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Improving the quality of educatior

The experience of World Bank projects shows that better quality teaching and teaching tools are crucial.

Stephen P. Heyneman

The contribution of learning to economic growth has long been recognized, although the precise measurement of its effects is still subject to debate. Parental demand for educational opportunity, coupled with the economic and political incentives for authorities to supply it, account for the expansion of formal schooling to unprecedented levels. Universal primary school enrollment has now been achieved in 35 of the richer developing countries since World War II, including Argentina, Gabon, Malaysia, and Trinidad and Tobago (Table 1). In the 36 poorest countries (whose per capita gross national product (GNP) was US$265 a year or less in 1975) average enrollment in all levels of primary education increased from 48 per cent of the school-age population in 1960 to 70 per cent in 1977. There are, moreover, about 50 per cent more children enrolled in grade one than in grade four, so this 70 per cent enrollment figure significantly understates the proportion of children who begin school. By the end of this century, every child will probably be able to start school.

The quality of education received by these children is the subject of this article. Typically, primary school teachers in developing countries have few teaching tools, and even these are of poor quality. Their own salaries absorb most available funds. Not surprisingly, despite common objectives in teaching mathematics, reading, and science, their pupils leave school with far fewer skills than do their counterparts in the developed world, who are exposed to schools of substantially higher quality. And yet the Bank's experience shows that even poor education in these basic skills makes for better farmers, better administrators, and better mothers with healthier children. Analysis that attempts to isolate those factors that have the most effect on a pupil's achievement in developing countries shows conclusively that better quality teaching and teaching tools—particularly more and better textbooks—have a substantial effect. As a result, there has been a shift in emphasis within educational investments.

Poor resources

Perhaps the most serious oversight of educational planners during the 1960s was to bypass the issue of how well schools were teaching skills. This is no longer possible. Schools are asked to transfer an increasing number of cognitive skills and amount of factual knowledge. The mathematics and science taught to primary school students today were, ten years ago, often expected only of secondary school students. Similarly, secondary school students are taught now what before was taught in university or, in some cases, not at all because the field is new.

Yet in spite of the significant advances made in providing places in primary schools, these schools in the developing world generally have poor resources and therefore pass on less effectively than they could the increasingly complex skills required of school leavers today. The education of teachers and the availability of furniture, equipment, and materials are normally well below the standards considered minimal for schools in industrial societies.

In 1977, for instance, there were ten pupils for each available primary school textbook in the Philippines. In Bolivia, in 1978, the monetary value invested annually in furniture and materials in the average fourth-grade classroom was approximately 80 U.S. cents a pupil, one sixtieth of the investment for each pupil in Maryland (U.S.A.) during the same year. In a survey conducted in Malawi in 1979, 1 pupil in 8 was found to have a chair, and only 1 in 88 a desk. Primary schools were without safety standards. Walls frequently collapsed after a rain; roofs had large holes; wind and storms disrupted classroom activity as a matter of course. The normal classroom was dark and stuffy; students sat on the ground, balancing an exercise book or slate on their knees to write. Teachers had no offices, chairs no backs, and stools half a seat. The results of inadequate sup-

Table 1
Primary school enrollment ratios, 1960–78

Country income group by GNP per capita	Number of countries	Gross enrollment[1] (In per cent)				
		1960	1965	1970	1975	1978
Low income, less than $265[2]	36	48	58	61	64	70
Lower middle income, $265–$520[2]	21	59	65	69	73	80
Intermediate income, $520–$1,075[2]	21	71	84	95	102	107
Upper middle income, $1,075–$2,500[2]	14	85	93	96	102	103
Low and middle income	**92**	**57**	**66**	**71**	**75**	**78**
High income, above $2,500	**17**	**114**	**118**	**120**	**120**	**116**

Source: World Bank, *Education Sector Policy Paper*, 1980.
[1]The gross enrollment ratio is the total enrollment of all students in primary school divided by the population that corresponds to the age group of primary schooling. Over- or under-aged students can frequently inflate the figures, and account for the percentages above 100. See United Nations Educational, Scientific, and Cultural Organization, *Statistical Yearbook 1978–79*.
[2]In 1975 U.S. dollars.

in developing countries

Table 2
Allocation for nonsalary school resources as a per cent of total recurrent expenditures, 1978–79

	Primary	Secondary	Tertiary
Africa	3.8	12.7	13.1
Asia	8.8	13.8	22.7
Industrial countries	14.4	14.8	25.5

Source: United Nations Educational, Scientific, and Cultural Organization, *Statistical Yearbook 1978–79.*

port for educational systems have a negative impact on an economy by reducing the value of the already low investment of scarce resources.

