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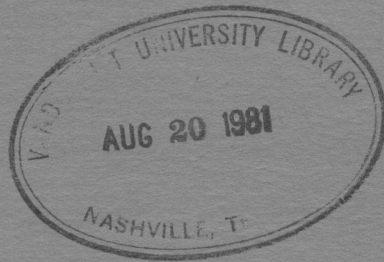


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Textbooks and Achievement in Developing Countries: What we Know

Stephen P. Heyneman
World Bank, Washington, D.C.

Joseph P. Farrell
Ontario Institute for Studies in Education

Manuel A. Sepulveda-Stuardo
Ontario Institute for Studies in Education

In a recent review of the impact of teacher-training on academic achievement, Husén *et al.* report equivocal results: out of 24 studies in less industrialized societies, 13 (54%) report positive relationships of varying magnitudes; but nine (37%) report null relationships and two report negative relationships.¹ On the other hand, between books and achievement the relationships are more consistent and more clear as is seen in table 1. There have been studies in 10 developing countries. From these have emerged 18 separate statistical relationships between reading and achievement of some kind. Fifteen of the 18 are measures of academic achievement—mathematics, science, reading and language. Of the 18, 16 measured the availability of textbooks in the classroom; one measured the availability of a school library (Beebout); and one measured the amount of daily time spent reading (Simmons and Askoy). Fifteen of the 18 (83%) are positive, as against two negative and one null. As suggested below, these latter findings may be spurious.

This does not mean that we know all we need to know. What it does mean is that compared to other commonly measured potential correlates of school achievement, such as teacher-training, class size, teacher salaries, boarding facilities, grade repetition etc., the availability of books appears so consistently associated with higher achievement levels that it is worthy of more experimentation and close scrutiny as an instrument for affecting learning.

Data on pupil achievement and access to reading materials in school are available from Ghana, Thailand, Uganda, India, Iran, Chile, El Salvador, Brazil, Ecuador and Malaysia. In two studies (Schieffelbein and Farrell's study of Chile and Haron's study of Malaysia), textbook influences are explored in detail. In the others they are considered as only one among a large number of variables in a regression or an A.I.D. (Automatic Interaction Detection used in El Salvador) procedure.

Table 1. Availability of reading material and its relationship to student achievement

Country	School level	Criterion variable	Relationships		
			+	0	-
Thailand ²	Primary G 3	Language and arithmetic	++		
Chile ³	Primary 6-8	Mathematics and language	++		
Chile ³	Primary 6-8	Educational aspirations	+		
Chile ³	Primary 6-8	Type of secondary school entered	+		
Chile ³	Primary 6-8	Survival to end of secondary school	++		
Uganda ⁴	2293 seventh-grade students from a random sample of schools in five districts and three urban areas	Mathematics, general knowledge, and English	+		
Chile ⁵	Primary (11 years old)	Science	+		
India ⁵	Primary (11 years old)	Science	+		
Iran ⁵	Primary (11 years old)	Science			-
Chile ⁶	Primary (14 years old)	Literature	+		
Iran ⁶	Primary (14 years old)	Literature			-
El Salvador ⁷	Grades 2, 3, 5, 6, 8 and 9	Spanish, mathematics, social and natural science	+		
Malaysia ⁸	National probability sample of 6000 12-13-year-old youths	Bahasa Malay, English, mathematics, science, history and geography	++		
Ecuador ⁹	33 randomly selected first-grade classrooms.	Pre- and post-tests over a one-year period in reading comprehension		0	
Ghana ¹⁰	40 rural schools at the eighth and ninth grades	Pre- and post-tests over a two-year period in reading comprehension	+		
Tunisia ¹¹	44 students from a village and 80 students from an urban suburb in the fourth and eighth grades	Arabic, French, arithmetic	+		
Malaysia ¹²	7674 students in the tenth and eleventh grades; random sample of 89 schools.	Amount learned between secondary entrance and secondary leaving examinations	+		
Brazil ¹³	Random selection of 5% of the first-grade students in Rio Grande do Sul (N=20 000)	Language competence in Portuguese as assessed by a first-grade teacher	++		

† Stronger in students with low SES.

What we know

The IEA studies: India, Iran and Chile

Under the auspices of the International Association for the Evaluation of Educational Achievement (IEA) a vast and comprehensive study has been conducted of academic achievement in six subject areas (science, reading comprehension, literature, English as a foreign language, French as a foreign language, and civic education) and the factors that affect achievement in these subjects. The study was conducted in 21 countries, among student populations ranging from 10 years of age to those in the last year of secondary school. Our concern here is with the results with respect to the two subject areas, science and literature, where the effect of textbooks

on achievement is reported in three developing nations: India, Iran and Chile.^{17†} In science the data are taken from the 10-year-old population, most of whom were in the fourth and fifth primary grades (60% of 2731 students in India, 97% of 708 students in Iran, and 79% of 1510 students in Chile). The achievement instrument was a 40-item test of general knowledge. The textbook variable was measured by determining if each student had a textbook available for learning science. There is no indication whether having a textbook available meant that each individual student had a book, only whether there was a book in the classroom which students could use. In all three countries surprisingly high proportions of students reported having a textbook 'available': 69% in Chile and 81% in both India and Iran. Simple correlations of textbook availability with test score are reported at both the between-student and between-school levels for all three countries. (See table 2.)

Table 2. Textbook availability and test scores—India, Iran, Chile†

Country	Between-students r	Between-school r
India	0.21	0.34
Iran	0.10	-0.26
Chile	0.02	0.21

†Source: see Note 4, pp. 248 and 205.

No significance levels are reported for these IEA data, but given the size of the samples involved the probabilities of even very weak r s having arisen by chance is fairly remote.

