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Cost Analysis for Educational Policymaking: A Review of Cost Studies in Education in Developing Countries

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Given the major challenge of improving education under tight budgetary constraints, educational policymakers in developing countries today are concerned with issues regarding educational costs. Using an economic framework, this paper reviews the issues and synthesizes the findings in a diverse literature on costs of education in developing countries. Four key educational-cost issues are considered: (a) What are the costs of education? (b) What are the major determinants of educational costs? (c) In what ways can cost analysis improve policymaking in education? and (d) What are the informational needs for cost analysis in education? The paper concludes that although cost analysis can contribute significantly to informed decisions on education, greater efforts must be undertaken to strengthen the informational basis of cost analysis and to incorporate cost analysis in educational policymaking.

What are the costs of education? What are the major determinants of educational costs? In what ways can cost analysis improve policymaking in education? And what are the informational needs for cost analysis in education? These are the key questions to be considered in this review. These questions are important to address in light of the major challenge for educational decisionmakers in developing countries today, that is, improving education under tight budgetary constraints.

The important role of education in national development is widely recognized. Education brings numerous economic and noneconomic benefits to both individuals and society. Studies have shown that expenditure on education in developing countries is a very profitable investment and that rates of return to education are higher than for physical-capital investment (Psacharopoulos, 1985). Education is also seen as a basic human need (World Bank, 1980).

Given the importance of education, developing countries have devoted a substantial portion of their resources to education in the last two decades. For example, between 1960 and 1979, average public expenditure on education in developing countries has increased from 2.3% to about 4.0% of GNP and from 11% to 15%

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of total public expenditure (Eicher, 1984; Zymelman, 1976a, 1982). In current monetary terms, public expenditure in education has increased about tenfold.

Although total enrollment in education in developing countries has increased significantly in the past two decades, the current conditions in education are less than desirable. In many developing countries, especially those in Africa, the enrollment ratio in primary education is low (less than 50%), and universal attendance will remain a distant reality. Primary schools are also plagued by high dropout and repetition rates (Haddad, 1979) and low quality (Aklilu & Heyneman, 1983; Heyneman, 1983). Not only is access to higher levels of education still very limited, but the distribution of educational opportunities and resources among different social groups is highly unequal (Farrell, 1982). Moreover, a large number of school leavers are either unemployed or underemployed (World Bank, 1980). Significant problems of inefficiency and inequality in education exist in developing countries.

However, the future prospects for education do not look promising. Faced with sluggish education growth and intense population and fiscal pressures, developing countries find it difficult to increase or even to maintain their current level of expenditure on education. Thus improvements in education, in both quantity and quality, have to be made under very tight budgetary constraints, not to mention other political, cultural, and human-resources constraints (Windham, 1986). Policies that promote the efficient use of existing resources for education are an obvious necessity.

Analyses of the costs of education can reveal the cost implications of an educational policy, provide diagnosis of past cost patterns (such as the determinants of costs and sources of variation in costs) and prognosis of future cost requirements, and assess the relative cost-efficiency of alternative educational policies or interventions. Cost studies in education can thus contribute to improved policymaking in education. This paper provides a review of these studies in developing countries.

In the following, we give a brief overview of cost studies in education in developing countries and present an economic framework for reviewing and synthesizing the findings of this literature.

Cost Studies in Education in Developing Countries

A major effort to promote the application of cost analysis in educational planning in developing countries began in the late 1960s. The effort was organized by UNESCO, with the participation of 19 countries, 12 of which were Third World countries. It included the preparation of monographs on the methodology of cost analysis in educational planning (Hallak, 1969; Vaizey & Chesswas, 1967; Woodhall, 1967) and the implementation of a large-scale research project consisting of 27 case studies (UNESCO, 1972). Cost analysis was applied to education to test the economic feasibility of education expansion plans, cost educational reforms and innovations, and guide efficient allocation of scarce resources to education. The focus was on formal schooling.

This effort occurred during a period of rapid increases in enrollment and public educational expenditure, stimulated partly by the popular belief in the considerable economic value of education. The application of cost analysis to educational planning reflected the acceptance by educational policymakers that educational spending was an investment activity amenable to economic calculus.

In the 1970s, these applications of cost analysis continued to receive attention in developing countries (McMeekin, 1975; Zymelman, 1976b). During this period, however, a major focus was placed on the costing and cost-effectiveness evaluation of new educational media (Eicher & Orivel, 1980a; Jamison, Klees, & Wells, 1978; UNESCO, 1977). This was prompted by the realization of the expensiveness of a linear expansion (simply increasing the size) of the traditional education system. The capability of television and the radio to reach large audiences and remote geographical regions, as well as the potential savings in the cost of education per student, generated much enthusiasm in new educational media. At the same time, the interest in nonformal education for rural development also led to studies on the economics of nonformal education (Ahmed, 1975; Hunter, Borus, & Manan, 1974).

But since the late 1970s and especially in the past few years, stagnant economic growth and severe fiscal constraints have shifted attention to the control and/or reduction of educational costs, as well as to employment of alternative mechanisms for financing education. Studies addressing these concerns have emerged (Eicher, 1984; Psacharopoulos, Tan, & Jimenez, 1986; Schiefelbein, 1986; Wolff, 1985; World Bank, 1985).