Such inadequate teaching environments are partly a result of the fact that the lion's share of the funds available for education—on average 95 per cent of the money set aside for primary schools—has to go toward teachers' salaries. But paying a teacher to copy from a worn-out textbook onto a blackboard and to supervise its memorization by 50 students is an ineffective utilization of expensive talent. The question is what level of classroom resources teachers should have available to justify their salary. In industrial countries today, 14 per cent of recurrent costs of primary schools are allocated to classroom resources—books, maps, visual aids, furniture, and the like—and 86 per cent is spent on salaries. The average in Asia is 9 per cent and 91 per cent for salaries; and in Africa 4 per cent with 96 per cent for salaries (Table 2). One policy dilemma that developing countries are now confronting with regularity is the minimum standard of resources a primary school should have before new teachers are taken on. Experience has shown that, at a minimum, expenditures on teaching tools should account for approximately 10 per cent of public recurrent expenditures.

The large difference in educational quality between low- and high-income countries is also widening. As more and more pupils enter school there is less available to teach them with. In 1960, the average Organization for Economic Cooperation and Development (OECD) country invested 14 times more for each elementary school pupil than did any of the 36 countries with per capita incomes of below $265 per year. But by 1977 the difference had grown to 50:1.

Education and productivity

Although conclusive evidence is scarce, it is clear that the poor quality and limited educational materials available in developing countries adversely affect the level of cognitive skills a student can acquire at school. Recent studies show the average student from a developing country scoring at a level that falls in the bottom 5 to 10 per cent of students from a high-income country, and the poorer the country in economic terms, the fewer cognitive skills are acquired by the end of the primary school cycle. Though any comparison—whether between pupils or schools or districts or countries—should be approached cautiously, there is general agreement that achievement is lower in schools in poor countries.

The implications of these results for growth in the developing world are sobering. The general education of a population in science, mathematics, and reading has a significant bearing on the degree of productivity to be expected from it. The link between irrigation-based farming and education is illustrative. There are approximately four different levels of technology involved in irrigation-based agriculture

Four basic stages of agricultural productivity and their learning requirements

Farmer-entrepreneurs technology level	Agricultural inputs	Minimum learning requirements
Level A: Traditional farming *(Techniques passed from parent to child)*	Local varieties of seeds and implements.	Addition and subtraction—not necessarily acquired through formal education.
Level B: Intermediate technology	Small quantities of fertilizer.	Addition, subtraction, division, and rudimentary literacy.
Level C: Fully improved technology	High-yielding varieties; proven seeds; seed rates/acre; fertilizer rates/acre; and pest control rates/acre.	Multiplication, long division, and other more complex mathematical procedures; reading and writing facilities, and rudimentary knowledge of chemistry and biology.
Level D: Full irrigation-based farming	All above inputs; tubewell access during the off-season; and water rates/acre.	Mathematics, independent written communication, high reading comprehension, ability to research unfamiliar words and concepts, elementary chemistry, biology, physics, and regular access to information from print and electronic sources.

Source: Risto Harma, "The Farmer Entrepreneur and His Prerequisite Prior Education in Agricultural Development," mimeograph, World Bank, 1979.
[1]Direction from agricultural extension agents is helpful at any stage, but the essence of a farmer-entrepreneur is his ability to calculate his own production function.