Regression coefficients for *individual variables* would permit one to determine the effect of textbook availability in relation to the effects of the large number of other variables measured in these studies. But these are not reported. The coefficients which are reported, at both student and school level, are *blocks* of school variables. In both Chile and India a 'learning conditions' block, which includes textbook availability, accounts for more of the variance in test score than does a block which includes home circumstances and student age and sex. This is the case at both the student and school level. In Iran, however, the pattern is reversed, although even there the 'learning conditions' block accounts for a noticeable portion of the variance (6% at the student level and 13% at the school level).¹⁹

In literature, the data are taken from a 14-year-old population: 1058 students in Chile and 1254 in Iran (data from India are not reported). The achievement test was a 17- to 19-item instrument measuring ability to read a literary text critically. This included both comprehension and interpretive skills. The textbook variable was measured in two ways: (a) by asking whether teachers used textbooks as a prime teaching material; and (b) by asking how frequently texts were used. Again, neither of these items indicate whether each student had a text, nor how many texts students had. Results using these measures are reported only at the between-student level.

Simple correlations between literature achievement and use of texts as a prime teaching material are reported for both countries (Chile $r = 0.09$, Iran $r = 0.10$). Here, too, regression coefficients are not reported for this measure of text availability, but

†Precisely because they were collected in developing countries, the data from Iran, India and Chile are not as 'clean' as the data from the richer nations included in the IEA survey. The interested reader can consult the original sources, or Peaker, for careful discussions.¹⁸ However the problems in the data are not in our judgement sufficient to invalidate the findings; they are problems which plague *all* research on developing areas.

the variable is included in an 'instructional variables' block. In Chile this block explains 9% of total achievement variance. This is less than the 14.4% explained by home background and age and sex. In Iran 12.1% of variance is accounted for by instructional variables, compared to 4.5% by home background, age and sex. For Chile the unique contribution (from commonality analysis) of frequency of use of textbooks is reported (0.9%).²⁰

Thailand

The data from Thailand are derived from a 1973 stratified probability sample of 23 555 third-grade pupils and 987 teachers from all types of schools and regions throughout the country.²¹ Achievement was measured by a test covering arithmetic concepts and problem-solving, reading comprehension, vocabulary and spelling. Textbook availability was measured as the number of books available to pupils. The correlation coefficient between these variables is positive but modest ($r=0.11$). In this study, regression coefficients are reported so that one can assess the 'independent' effect of textbook possession. This is particularly important since one can assume that in many societies possession of a textbook is highly correlated with the socio-economic status of a student. Table 3 presents the regression results for the total sample. Textbook possession clearly has some independent effect upon achievement but, relative to other variables included in the analysis, not a large one. It is worth noting that when socio-economic status is excluded from the analysis, the regression coefficient associated with textbook possession does not change markedly, nor do any of the other coefficients. Of particular interest in this study is an analysis by type of school, since different types of schools in Thailand cater to different social strata. Four types of schools are considered: *private* schools are urban and serve

Table 3. School achievement as a function of selected pupil, school, and socio-economic background characteristics in Thailand†

Variables	Equation 1 Socio-economic background included		Equation 2 Socio-economic background excluded	
	B coefficient	Cumulative R ²	B coefficient	Cumulative R ²
School size	0.21	0.20	0.26	0.20
Social class (father's occupation)	0.18	0.27		
Attended kindergarten	0.13	0.29	0.18	0.25
Did not repeat any grade	0.13	0.31	0.13	0.28
Teacher's general view of learning ability of children	0.09	0.32	0.10	0.29
Pupil weight	0.08	0.32	0.09	0.31
Pupil/teacher ratio	0.07	0.33	0.08	0.30
Teacher qualification	0.06	0.33	0.05	0.32
Pupil absence	-0.05	0.34	-0.06	0.31
Teacher's years of schooling	0.04	0.34	0.05	0.32
Distance from home to school	-0.06	0.34	-0.07	0.30
Availability of textbooks	0.02	0.34	0.03	0.32
Age	-0.04	0.34	-0.05	0.32
Teacher's absence record	0.01	0.34	0.01	0.32
Constant		19.27		25.34

† Source: see Note 2, p. 33.

All reported values are statistically significant ($p < 0.001$).

relatively wealthy people; *Ministry of Education* schools are urban and serve primarily middle-class families; *municipal* schools are also urban but appear to serve slightly lower social status families; *provincial* schools are generally rural and serve pupils of relatively low economic status. In the two types of schools which serve primarily middle- and upper-class students (private and Ministry of Education) textbook possession has no observable effect upon achievement. In the two types of schools which primarily serve lower status students (municipal and provincial) there is an observable textbook effect. (Municipal schools: $b=0.06$ —5th of 10 variables reported; provincial schools $b=0.04$ —12th of 14 variables.)

Uganda

The Ugandan data were derived from a random sampling of 67 primary schools in five districts and three urban areas.²² Information was collected from 2293 children on parental occupation, education and household possessions. There is information on school facilities and teacher characteristics. Data on learning were collected by measuring the child's performance in the 'Primary Leaving Examination', containing sections on mathematics, science, English, geography and history. Book measures were obtained by the investigator personally counting each book available to the students in the first and seventh grades. No effort was made to distinguish old books from new, inappropriate from appropriate, or English from vernacular. The measure consisted of a count of the total number of textbooks and readers available per child in the highest and lowest grade levels in the primary school.

Access to textbooks in the first grade appears to have an equivocal relationship to seventh-grade academic performance, averaged by school ($r=0.01$). But access to seventh-grade textbooks does not. There the relationship which emerges with performance averaged by school ($r=0.24$, $p>0.05$) is the third largest among the physical facilities, and remains consistent irrespective of socio-economic status controls.

Chile

A more detailed analysis of the effect of textbook availability is found in a separate longitudinal study of Chile.²³ The original student cohort, sampled in 1970, consisted of 3530 students in the eighth grade (the last year of primary schooling) from throughout Chile. The achievement measure consisted of a 100-item national test administered to all eighth-grade students in Spanish and mathematics. Textbook availability was measured by asking students in a questionnaire whether they had a text for their personal use in each of the five academic subjects in the eighth-grade curriculum (Spanish, mathematics, social science, natural science and foreign language—usually English). From these data a total score was produced for each student.

