Krashen, S. Lee, SY, & Lao, C. 2017 Comprehensible & Compelling: The Causes & Effects of Free Voluntary Reading. Libraries Unlimited.

What Have We Learned from PIRLS? 7

In this chapter, we present additional evidence confirming the importance of access to compelling comprehensible input—namely, libraries—and also present important evidence that strongly suggests that access to libraries can balance, or at least reduce, the devastating negative impact of poverty on reading achievement. Our source is a well-known international test: the PIRLS test.

The PIRLS Test

PIRLS (Progress in International Reading Literacy Study) regularly administers a reading test to fourth-graders in over 40 countries. 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 their national language.

☐ The PIRLS test is a reading test given to 10-year-olds in over 40 countries, in their first language.

PIRLS provides not only test scores but also the results of an extensive questionnaire given to teachers, parents, and students, which includes questions concerning attitudes, reading behavior outside of school, and classroom practices (Mullis et al., 2007). PIRLS also supplies data on socioeconomic status.

Krashen, Lee, and McQuillan (2012) presented two analyses of the PIRLS test administered in 2006. Both analyses covered the countries

for which complete data were available for all variables under study.

The study reported here attempts to replicate one of these analyses, the "simple" analysis that only included a few selected variables. The other analysis reported by Krashen, Lee, and McQuillan (2012) analyzed all data supplied by PIRLS and then entered the factors into a multiple regression. Both analyses yielded similar results.

In the simple analysis, a single predictor was chosen to represent each factor. The predictor in each case was felt to be most representative of the factor Krashen et al. were interested in investigating.

A widely used measure, the Human Development Index (HDI) developed by the United Nations (UN), was used to represent **socioeconomic status (SES)**. The Human Development Index is an average of three factors: education (adult literacy rates, school enrollment), life expectancy, and wealth (logarithm of income: see http://hdr.undp.org/en/content/human-development-index-hdi). The UN considers a high HDI rating to be between 0.8 and 0.95; a mid rating to be between 0.5 and 0.79; and a low rating to be between 0.34 and 0.49.

□ *The study reported here compared the impact of poverty, independent reading, the availability of a school library, and direct instruction on PIRLS test scores.*

In addition to the HDI, the analysis included several other predictors:

independent reading—the percentage of students in each country who read independently in school every day or almost every day.

library—represented by the percentage of school libraries in each country with over 500 books.

instruction—the average hours per week devoted to reading instruction in each country.

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beta=0.41).

Table 7.1: Predictors of PIRLS 2006

Predictor
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Independent reading
Library: 500 books
Instruction

r^2=0.63

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Table 7.1 presents the results of a multiple regression analysis, a procedure that allows us to examine the impact of each of the predictors uninfluenced by the other predictors. For example, there is a positive correlation between SES (HDI) and the availability of school libraries with at least 500 books: Countries with higher SES levels have a higher percentage of schools with well-equipped libraries (r=0.37; appendix, Krashen et al., 2012). Multiple regression tells us the impact of school libraries controlling for the effect of SES, as if SES and library access were unrelated.

□ *Previous studies consistently show that high poverty is related to lower reading scores. This study found the same result.*

According to Table 7.1, SES has the strongest effect on reading scores, as reflected by the value of the beta associated with SES (beta=0.41), a result consistent with nearly all studies examining the impact of poverty on literacy development. Independent reading was also positively associated with reading scores, in agreement with numerous studies showing the value of in-school reading, that is, sustained silent reading (Krashen, 2004), but the beta size fell just short of statistical significance.

The effect of independent reading was not as large as the effect of SES (beta=0.16, compared to beta=0.41).

