1 shows, however, that some of the predictors are correlated with each other: In higher SES countries, for example, there were higher percentages of children who did independent reading in school ($r = .43$) and higher percentages of students who had access to a school library with 500 books or more ($r = .37$).

Multiple regression allows us to determine the impact of each predictor independent of the others, that is, with the others held constant. For example, it allows us to determine the impact of SES and SSR as if these predictors were not correlated.

Table 2 presents the results of a multiple regression analysis (a more detailed table is presented in the Appendix as table A2). The "beta" column indicates the strength of each predictor, compared to the others. As was the case in table 1, SES is the strongest predictor, and is easily statistically significant ($p = .005$). SSR remains a positive predictor of reading performance, and falls just short of statistical significance. Access to a school library is a strong predictor, nearly as strong as poverty. Once again, the effect of instruction is negative, and it was close to statistical significance.

Table 2: Multiple Regression Analysis

predictor	beta	p
SES	.42	0.003
SSR	.19	0.09
Library	.34	.005
Instruction	-.19	0.07
$r^2 = .63$		

p = probability that the result could have occurred by chance. $p = .005$ means that the odds are five in a thousand chance this result could have occurred by chance (highly unlikely). Normal procedure is to consider $p = .05$ or less to be "statistically significant."

Table 2 also indicates that $r^2 = .63$: The four variables considered here account for 63% of the variability in reading test scores. In other words, if we know the SES level of a country (HDI score), the percentage of children who do independent reading in school, the percentage of children who have access to a library of 500 books or more, and the amount of instruction, this is 63% of the information we need to predict their reading score. This r^2 is quite high, but is similar to the r^2 found in previous studies of this kind in the United States (McQuillan, 1988).

DISCUSSION

Our results confirm that variables related to reading are powerful predictors of reading test scores. High SES generally means easy access to books outside of school, more SSR time means more reading, access to libraries is associated with more reading (Krashen, 2004), and more time devoted to reading instruction could mean less time devoted to actual reading.

The impact of the library can also be estimated using multiple regression. The average PIRLS score is 500. PIRLS defines levels as follows: Advanced = 625; High = 550; Intermediate = 475; Low = 400. If a country has a PIRLS score of 400, with no children having access to school libraries with more than 500 books, and then takes steps so that all children in the country have access to school libraries with more than 500 books, and makes no other changes, the multiple regression analysis predicts that their PIRLS score would improve from 400 to 480, moving them from "low" to "intermediate." (See Note in Appendix for details on this calculation.)

The finding that the impact of the school library was nearly as strong as the impact of SES suggests that the library can, to at least some extent, make up for the effects of low SES on reading: Several studies confirm that children of poverty have little access to books at home or in their community (Krashen, 2004); the school library may be the only source of books for these children.

The negative relationship between instruction and reading proficiency could be a result of schools offering more instruction to those who need it most. The result is, however, also consistent with reports showing little or no effect of intensive reading instruction on tests that require children to understand what they read (Garan, 2001; Krashen, 2009). What we can conclude is that the research shows that the library is a better investment than heavy skills-based reading teaching.

It could be argued that our analysis is flawed because it was based only on a few factors, predictors that we selected in advance. A more complex or "full" analysis based on as much information provided by PIRLS as possible is included

in Krashen, Lee and McQuillan, forthcoming, and the results are similar to what was reported here.

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APPENDIX

Table A1: Means and standard deviations of all variables

	mean	s.d.
READING	506.3	66.8
HDI	0.875	11.8
SSR	67.6	11.8
Sch Lib	72.7	28.4
Instruction	2.46	0.88

Table A2: Multiple regression (detailed)

predictor	beta	b	stand error	t	p
HDI	0.42	307.1	105.3	2.92	0.003
SSR	0.19	1.06	0.77	1.37	0.09
school libr	0.34	0.8	0.29	2.75	0.005
instruction	-0.19	-14.8	10.1	1.47	0.08
r ² = .63					

Note: Estimates of gain based on HDI = .8; SSR = 44; School Library = 0, 100%; Instruction = 2.46