In table 4 the results of regression analysis on eighth-grade test scores are reported. Here textbook possession has a regression coefficient of 0.06, the eighth highest of the 12 variables included in the equation. Of those variables which lend themselves to policy manipulation, textbook possession is essentially equal in effect with 'average age of teachers', interpreted as a rough proxy for teacher experience, and more powerful than the other, 'school size'.

Having discovered that textbooks have some significant overall relationship with achievement independent of other variables, Schiefelbein and Farrell went on to specify the effect of textbook possession in relation to several other variables: a student's sex, school type (private or public) and education of the father (as a measure of SES). The results are noted in table 5.

Table 4. Standardized regression coefficients in order of size, for each of 12 regressor variables on total score on national test (Chile) for the eighth grade†

Variable	Coefficient
Average eighth-grade mark per class	0.18312
SD per class on verbal national test (inverted)	0.16788
Hours per week in free reading by individual student	0.15286
Average possession of TV sets per class	0.11864
Socio-economic status of individual student	0.09556
Liking for academic subjects	0.06910
Average age of teachers	0.06688
Textbook availability in class	0.06264
SD per class on hours spent in free reading	0.05067
Average inherited status of teachers	0.03860
Student height	0.03626
School size	0.03390

† Source: Schiefelbein and Farrell (1974) (see Note 3), p. 22.

Table 5. Chile: textbook availability and academic performance: means and standard deviations by sex of student, type of school, and education of student's father†

Variable	Few texts			Normal texts			Many texts		
	M	SD	N	M	SD	N	M	SD	N
Total students	49.89	14.59	974	53.51	14.76	1225	58.49	14.52	879
Boys	50.65	14.53	456	53.44	14.70	547	60.71	14.55	432
Girls	49.21	14.53	518	53.02	14.83	678	56.33	14.49	430
In public schools	49.70	14.73	799	53.16	15.03	807	56.64	14.19	430
In private schools	50.70	13.95	175	53.28	14.27	418	60.25	14.83	339
Father's education									
Primary or less (FEP)	48.39	14.37	719	50.83	14.51	636	54.22	14.58	264
Secondary or more (FES)	54.10	14.10	255	56.38	14.41	589	59.35	14.06	615
Boys in public school									
FEP	48.77	14.36	296	50.44	14.07	218	57.35	11.38	66
FES	55.07	14.13	90	56.81	14.87	145	58.83	14.30	126
Boys in private school									
FEP	47.05	14.64	39	53.84	14.77	56	56.50	17.98	44
FES	60.24	12.66	31	57.41	14.47	128	64.00	14.35	197
									(N.S.)
Girls in public school									
FEP	48.71	14.81	321	51.88	15.21	265	53.54	14.90	112
FES	50.96	15.07	92	55.44	15.00	179	56.84	14.40	126
Girls in private school									
FEP	45.81	11.98	63	47.16	13.46	97	48.71	14.42	42
									(N.S.)
FES	54.38	12.96	42	56.20	13.10	137	59.72	13.28	166

† Source: Schiefelbein and Farrell (1974) (see Note 3), p. 24.

In a table such as this, one could make many comparisons between mean test scores, for each of which a level of statistical significance may be calculated. The means, standard deviations (SDs) and Ns are reported so that readers can calculate the statistical significance of a particular comparison. Perhaps the most telling comparisons are between the categories 'few texts' and 'many texts' in each row. All of these comparisons are significant at least at the 0.01 level except for the two rows marked N.S.

Textbook availability was divided into three categories—few texts, average texts, and many texts. The cutting points between the categories were one-half of a standard deviation above and below the mean on the textbook availability scale. To interpret these data two facts must be taken into account: first, in Chile, texts are usually not provided by the school; they are bought by the student or his parents. Thus one would expect a high correlation between number of textbooks possessed by a student and his socio-economic status. That this is in fact the case makes all the more impressive the relatively strong effect of textbook availability, independent of socio-economic status.

Second, textbooks are rather widely available to eighth-grade students in Chile—at least by the standards of most developing nations: 71.4% of the students reported that they had a Spanish text and 74.6% stated that they had a text for the foreign language they were studying; some 54.7% had a social science text, 43.9% had a mathematical text, and 42.8%—the lowest figure—had a natural science text. Eleven per cent of the sample reported that they had no book of any kind in any of these five subject areas. Thus there is sufficient variation in this indicator to make its analysis useful.

As reported in table 5, there is an almost nine-point difference in test score between students with few texts (48.89) and many texts (58.49) considering no other variables. Such a result is to be expected, given the relatively high correlation of text availability with test score. The difference between the extreme categories is somewhat more pronounced among boys than among girls. The differences are also more pronounced among students in private rather than public schools.

The finding that text availability has a stronger relationship to academic performance among children in private schools has an interesting implication. Private schools in Chile cater mainly (though not exclusively) for children of wealthier, higher-status parents. One may be observing here what has come to be called the 'headstart' effect, which seems to appear with most educational 'treatments', i.e. that programmes designed to improve the academic performance of all children tend to benefit most those who are already advantaged, thus increasing rather than decreasing the 'learning gap' between high- and low-status children. In societies that are trying to reduce educational inequalities based on non-school factors, and at the same time trying to use education as one of many levers to reduce social inequalities in the society as a whole, the existence of this pattern could be quite important.

However, as can be seen in table 5 the magnitude of difference in test scores between students with few and many texts is nearly identical for students with high-education and low-education fathers. Among boys, however, the greatest textbook effect is found among lower-class students in private schools, where the difference between those with few and many texts is 9.45 points. The textbook effect among higher-class boys (3.76 points) is much smaller, and identical in public and private schools. Moreover the difference between lower-class boys with few and many texts is almost as great in public schools as in private schools (8.58). Among girls, by contrast, the textbook effect is greater in public than in private schools. It appears that if a 'headstart effect' operates at all, it is only among girls in private schools, and there only slightly. Indeed what is most striking in these data is the very strong reversal of this effect among boys.