Table 7.1: Predictors of the Reading Test: PIRLS 2006

Predictor	Beta	p
SES	0.41	0.005
Independent reading	0.16	0.14
Library: 500 books	0.35	0.005
Instruction	−0.19	0.085

r^2=0.63

The percentage of students who had access to a library of at least 500 books ("Library" in

Table 7.1) was positively related to reading scores, and the beta was large, nearly as large as the effect of SES. This is a very important result because it suggests that providing access to a library can balance the negative effect of poverty. This makes sense: access to books results in more recreational reading, and recreational reading results in better literacy development (Krashen, 2004). Children of poverty lack access to books; good libraries provide this access, which results in more reading and better literacy development.

☐ *Previous studies consistently show that availability of a library is related to higher reading scores. This study found the same result.*

The final predictor, the amount of literacy instruction, was negatively related to reading scores. Those in schools providing more reading instruction had lower scores on the PIRLS examination, even when SES was controlled. This result may seem surprising, but it is consistent with other research. "Reading instruction" nearly always means direct instruction in the elements of literacy, such as phonemic awareness and phonics. There is no demonstrated relationship between instruction in phonemic awareness and tests of reading comprehension (Krashen, 2001), and it has been demonstrated that "intensive, systematic phonics" instruction only helps children do better on tests in which they pronounce words presented in isolation; it does not contribute to performance on tests of reading comprehension (Garan, 2002; Krashen, 2009).

☐ *Previous studies consistently show that direct instruction is not related to higher reading scores. This study found the same result.*

Table 7.1 indicates that $r^2 = 0.63$. This indicates that the combined, the four predictors in this table provide 63 percent of the information needed to predict a country's PIRLS score. This is a very high percentage.

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Replication of the Simple Analysis, Based on PIRLS, 2011

A similar analysis was performed on data from PIRLS 2011. Following Krashen, Lee, and McQuillan (2012), the United Nations HDI was used as a measure of SES (Human Development Report, Summary, 2011 (http://hdr.undp.org/en/content/human-development-index-hdi).

> ***Library*** in the 2011 PIRLS is defined as the percentage of students in each country who had access to a school library containing at least 5,000 books. In our previous study of PIRLS predictors, the school library, defined as the percentage of students in each country who had access to a school library containing at least 500 books, was a strong predictor of PIRLS reading sores (Krashen, Lee, and McQuillan, 2012), even when SES (HDI) was controlled.
>
> ***Instruction*** is defined as the total number of hours per year dedicated to reading instruction, including reading across the curriculum (both in and outside of reading class) (PIRLS 2011, Exhibit 8.4).

In the analysis of PIRLS 2006, we included the percentage of students who were given time for independent reading in school. This question was not asked in the 2011 PIRLS.

Additional Predictors

This replication included a number of additional predictors not included in the analysis of PIRLS 2006. One of these additional predictors was a book access variable, called ***"Classroom library"*** (abbreviated as Classlibr), included to supplement the analysis of the school library:

"Classroom library" is defined as the percentage of students with access to a classroom library containing at least 50 books.

The impact of parents' reading habits was also included: ***"Parental reading"*** (parent read) was defined as the percentage of parents in each country who say they like to read.

In addition, ***"Early literacy achievement"*** (early lit) was included because of the common view that reading development can be improved if we prepare young children for school with early (preschool) direct reading instruction. Early literacy achievement was defined by PIRLS as the percentage of parents who report that their child could perform three of the following five tasks "very well" and two others at least "moderately well."

1. Recognize most of the letters of the alphabet.
2. Read some words.
3. Read sentences.
4. Write letters of the alphabet.
5. Write some words.

Table 7.2 presents the multiple regression analysis:

Table 7.2: Replication: PIRLS 2011

Predictor	Beta	*p*
SES	0.52	0.01
Library: 5,000 books	0.2	0.08
Class library	0.08	0.28
Parent read	0.065	0.31
Early lit	−0.26	0.04
Instruction	−0.016	0.5

$r^2=0.62$.

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Once again, SES is the strongest predictor, with the largest beta. And once again, access to a school library is a substantial predictor, falling just short of statistical significance. It is not as large as it was in the original study, but is still impressive.