(see chart). The most elementary is where knowledge and skills are passed from father to son (see chart, level A); little schooling is required here. The second level of technology (B) includes a single modern input, such as fertilizer, whose utilization is substantially improved if the farmer has rudimentary literacy and a knowledge of addition, subtraction, and division. If a farmer has none of these skills, he will have to follow by rote the one-to-one advice of an extension agent—an expensive and comparatively inefficient method of learning. The third level (C) includes several modern inputs simultaneously, such as high-yielding varieties of seed and careful allocations of pest control and fertilizer. Here, having to follow the advice of an extension agent by rote is even more expensive, but for the farmer to take his own initiative requires an understanding of long division, multiplication, and other mathematical procedures; an ability to read and write; and rudimentary knowledge of some chemical and biological principles. The fourth level of technology (D) is the most modern and includes all the above inputs plus tubewell access during the off-season. For a farmer to operate efficiently at this level he needs to be able to communicate in writing, to research unfamiliar words and concepts himself, to understand basic concepts drawn from chemistry, biology, physics, and to have dependable access to new information from print as well as electronic sources. This is the ideal: that every farmer be able to calculate his own "production-function" anew every year and with each change in crop.

Irrigation farming has been used here as a proxy for national development schemes that aim to increase farm productivity by using new technologies in the (C) and (D) categories. For these schemes to be successful, certain minimum cognitive skills are required of the farming population. A lack of understanding or a misunderstanding of the principles on which new technologies are based can result in catastrophic agricultural yields, and harmful side effects as well. Such skills are required no less urgently by the manufacturing and service industries.

Basic cognitive skills are also required if further training in other, often nonformal, areas is to be successful. The Bank's experience has shown that if people are to be able to make the most of technical or on-the-job training, they not only need to spend a certain amount of time in formal education, they also need to emerge from formal education with a sufficient grounding in cognitive skills. Being exposed to 6–12 years of the low quality education provided in many countries may not be enough. Several faculties of engineering have remained up to one third empty—not because of a lack of demand for local engineers but because there has not been a sufficient supply of qualified entrants with the requisite grounding in mathematics and science. This experience has forced the Bank, for example, to rethink the process of manpower planning very carefully and to incorporate a factor of quality in addition to the normal supply figures for numbers of years exposed to formal schooling.

Textbooks crucial

Since the 1960s, social scientists have been trying to isolate the characteristics most closely associated with achievement in basic cognitive skills. The approach is relatively recent and imperfect; but, though technical caveats abound, it has come to one important conclusion: in wealthy countries much of the learning in school is accounted for by factors not connected with the school environment, implying that additional physical facilities, teaching equipment, and textbooks only help the acquisition of new knowledge a little. But the quality of the physical and particularly the classroom tools in low-income countries is shown to explain three and even four times the differences in achievement that it can in high-income countries. In fact, the poorer the country in economic terms, the larger the impact on achievement school quality seems to have.

The evidence is scarce on which aspects of the educational environment can be expected to have the most impact on student achievement in the developing world. But one conclusion is consistent: higher achievement is associated with the availability of textbooks and other printed materials. Of the 20 assessments that have been made of the relationship between the availability of printed material and student achievement scores, 17 have reported positive effects.

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Providing books where there is nothing to read in the schools sounds like a simple undertaking but may entail substantial logistical challenges—the books have to be acquired or produced, stored, distributed, and so on. But there have been successes in the efforts made to improve this aspect of schooling. The Bank's Third Education Project in the Philippines assisted the Government to design new, high-quality textbooks in mathematics, science, and Pilipino. Approximately 97 million of them were distributed sufficiently widely to alter the average ratio of pupils to books from 10:1 before the loan to 2:1 afterward. Average student scores were raised significantly; in fact, the achievement gains in the Philippines were approximately twice the magnitude to be expected in North America were class size to be reduced from 40 to 10. Moreover, the gains from the project were frequently the greatest where they were least expected—among students whose family background and school location have been associated with severe poverty and who came to the school with low levels of knowledge.

Where there are enough textbooks, and the school system has met certain standards of efficiency and good management—as in Algeria, Greece, Ireland, or Korea—the Bank tends to lend for science laboratory equipment, supplementary readers, library facilities, electronic media, or specialized teaching facilities. These too can be expected to increase achievement by significant amounts.