It seems clear that textbook availability has a positive relationship to academic performance over many different types of Chilean students. Most importantly, this

variable seems to be one of the few discovered which reverses a 'headstart' effect and has its greatest effect precisely among those children who are most in need of educational assistance—children from lower social strata.

Being longitudinal, Schiefelbein and Farrell's study also produced data on the effects of textbook possession on other key elements in a student's educational career: educational aspirations at the eighth-grade level, the kind of secondary school a student enters, and the probability of a student surviving to the end of secondary school. The most powerful predictors, using either regression analysis or weighted net percentage differences, included in each case texts as one of the most important predictors. One additional specification analysis is reported by Schiefelbein and Farrell with respect to the probabilities of survival to the end of secondary school. Here again, textbooks have their most important effect upon children of lower social status, particularly among lower-class students who had high achievement levels at the end of the eighth grade.

El Salvador

In 1974 El Salvador administered a series of national achievement tests in mathematics, social science, natural science, and Spanish to a sample of 55 000 pupils in the second, third, fifth, sixth, eighth and ninth grades. A subsample of 2600 pupils also completed an 80-item questionnaire which noted their social status, attitudes and numerous other characteristics, including whether students had pencils, notebooks and books.²⁴

The former, it was found, were universally distributed—every student had a pencil and a notebook. In urban schools, however, 15% of the children had no books; in rural schools 55% had no books. The published report which discusses this variable, notes that 'average scores for students without books were in general significantly lower than scores for students with books'²⁵ but there is no attempt to explore this further. One task with high priority will be to take these data and apply one of the methodological techniques used elsewhere to them, thus creating a meaningful comparison.

Ecuador

In the mid 1960s, the Ecuadorian Ministry of Education decided that the style of teaching in primary-school classrooms needed to be changed, and that the best way to change teaching was to design new textbooks with 'modern' content, quickly train teachers to use the books, and then distribute them widely. This they did over a six-year period commencing in 1967.

First a set of 'objectives' was decided upon. Then new textbooks were designed, the content and lay-out of which had been specifically constructed to correspond to 'modern pedagogy'. In constructing the books in this way it was believed that such a pedagogy was definable, that such a pedagogy was correct, and that it could be successfully transplanted from the USA to Ecuador. This was despite the fact that few Ecuadorian teachers had previously studied the concepts of 'new maths' or the 'whole word method' of teaching reading, and despite the fact that these new methods were significant breaks with past local experience.

In late 1970 these new first-grade textbooks in mathematics, reading and science were distributed to Ecuadorian schools. If pupils wanted them, they had to pay \$(US)1.20, slightly more than a day's wages for a labourer. An experiment was designed to monitor changes in learning in the following way. A random selection of 88 schools was taken and divided into three groups: (a) those schools which had been offered new textbooks, teacher's guides and teacher orientation to the teacher's guides; (b) those schools which had been offered new textbooks and teacher's guides but no teacher orientation; and (c) those which had access to old textbooks at whatever level of quality and quantity which had existed previous to the experiment.²⁶ Pre- and post-test scores were collected in each of the three school categories, and in each of the three subjects: mathematics, science and reading. The experiment was limited to the first grade and to a duration of one school year only. In the experimental group, therefore, schoolteachers had unfamiliar books, based upon unfamiliar beliefs about how to teach well; and to succeed, they had to adjust to these unfamiliar characteristics on the first try, that is, in year one.

Table 6. Mean achievement gain between pre- and post-tests in three types of Ecuadorian first-grade classrooms†

	1/ A (N=31)	2/ B (N=27)	3/ C (N=30)	B minus C
Reading 4/	15.09†	15.56†	15.42†	+0.14§
Math 4/	12.73†	12.74†	12.11†	+0.63§
Science 4/	9.87†	9.93†	9.20†	+0.73§

† Source: Lynch (see Note 9).

‡ p < 0.01.

§ Not statistically significant.

1/A = classrooms with new texts, teacher's guides and teacher orientation.

2/B = classrooms with new texts and teacher's guides but without teacher orientation.

3/C = classrooms without new texts.

4/ Range = 0-50; no display of means or standard deviation in Lynch (1974).

Post-test scores at the end of the year were significantly higher in all three subjects. This was to be expected. The issue was whether the learning gain in the classrooms with new textbooks was significantly higher than the learning gain in classrooms without new textbooks. The results show that they were higher; but not significantly higher. This is illustrated by table 6. The difference in mean achievement gain is less than one point on a 50-point scale, and not sufficient to say with certainty that the difference was not due to chance.

These data from Ecuador raise more questions than they answer. One cannot be certain that the new textbooks did not create the anticipated effect because they were poorly written; there is no way to tell whether they were distributed in any larger quantity than the books already available;† nor is it certain that the teachers were committed to the teaching changes required as the purpose of the experiment.

† Few first-grade classrooms had mathematics or science books previous to the experiment; but many had readers.

Ghana

The *Densu Times* project began as an intervention to combat illiteracy. It is relevant for our purposes because its effectiveness was evaluated on the basis of reading comprehension gains among schoolchildren. In October 1974, members of a research team from the Ministries of Information, Education, and the University of Ghana picked 40 rural eastern region schools. Students in forms II and III (equivalent to the eighth and ninth grades) were divided into experimental and control groups of 20 classrooms each, and were pre-tested for reading comprehension. The experimental groups were given access to a weekly newspaper for use in their classrooms.²⁷

The newspaper contained stories on local items of interest, many of which were contributed by readers. Sixty-five per cent of the teachers in the experimental schools claimed to have used the newspaper in their classrooms 'every week without fail'. In the course of the two-year experiment period the newspapers' editors received over 3000 written contributions (about 35 a week). The impact on reading comprehension is reported in table 7.