Classroom libraries and parental reading habits were not significant predictors of reading scores. Both of these variables correlated positively with PIRLS reading scores (classroom libraries and reading scores, $r=0.34$; parental reading and reading scores, $r=0.39$), but both were also correlated with SES (classroom libraries and SES; $r=0.35$; parental reading and SES; $r=0.56$). When SES is taken into consideration, or "controlled," the relationship between classroom libraries and reading scores and the relationship between parental reading and reading scores disappears.

□ *Contrary to popular opinion, classroom libraries and parents' reading habits were not related to reading scores when poverty level is included in the analysis.*

As was the case in the 2006 analysis, time dedicated to reading instruction was not related to reading proficiency. Unlike the earlier analysis, however, the relationship was not negative, but nearly zero.

The relationship between early literacy achievement—that is, parents' judgment of the child's literacy skill on entering school—and reading ability measured five years later was significantly negative. The simple correlation between early literacy achievement and PIRLS test scores was negative and significant ($r=-0.33$) and remained negative and significant in the multiple regression analysis.

□ *The child's early mastery of "literacy skills" (letters of alphabet, early writing) does not predict later reading ability.*

Summary

In both the original study and the replication study, SES was a powerful predictor. In both studies, access to a school library was a positive predictor of reading scores, even when controlling for

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RLS 2011

Beta	*p*
0.52	0.01
0.2	0.08
0.08	0.28
0.065	0.31
−0.26	0.04
−0.016	0.5

SES. In one study, the size of the impact was large; in the other it was modest. Other studies have produced similar results (reviewed in Krashen, 2011c; a recent contribution to this research is Adkins, 2015).

None of the other predictors were significant when SES was controlled. The positive relationship seen between parents' reading habits and reading scores, as well as classroom libraries and reading scores, was, in this study, an artifact of their positive relationship with SES. Children of parents who read more do indeed read better, but parental reading is not the cause of the children's better reading achievement. Children with access to better classroom libraries also read better, but the classroom library is not the cause, admittedly an unusual result.

Some Special Cases: Hong Kong and Taiwan

Table 7.3 presents average (mean) scores on the PIRLS 2011 for Hong Kong and Taiwan.

Table 7.3: Mean Scores on PIRLS 2011

	Mean	Sd	HK	Taiwan
Score	507.6	55.4	571	553
HDI	0.82	0.087	0.9	0.88
Library: 5,000 books	30.34	26.7	82	90
Class library	25.2	20.3	75	73
Parent read	31.11	11.15	14	17
Early lit	26.3	11.7	41	30
Instruction	143.34	42.05	102	65

Both Hong Kong and Taiwan are very high scoring countries on the PIRLS. Hong Kong, in fact, ranked number one in the world, and the

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Taiwan average was a full standard deviation above the mean for all countries tested.

Both Hong Kong and Taiwan also score extremely high on school libraries and classroom libraries, and our analysis suggested that the school library quality is the crucial one.

Parents in both Hong Kong and Taiwan reported reading less than average for all countries tested. According to our analysis, however, parental reading is not a significant factor in producing higher reading scores.

Both Hong Kong and Taiwan do better than average in "early literacy," but in our analysis, a higher performance in early literacy was associated with lower reading on the PIRLS. Both countries were well below the average in total time dedicated to reading instruction, but according to both analyses above, time dedicated to reading instruction is not a significant predictor of reading achievement, and in the 2006 analysis, it was negatively related to reading achievement.

Some Disturbing Data

There is an additional factor particular to Hong Kong, Taiwan, and two other countries (Italy and Singapore). According to questionnaire results from PIRLS 2011, neither children nor adults (their parents) in these countries report reading much. Table 7.4 compares the percentage who say they "like reading" in these countries with "baseline" countries, other countries with high socioeconomic status and high PIRLS scores (Loh and Krashen, 2015).

☐ Some countries appear to be "test prep" countries: those with high reading scores, but with little interest in reading among children or adults.