Thus, the demand for educational investment is slowly experiencing a shift in emphasis away from providing places for universal primary education and toward improving the quality of the learning. As far as we can predict, the bulk of the Bank's capital investment in education will continue to assist the expansion of schools, but this proportion is expected to decrease. In fiscal year 1983 it should decline to less than 85 per cent of resources disbursed for education—from 93 per cent between 1975 and 1978. The decline is accounted for by increases in lending for curriculum development, for radio, television, educational administration, and particularly for increases in the development, production and distribution of learning materials. By fiscal year 1983 the Bank's education sector lending is expected to be $50 million a year in classroom "tools"—up from $1.6 million a year a decade earlier. For example, 5 per cent of education projects contained funds for textbooks in fiscal year 1975; 10 per cent in 1976; and 25 per cent in 1977. By fiscal year 1978 this had risen to 40 per cent. As a result of the Bank's investments, a very large proportion of students have or will

have textbooks in Benin, Brazil, El Salvador, Indonesia, Lesotho, Malawi, the Philippines, and Swaziland.

Future policy developments

Two results seem to be emerging in the wake of the demonstrated importance of the quality of educational materials. First, developing countries want to design, manufacture, and distribute their own educational materials, including textbooks. The World Bank has, where it is economic to do so, made loans for printing presses, storage and distribution systems, paper mills, and the training of editors, designers, and production experts. This is the case in both Indonesia and the Philippines.

But this area needs to be analyzed carefully. In some cases, the cost of producing books locally from scratch may be prohibitive and the technical experience, equipment, and raw materials (particularly paper) may be imported more cheaply from Western Europe or North America. The publication process demands substantial experience in editing and production, in printing, testing, and marketing. Six to ten years is normally required to develop a new generation of textbooks for primary school grades one through six. This may, given the availability of the necessary skills, be economic for books on local history, civics, and literature; but it may be cheaper to adapt already published materials in mathematics and the sciences. However, it is often more economic for countries to publish their own textbooks than to print them. Printing in large quantities requires specialized machinery and a constant supply of raw materials and maintenance skills; publishing requires editorial and design skills but not necessarily the local hardware for manufacture.

A second effect of the interest in the quality of education is the increased awareness of the need for equality of educational opportunity within and between populations. There is a standard for educational opportunity today that varies only slightly from one high-income country to the next. In developing countries, however, equal educational opportunity has, so far, meant only a place at school. But when a pupil in Bolivia, India, or Malawi, who must learn similarly complex skills of mathematics or science, has access to only one sixtieth the level of learning resources as the child in Europe or North America, there is no equality of educational opportunity between Bolivia, India, and Malawi on the one hand, and Europe or North America on the other. For the first time in history it will soon be possible for every individual at a given age to have an opportunity to begin schooling. But this is not a sign that equality of opportunity has been reached between nations. Substantial new resources would have to be made available to pupils in developing countries if they are to have anything approaching equality of opportunity with pupils in the developed world after entry in school has been obtained.

This poses a substantial economic dilemma. Should the quality of education in developing countries be the same as that in the industrial countries? Some areas of education—such as electrical engineering, architecture, or computer sciences—are fairly similar in all countries; consensus exists on the requirements for training and the physical inputs necessary to deliver it. This consensus is similar to the agreement that exists on the physical requirements for building a bridge, a road, or a dam with certain specifications. Moreover, minimum physical requirements, and therefore minimum cost standards, are predictable.

Primary and secondary schools also have minimum requirements for achievement in different skills, but there is little consensus on the minimum resources required to provide them. The major industrial countries invest 50 times more per pupil to meet similar curriculum objectives than do certain developing countries. This disparity leaves developing countries with an unenviable choice: establish a ceiling on enrollments; possibly also decrease science and reading curriculum objectives to a level well below those of industrial countries; or increase expenditures on education to provide the quality of resources needed if their curricula are to be efficient. If the latter option is chosen, some consensus must be reached on the level of inputs required and where resources can be found to obtain them. These will be the central issues in most developing countries in the years to come. F&D

Related reading

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An earlier readership survey, conducted in 1976, gave us a good indication of the composition of our readership. The new survey updates and expands this information, but its primary purpose is to elicit the views of our readers on the journal's contents, presentation, and many other matters. We hope the results will provide us with guidance regarding the needs and preferences of our readership.

The response to the survey has been excellent and we should like to thank those of you who took the time to participate. The results are being tabulated and a report will be published in our June issue.