Students in the 20 classrooms receiving the *Densu Times* gained between five and six more points (on a 37-point test) on reading comprehension; the difference is statistically significant. It is not entirely clear which particular element in the experiment can account for the difference. It might have been the excitement generated by having readers respond to newspaper stories of their own; or perhaps it was the personal flavour of the news itself; or the scarcity of other available printed materials. In any case, it is clear that having a weekly newspaper did affect the ability of eighth- and ninth-grade Ghanaian children in learning how to read.

Table 7. Mean gain in reading comprehension between pre- and post-tests in 40 Ghanaian schools (October 1974-June 1976)†

	A/1 Gain for the experimental group (20 schools)	B/2 Gain for the control group (20 schools)	C Difference (A-B)
Form II	18.9	13.9	+5.0‡
Form III	15.5	9.6	+5.9‡
Total (N=1659)	17.2	11.8	+5.4‡

† Source: see Note 10.

‡ Test range = 37; $p < 0.001$.

A/1 Schools receiving a weekly newspaper.

B/2 Schools not receiving a weekly newspaper.

Malaysia

In 1972, a probability sample was taken of approximately 5% of the children born in Malaysia in 1960. A subsample of 6056 youths (2389 out-of-school) answered a questionnaire designed by the Malaysian Ministry of Education's Division of Educational Research and Planning. Parental background data were obtained from the 1970 census records. Pupil data were collected from teachers and school records as well as the pupils themselves. These included pupil performance on national

standard five examination results from 1972 in Bahasa Malay, English, mathematics, science, history and geography. Data about schools were gathered from interviews with school principals: there were measures of school size, pupil-teacher ratios, central library, class libraries and the number of books in them, teacher qualifications, and the percentages of children with individual textbooks (as near as the principal could estimate).

In 25% of the urban and 65% of the rural schools less than 80% of the pupils had individual textbooks. Having an individual textbook was related to a pupil's socio-economic status ($r=0.2$); to teacher experience ($r=0.2$); to school size ($r=0.3$); and (negatively) to teacher qualifications ($r=0.18$).²⁸

Neither the number of volumes in the school libraries nor the proportion of pupils with individual textbooks appear at first to be related to pupil performance ($r=0.081$ and $r=0.082$). But by means of both regression analysis and specification of subsamples for rural and urban location, high, medium, and low social status, and ethnic group, the intervening influence of a child's background is controlled and the influence of having a book emerges. Pearson coefficients are highest for urban Indians ($r=0.25$), but are positive and statistically significant for each geographical, SES and ethnic category. (Chinese living in rural areas are the only exception.) Furthermore, gains in achievement associated with having access to a textbook are stronger and more definitive among children of the less privileged within the Chinese and Indian ethnic groups. The study, however, is cautious in not assuming that the differences in achievement that were found can be explained by books alone, and speculates on the influence which might be attributable to parental motivation. This query could be raised with respect to each of the sets of data discussed here.

Brazil

In 1968 the Center for Educational Research and Orientation (CPOE) of the Secretariat of Education in Rio Grande do Sul collected information on each primary school in the state, including information on each principal, teacher, and first-grade student. The amount of data generated was somewhat burdensome, to say the least; and only 5% of the sample (20 120 students) was subjected to intensive analysis.

The teacher questionnaire included a request for information on the number of textbooks owned by each student and whether students received a passing Portuguese grade after their year in first grade. Questionnaires were returned by mail. Results were analysed for the sample as a whole, and individually within four categories: urban state schools, rural state schools, municipal schools, and private schools.²⁹

The investigator is quick to point out that the data contain two flaws which make the results difficult to interpret: one as to the meaning of book ownership, another, and more serious, as to the meaning of a first-grade pass. Some ambiguity arose as to whether number of books owned was a proxy for the influence of socio-economic status. It is intercorrelated with parental education ($r=0.28$), but was not collapsed into a general SES scale. The influence of books, therefore, can be separated from measures of other SES influences.

This is illustrated in table 8 which displays the proportion of children who receive a passing grade in Portuguese in each category of primary school, at each level of parental education, and number of books. Thus in urban state schools there were

Table 8. Pass in language and the number of textbooks owned by the student, by level of parental education and type of school (Rio Grande do Sul, 1968)†

Number of books	<i>Parents' education</i>							
	None		Incomplete primary		Complete primary		Secondary and university	
			<i>Urban state schools</i>					
	%	(N)	%	(N)	%	(N)	%	(N)
0	34.0	(238)	40.0	(402)	44.3	(194)	75.6	(41)
1	52.8	(547)	58.9	(1273)	65.3	(995)	81.5	(205)
2+	64.9	(97)	76.4	(301)	88.7	(337)	81.0	(174)
			<i>Rural state schools</i>					
0	24.4	(135)	42.2	(185)	60.6	(33)		
1	49.9	(381)	53.7	(806)	61.0	(254)		1/
2+	66.6	(63)	70.4	(152)	72.6	(95)		
			<i>Municipal schools</i>					
0	39.1	(527)	48.2	(577)	58.9	(112)		
1	50.6	(1895)	57.8	(3580)	65.3	(767)		1/
2+	62.2	(225)	71.0	(521)	78.6	(168)		
			<i>Private schools</i>					
0	36.8	(19)	38.5	(26)	80.0	(15)	60.0	(5)
1	53.6	(69)	61.5	(182)	75.7	(185)	76.6	(64)
2+	61.0	(41)	72.7	(165)	87.6	(275)	94.2	(206)

† See Note 13.

1/(N) is too small for comparisons.

In rural state schools, those children whose parents had no education had a two-thirds chance of receiving a passing grade if they owned two books; but only a one-fourth chance if they owned no book. Those whose parents finished primary school had a 72% chance with two books, but only a 60% chance with no book. What this demonstrates is that books are consistently effective within each category of parental status.

238 children whose parents had no education at all and who owned no books. Thirty-four per cent of these received a passing grade. On the other hand, there were 97 children whose parents also had no schooling but who owned two books, or more. Of this group 64.9% received a passing grade, a proportion of 1.9 times more.