One suspects that the high PIRLS scores achieved by these countries are not achieved in the normal way, via self-selected reading of interesting books (see Chapter 4). A troubling possibility is

Table 7.4: Interest in Reading, HDI (SES), and PIRLS Scores

Country	HDI	Parent Likes	Child Likes	PIRLS
Hong Kong	0.90	14	21	571
Taiwan	0.88	17	23	553
Italy	0.87	24	23	541
Singapore	0.87	21	22	567
MEANS	0.88 (0.01)	19 (4.4)	22.3 (0.96)	558 (13.7)
Baseline	.91 (.01)	43.7 (5.2)	33 (2.5)	538.4 (9.7)

that the high scores are a result of massive required reading, test preparation, and teaching strategies that increase scores without increasing competence, for example, teaching children which questions to skip, when to guess and when not to, and so forth. The PIRLS data suggest that this approach fails to result in enthusiasm for reading, thereby preventing the continuing development of literacy.

Excluded Variables

Many factors that could play important roles in literacy development were not included in this analysis, including reading aloud to students when they were younger (although PIRLS included reading aloud as part of a broader variable) and access to public libraries.

Books in the home (percentage of students who live in homes with at least 100 books) was included by PIRLS, but inclusion in the analysis resulted in multicollinearity (extremely high correlation with other predictors). A simple analysis, however, revealed that although books in the home correlated with PIRLS scores (r=0.59), it was also very highly correlated with SES (r=0.81), and a small-scale multiple regression analysis confirmed that when SES is controlled, books in the home has

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no effect on reading scores (Table 7.5). Hong Kong and Taiwan were close to the international mean for this variable, with Taiwan slightly above.

Table 7.5: Impact of Books in the Home, with SES Controlled

	Beta	p
HDI	0.73	0
Books in home	0.023	0.46

r^2=0.49.

As was the case with parental reading and classroom libraries, it appears that the relationship between reading achievement and the home print environment is the result of the influence of SES.

□ *Do more books in the home mean better reading? The research does not yet give a clear answer.*

We are hesitant to ignore this variable, however, as there is some evidence suggesting that when SES is controlled, books in the home might be a predictor of literacy development. In one study, for example, middle-class (high school) students coming from homes with a more print-rich environment (books owned, magazine subscriptions) engage in more free voluntary reading in their first language (Chinese) (Lee and Krashen, 1996). In another study, focusing on fourth-graders in Hong Kong, "family reading financial capital," which included the child's estimate of the number of books in the home and parents' average expense on buying books, was a significant predictor of reading proficiency, controlling for several SES predictors: father's education and employment, and family financial status (Tse, Lam, Ip, Loh, and Tso, 2010).

Motivation to read was not included in the analysis because it was based on questions that lacked validity. Some of the questions were

clearly related to extrinsic motivation, (e.g., "It is important to be a good reader"; "My parents like it when I read"; "I need to read well for my future"; etc.) and, oddly, none of the questions related to reading enjoyment.

Conclusions

Some countries achieve higher scores on international reading tests than others. The major reasons, according to our analysis, are poverty and lack of access to reading materials in school libraries.[1] These results make sense: a number of studies confirm that poverty has a devastating impact on school performance: Children who live in poverty often suffer from food deprivation and lack of health care (Berliner, 2009), as well as a lack access to books in their homes, neighborhoods and in their schools (Krashen, 1997).

☐ *The major conclusions: Poverty is related to lower reading achievement. Libraries are related to higher reading achievement.*

Our results are also in agreement with research on the positive impact of libraries. Research consistently tells us that better libraries mean higher reading scores (see McQuillan, 1998, and studies reviewed in Krashen, 2004). Keith Curry Lance's school library impact studies provide strong evidence that confirms the positive impact of school library quality and library staffing on reading achievement. (For extensive reports, see, for example, http://keithcurrylance.com/school-library-impact-studies/).

Both analyses presented here suggest that a good school library can compensate for some of the effects of poverty by providing access to reading material. But in light of the "disturbing results" presented earlier, it is to be determined whether children in some countries actually take advantage of greater access to books, whether at home or in libraries.