There is another trend evident in table 8: the effectiveness of books is stronger if parents had no schooling. In urban state schools the advantage of having two books, over none, is 1.9 for children whose parents have no education, but only 1.1 for children whose parents have had secondary or university education. In municipal schools, too, it is significant (1.6 : 1.3); but of all categories of schools the difference in textbook impact on low-status children is greatest in rural state schools, where it is more than double the impact on high-status children (2.7 : 1.1).

This substantial textbook effect is evident when textbook ownership is entered into a regression (table 9). Here the influence of textbooks can be compared to other influences. In rural state schools, in urban state schools, and in municipal schools, of all the variables measured, the number of textbooks owned by students is the most powerful predictor of a passing grade in Portuguese language. In private schools and for all schools, the influence is only slightly less; in the latter case, equivalent to the impact of mother's education. These data indicate that textbook ownership is powerfully associated with passing Portuguese in grade one; although owning texts

Table 9. Most important beta coefficients in the step-wise multiple regression with grade in Portuguese language (Rio Grande do Sul, 1968)[†]

Variable [‡]	Type of school (N = 20 120)				
	All schools	Urban state	Rural state	Municipal	Private
Mother's educational level	0.14	0.13		0.06	0.16
Father's educational level	0.07		0.10	0.06	0.10
Number of textbooks owned by students	0.14	0.15	0.16	0.11	0.10
Father's occupational level		0.05			
Attendance in kindergarten		0.04			0.10
Number of teachers in the class	0.07	0.11	0.07		0.07
Teacher's experience in first grade		0.06			
Area per student			-0.06		-0.06
Numbers of hours in the school day			0.05		
Principal's experience in primary education					-0.14
Principal's experience in the job					0.08
Number of specialized personnel in school				0.05	
Presence of agricultural club					-0.09
Supervisor's level of training				0.05	

[†] Source: see Note 13.

[‡] Criterion for inclusion: improvement in the squared multiple correlation (R^2) of 0.002 or more; for private schools, of 0.003 or more.

may be more likely in higher social-status groups and within higher social-status schools, the effect of owning textbooks is not a proxy for the influence of social status. In fact the lower the social status, the larger the impact textbooks seem to have.

However, as the author suggests, these data are flawed in a serious way. They derive from a teacher-generated criteria of 'quality', and, since teachers differ in their judgements one cannot be certain that the same characteristics are being predicted in every case.[†] The dependent variable in this case is not so much a clear measure of Portuguese achievement as it is an indicator of who passes a teacher's judgement. Knowing this, all one can say is that those children whom the teachers report as owning more textbooks stand a significantly greater chance of 'passing' a teacher-administered first-grade assessment; and that the influence of owning more textbooks, independent of other influences, is strongest on those teachers in rural state schools and for those children in Rio Grande do Sul whose parents have had less education.

Summary of tendencies

While there is a positive association between textbook possession and academic achievement reported in most of these studies (the deviant cases being Iran and Ecuador) the results are not conclusive. Schiefelbein and Farrell's study of Chile indicates that textbook possession has its most important effect upon achievement among children of lower socio-economic status. Although the findings are less straightforward, the Thailand and the Malaysian studies point to the same conclusion. If texts have their greatest impact on children from lower social

[†] Despite the fact that teachers are supposed to follow state-wide criteria for deciding who should fail, there is a tendency to confuse strict teachers with good teachers. According to Wolff this may be one explanation why negative relationships emerge between pass rates and teacher quality.

backgrounds, then the 'deviant' negative findings from Iran may be significant. On only two variables does Iran differ notably from other developing nations included in the IEA studies. In Iran *all* sampled schools were urban, as opposed to India (21%) and Chile (58%). Twenty per cent of the students in the Iranian sample had fathers with managerial or professional occupations. This again contrasts with India (8%) and Chile (4%). Thus the Iranian sample is predominantly urban and disproportionately high status. Had the achievements of lower-status Iranian students been cross-tabulated, would the results have differed markedly from the results of Chile, Thailand and India? In one way or another the latter cases suggest that textbook possession has its strongest effect upon academic achievement among lower-status children.

It is interesting to note that where textbooks and achievement were measured at both the individual and school level (in the IEA studies of India and Chile), the correlation at the school level is markedly higher (again, Iran is a deviant case). This parallels Schiefelbein and Farrell's findings where both correlation and regression coefficients relating to achievement were higher at the classroom level. When aggregated to the school or classroom level what may be captured is not so much the effect on the individual student's learning of his own possession of a textbook, but the effect of a teacher in using them. When few (or no) students have textbooks, the teacher has to use the textbook as a guide, and rely on the blackboard or on oral dictation; students have to copy material into their own notebooks, thus producing their own texts. This wastes the time and energy of both teacher and student. Where most or all students have texts, a teacher may have an option of working with small groups, of assigning work, and engaging in other teaching practices. If this is the case then textbooks may be important not simply as learning aids for individual students who have them, but as a necessary condition for teachers to use more effective teaching techniques. If these inferences are correct, then there are implications for textbook distribution strategies and for the kinds of pre-service and in-service teacher-training programmes that might accompany programmes of textbook production and distribution.

No apparent connection with geocultural area (Latin America, Asia, Africa, the Middle East) is apparent in the strength of the relationship between books and achievement. On the other hand, each society considered here is developing. Comparisons with similar studies done in industrialized nations provide striking patterns of two kinds. First, achievement levels in all subjects studied are approximately 50% lower in poorer nations. The correlation between amount learned in science and reading and G.N.P. is approximately +0.7.³⁰ Second, variance in that achievement accounted for by in-school variables is much greater. This can be seen by systematically plotting the variance accounted for by home background and in-school factors against a nation's level of development. The more developed a nation, the greater is the proportion of achievement variance accounted for by home background factors $r=0.60$ ($p<0.01$) and the smaller is the proportion of variance accounted for by in-school factors $r=0.57$ ($p<0.01$).³¹ In India for example, sex and family social status has only 10% as much influence on science achievement than they do in other (mostly industrial) IEA countries. On the other hand, the impact of Indian schools is three times more in science and almost four times more in reading.³² This finding is illustrated in table 10. School investment in New Delhi can be three to four times more likely to account for a difference in achievement than would a similar investment, say, in Chicago.³³

Table 10. Contributions to the variance in learning by four blocks of variables, in India and in other IEA countries†

	Science			Reading		
	Median for 18 nations A	India B	Fraction (B-A) C	Median for 15 nations A	India B	Fraction (B-A) C
<i>10-year-olds</i>						
Sex and SES	14.9	1.3	(0.08)	14.0	1.6	(0.11)
Curriculum track	0.4	0.1	(0.25)	0.4	0.4	(1.0)
School influences	6.7	19.8	(3.0)	3.9	14.9	(3.8)
Attitudes	5.8	8.1	(1.4)	6.8	13.9	(2.4)

† Source: see Note 32: table 7 and table 8.

One hypothesis that would account for this is that school variables, measured by cross-sectional data, vary less in developed societies and therefore cannot account for as much variance in achievement scores. In industrialized societies it can be assumed that every pupil will have a complete set of textbooks for all subject areas, indeed often complemented by a variety of alternative texts, workbooks, classroom libraries, and so forth. In rich societies investigators must look for subtle and complicated differences in quality of texts. But these are difficult to define, let alone measure.

The little we know about the effect of textbooks upon academic achievement suggests that they are a consistently important variable, but that the degree of their effect is not consistent. The potential value of very detailed analyses of existing data-sets is indicated by the results from the Haron and Schiefelbein and Farrell studies, both of which suggest that textbooks have their most significant impact upon the education of lower-status students.

Where do we go from here?

Detailed analysis of existing data-sets

We should devote effort to sets of data already created. The IEA, El Salvador and other data-sets contain valuable information on access to and use of reading materials. These need to be pursued systematically. Two styles of analysis are particularly important. In many societies access to and use of reading material is closely associated with socio-economic status. Without the results of multiple regression or similar multivariate analyses, it is impossible to tell if correlations between reading materials and achievement are spurious, proxies for social status, or represent an independent effect. We also can profit from more analyses, which carefully consider the *interaction* between textbook possession and other variables: teacher training, class size, in-service training, community type (urban versus rural), ethnicity, and social background. It will be particularly important to investigate 'process variables'—whether parents assist with homework, whether pupils like to read in their spare time, and others. These variables are consistently more important in predicting learning than is socio-economic status; and though the level of impact of socio-economic status varies dramatically between industrial and non-industrial societies, the influence of these 'process' variables does not. These may be

particularly relevant for understanding how reading materials get utilized effectively in one social context but not in another.

Future intervention evaluations

One way to find out whether having more reading materials available will increase learning is to distribute them and record the level of learning before and after. Because books can be distributed in a manner approaching uniformity, they make particularly good candidates for interventions. This can be done in two ways.

One is through straight (non-experimental) project evaluation. Thus with the assistance of a World Bank loan, The Philippines Government is developing, revising, printing, and distributing textbooks for elementary and secondary schools. The quantitative objective is to reduce the ratio of students per textbook per subject from 10:1 to 2:1. The evaluation component will compare the improvement in learning in the first and second grades, in Filipino, science, and mathematics. The project is national; there is no *status quo* control group because the object is to distribute enough textbooks so that *all* children will have an equal opportunity for benefiting from them.

A second way is through an experimental intervention. Such a study has been undertaken in Nicaragua.† There, 40 classrooms, 20 in the first grade and 20 in the fourth grade, received one mathematics book for each child. First graders received workbooks (non-reusable); fourth graders received textbooks. In addition, each teacher received a short training course on the use of the texts, a teacher's guide, and a copy of the mathematics text for the grade above. The teachers are used to the textbook that was distributed and like it. It is a book common to most Nicaraguan schools but because of financial constraints, rarely before available to each child.

The experiment has two purposes. The first is to see whether children's mathematics achievement can be increased by giving each child access to a high-quality, attractive mathematics textbook. Pre-test measures have been taken of mathematics achievement and performance will be measured at the end of the experiment. Results will be compared to pre- and post-test scores of children in a randomly selected control group whose access to texts and other school resources has not been altered from the norm.

Studies of book production and use in classrooms

Both surveys and intervention experiments are only rough maps of what actually goes on in classrooms. Their primary function is to tell us whether reading materials get to classrooms, in what amounts, and what effect they have. They supply little information about the extent, or the ways, in which reading materials are actually used. For this we need observational studies. Thus, one important question is whether there is a 'critical mass' before supplies have an effect. If shared, is half the students having texts equivalent to all having them? Is there a threshold—a proportion of students who have to have books before their impact can be multiplied? We do not know what that threshold might be, and for poor nations, this would be a key datum.

† Data collection efforts have been successful despite the political and social changes taking place in Nicaragua.

Does the importance of reading material differ by grade level, or by subject area? Obviously, it is difficult to teach reading skills without books. But once initial skills have been established, could the mechanics, of reading be maintained or improved through the use of non-specialized reading matter—newspapers, magazines, wall posters, comic books? This is what the Ghanaian study would suggest. Conversely, in mathematics one may be able to teach the basic algorithms and number facts without a text, but is it more difficult to present problems in higher grades and teach the elements of mathematical theory without textbooks? Given the fact that many societies are not able to supply books for all subjects in all grades some systematic thinking needs to be done on this question.

When speaking of 'textbooks' people tend to have a standard image in mind—a set of pages bound together permanently, mass-produced with standard content for all children. Yet one suspects that the key feature of textbook availability is simply that learners have material to read and to work with. Perhaps equally effective material could be printed on newsprint or produced by mimeo-machine. For some subject areas and for some grades it may be better to have packages of locally-printed learning materials available than to produce a single standard text. Very little is known about the costs and benefits associated with these alternative means of providing printed matter.