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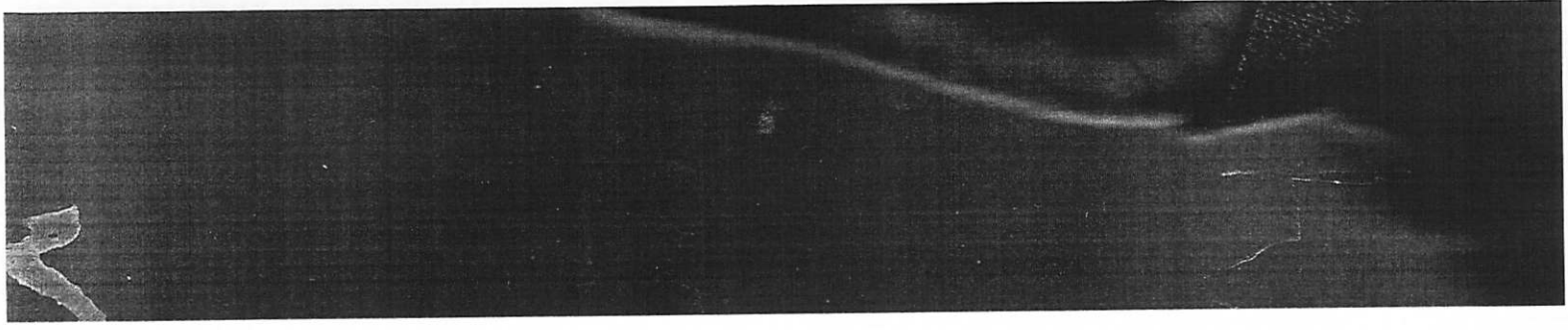

The amount of direct instruction in school in reading was not related to reading achievement, nor was "early literacy achievement," represented by parents' report of literacy competence on entering school. Both of these results are consistent with studies showing a lack of impact of phonemic awareness and intensive phonics on tests of reading comprehension (Krashen, 2001; Garan, 2002; Krashen, 2009), and are consistent with the hypothesis that our proficiency in phonics and spelling is the result of reading, not instruction (Smith, 2004; Krashen, 2004).

An important result of our second analysis is that two factors, parental reading and classroom libraries, commonly thought to be important to literacy development in children, may not be, but are, rather, the result of the presence or lack of poverty. This appears to be the case for books in the home, but other results make us hesitant to discard this source of books.

What is clear is that poverty is the main factor affecting school performance. This is nothing new in the education research, but is unrecognized in most discussions of school policy. Here is a notable exception:

> We are likely to find that the problems of housing and education, instead of preceding the elimination of poverty, will themselves be affected if poverty is first abolished. (Martin Luther King, 1967)

Note

1. Adkins (2014) reported that the presence of a school library did not predict math, reading, or English achievement for American 15-year-olds who took the PISA exam in 2009, but nearly all schools in her sample were in the United States and had a library. "Library adequacy," based on

principals' judgment of the adequacy of the library staff and materials, was, however, positively associated with scores in math, reading, and science, controlling for the effect of poverty. Technological adequacy of the library was a negative predictor of test scores. This was, however, not the case for students in the lowest levels of achievement.

Adkins's findings on principals' perception of library adequacy can be interpreted as parallel to ours: access to a library counts, even when social class is controlled, and the library plays some role in balancing the effect of poverty.

Thus, in countries where libraries are nearly universal, presence or absence of a library will not be related to academic achievement. But library quality does make a difference.

	Math	Reading	Science
Predictors	Beta	Beta	Beta
Wealth	0.705*	0.722*	0.632*
Library	−0.072	−0.193*	−0.212*
Library adequacy	0.212*	0.158*	0.226*
Tech adequacy	−0.157	−0.16*	−0.174*
r^2	0.57	0.625	0.542

Source: Adkins, 2014.

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