There is frequently an implicit assumption that a textbook is a textbook is a textbook—that content and presentation do not matter. The insignificant results from the Ecuadorian experiment would contradict this. Content can be differently organized and this can affect learning. Fierce debates exist on which style of organization is most appropriate. In Chile, for example, there are now four distinct *syllabarios* in use—all basic reading texts. Each uses, and implies for the teacher, a different style of teaching reading: phonetic method, globalized semantic method, word recognition method, etc. Despite enormous amounts of research in developed nations, there is relatively little agreement about which kinds of content or what approaches are most useful for which kinds of children with which kinds of teachers. In the varying cultures encompassed in the 'developing' world the answers are no less uncertain. For example, are books less important for privileged children because they have so many other learning resources, including printed matter, at their disposal? Or are books more effective when they are reinforced by other cultural clues and media? This review would indicate that texts are more effective with children for whom the textbook is one of the only resources available; but this is not crystal clear.

In the final analysis one can assume that the effectiveness of textbooks as didactic aids depends upon the use made of them by teachers. Beeby suggested that at the early stages of educational development, when teachers frequently know only a little more than their more advanced students, a textbook may be absolutely essential;³⁴ it is the only 'rock' they have to cling to. As a system develops, teachers may need texts less and can deviate from their content more. Although this suggestion has considerable intuitive appeal, it has never been verified.

One might assume that pre- and in-service teacher-training are important to maximize the effect of textbooks but, except for the Ecuadorian experiment, we have very little empirical evidence about how effective this interaction has been, despite the fact that very large sums are spent on teacher-training. When 'modern maths' textbooks were massively distributed in Chile, and national tests were constructed in relation to their content, large numbers of teachers knew nothing about this new

notion of mathematics nor how to teach it. A massive in-service training programme was implemented but a teacher's exposure to in-service training had no consistent relationship with student scores on the mathematics portion of the national test. In spite of this, possession of a mathematics text was related to student scores on the mathematics subtest ($r=0.10$).³⁵

Books are frequently treated as a single intervention; very little is understood about their impact in conjunction with other instructional aids, such as radio, television, or ditto-machines. Is a textbook a substitute for the use of science laboratories, or does each make the other more effective? Are reading materials more effective in large classes? Without texts, presumably a teacher in a large class has to rely upon the lecture/group recitation method. There is some unpublished evidence from Chile which suggests that in order for teachers in large classes to work with small groups, the presence of textbooks is a necessary, but not a sufficient condition of effectiveness.

Exploring questions of distribution, equity and costs

More information is needed on the costs of book production and distribution, costs of differing subject specializations, differing scales of operation, and differing systems of pricing ownership. It is often assumed that schoolbooks should be produced and distributed by the state and that central distribution would be more equitable than private purchase by schools or by individuals. This may or may not be the case.

Thus, among school resources, books are one of the simplest to purchase, distribute, and maintain. Books are prime candidates for providing increments in equity; they can be reliably provided in greater amounts to individuals (or schools) who currently have least of them. But to increase equity the distributing authority has to perform better than individual (or local) purchasers of books in two different ways. First it has to more intelligently decide which kind of books to distribute. This is not an impossible task since central authorities have access to wider experience and more scientific information on what works and why. But central authorities also have to *actually deliver* books more equitably than books have been acquired in the past. If books are distributed in a less equitable fashion, then the centralization of distribution can be said to have worked both against efficiency and against equity.

This mismanagement appeared in Uganda after the purchasing of textbooks was centralized. In table 11 two groups of correlations are displayed: (a) the number of classroom textbooks for each seventh-grade student acquired by schools through their own purchase prior to 1972; and (b) the percentage of each school's 1972 order of (approved and prepaid) textbooks which actually arrived from the central distribution agency. Both figures are correlated with measures of school socio-economic status: paternal educational attainment and the number of consumer possessions to be found in pupils' homes. It is not surprising that the number of textbooks/child tends to be higher in the schools with pupils from more privileged social backgrounds prior to centralization—this inequity, after all, was one of the justifications for having a central authority distribute school textbooks in the first place. What is surprising is to discover that the relationships were *strengthened* rather than diminished as a result of centralization of school textbook distribution. The relationship between access to textbooks and paternal education *increased* from $r=0.125$ to $r=0.638$. The lesson to be drawn is not that individual purchase is

Table 11. Relationships between access to school textbooks[†] and Ugandan primary-school socio-economic status

	Number of textbooks per seventh-grade child accumulated before 1972	Percentage of textbooks ordered from central authority which actually arrived [‡]
Father's educational attainment	0.125	0.535**
Home Possessions Scale [§]	0.285*	0.638**

[†] Source: see Note 36.

[‡] Range = 0 to 229%.

[§] Bed, newspaper, bicycle, radio, clock, car, television.

* $p < 0.05$.

** $p < 0.001$.

necessarily superior to central distribution but that a centralized system of distribution does not necessarily work in favour of equity.³⁶

Chile's experience in the late 1960s and early 1970s may also be instructive. Approved textbooks were privately produced and distributed, but state subsidization kept the cost fairly low. For the private entrepreneur they were still a profit-making item. In 1971 one could go to very remote and poor villages and find a local kiosk with textbooks for sale. The question is whether it is better to have texts theoretically free to all, but unavailable because of inefficiencies of the distributing monopoly, or available to all but requiring an investment which though small, may still put them out of the range of the poorest students. Perhaps there is a way to combine the distributional efficiencies of the private sector with the potential equity advantages of a more centralized intervention.

Conclusion

In sum, the evidence available suggests that an investment in textbooks will produce learning gains; and that this is more likely to occur as a result of a textbook investment than it is as a result of other educational interventions such as teacher training. We do not know the exact conditions under which textbook effects occur. We do not know the relative rates of financial return for an investment in texts as compared to an investment in other scholastic improvements, nor how to maximize that pay-off under varying conditions. Efforts to gather more precise information is important, because investment programmes in textbooks are likely to increase. If we were to have more pre- and post-tests, and more information on what kind of teachers and other materials already existed in the affected schools, this would later allow us to conclude, in a less ambiguous fashion, that both the amount and the substance of our investments were wise choices.

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