The literature on educational cost analysis in developing countries is quite diverse. It includes studies that vary in their scope of analysis, such as the modes of educational delivery (formal and nonformal education), levels of schooling, types of education (public and private), geographical locations (urban and rural), trends over time, as well as the scale of educational interventions (an educational project, an educational innovation, and an educational plan). The diversity of the studies is further multiplied by the different types of economic analysis in which these studies engage, such as costing, economic-feasibility testing, cost reduction, cost-effectiveness comparison, cost-benefit comparison, and others.

The diversity and the obviously large size of the literature notwithstanding, a significant number of the studies are not easily accessible or retrievable. This is because some of these studies were conducted by or for the governments of developing countries, involve one or more ministries in these countries, and are often not published. Language is also a potential barrier.

To make the review manageable, this paper has limited itself to cost studies of formal education and has concentrated on the findings for public education,[1] but it has placed no restriction on the type of economic analysis to be considered. The sources for the review include published and unpublished works available in the public domain, as well as a limited number of governmental reports. These sources are almost exclusively in English.[2] A substantial number of these works were conducted with the sponsorship of the World Bank or the United Nations Educational, Scientific and Cultural Organization (UNESCO).

An Economic Framework for Analyzing Educational Costs and Efficiency

The conventional economic approach to the study of education regards education as similar to economic production (Hanushek, 1979; Lau, 1979). In economic production, given production objectives, prices, and technology, inputs are transformed into desired outputs. The internal process that transforms inputs to outputs is represented by a production function that is a relationship indicating the

maximum amount of outputs that can be produced for given inputs. Let us consider the application of this framework to education.[3]

The objectives of education refer to the tasks to be accomplished by education that are demanded by the polity. They may include general ones such as "producing good citizens" and "learning cultural heritage," as well as specific ones such as computational and reading skills.

Outputs of education consist of education effects such as cognitive and noncognitive skills learned by students. Presumably, these skills are consistent with the objectives set for education. Besides these outputs, education may also generate benefits such as higher productivity and earnings.

Inputs to education are the various ingredients used in producing outputs, including students, teachers, instructional materials, equipment, physical facilities, and others. The resources devoted to these inputs constitute the costs of education.

The technology of education denotes the internal process encompassing the curriculum, pedagogical methods, school organization, management, and monitoring procedure. Alternative technologies of education exist, such as the traditional school and out-of-school distance teaching. The relationship between inputs and outputs is represented by an educational production function (EPF).

Using this educational production framework, we can distinguish several concepts of efficiency in education to which cost analysis can be applied. These concepts include internal efficiency, external efficiency, technical efficiency, and economic efficiency.

The internal efficiency of education compares the costs of education to the outputs or effects within education, such as the acquisition of cognitive and noncognitive skills. Education production is said to be more internally efficient when it can produce more desired outputs given the same resources.

The external efficiency of education compares the costs of education to the benefits of education that are external to educational production, such as higher productivity and earnings in postschooling work. It provides a measure of the profitability of investment in education.

Whereas external efficiency and internal efficiency are defined with respect to the boundary of educational production, technical efficiency and economic efficiency concern the very nature of educational production. Consider a given amount of financial resources. This amount of financial resources can be used to purchase a certain combination of inputs at prevailing prices. Given this combination of inputs and technology, educational production is technically efficient when the maximum amount of school outcome (outputs or benefits) is produced, that is, a school is operating on the production-function "curve." Educational production can be technically inefficient when some of the given inputs are underutilized. When a school is technically inefficient, school outcome can be raised without incurring additional cost, just by utilizing existing inputs more fully.

Given prices of inputs, the same amount of financial resources can be used to purchase different combinations of inputs, for example, more or fewer teachers as opposed to textbooks or physical facilities. Educational production is economically efficient when, given prices, technology, and financial resources, the maximum amount of school outcome is produced by selecting the right combination of inputs. When a school is economically inefficient, school outcome can be raised without incurring additional cost, just by altering the combination of inputs.

Thus the efficiency of education, internally or externally, can be promoted by "technical" and/or "economic" means.

The above discussion of the efficiency of education has been confined to a given technology of schooling. This, however, does not have to be the case. Given available resources, it is possible to raise school outcome by developing and using alternative technologies in terms of changes in organization, management, curriculum, or pedagogy. The costs and outcome of the alternative form of schooling and those of the traditional school can be compared.

So far, we have considered the efficiency of education from the perspective of a production system, using an educational production function to relate school outcome to inputs. An alternative but equivalent way to study efficiency (Shephard, 1970) is to use an educational cost function (ECF). An ECF is a relationship which, under the prevailing technology and input prices, indicates the minimum cost needed to produce a given level of outcome.

It is not difficult to see that the several concepts of efficiency mentioned above can be analyzed using an ECF. External or internal efficiency is increased whenever cost can be reduced in achieving a given level of external benefit or internal effect, respectively. Educational production is technically efficient when, given input prices, input combination and technology, minimum cost is incurred to produce a given level of school outcome, that is, school is operating on the ECF "curve." When school is not technically efficient, educational cost can be reduced by cutting excess inputs without affecting the level of school outcome. Finally, economic efficiency is attained when, at prevailing input prices and technology, the right mix of inputs is chosen to produce a given level of school outcome so that the cost incurred is minimal. When school is not economically efficient, cost can be reduced by changing the mix of inputs without affecting the level of school outcome.

Viewing education (or part of it) as a production system, we can conveniently place educational cost studies into three categories: (a) educational costing and cost-feasibility studies, (b) studies analyzing the behavioral characteristics of educational costs, and (c) cost-benefit and cost-effectiveness studies.

Studies in the first category are concerned with inputs to education only. The major tasks are to identify, classify, and measure the costs of various inputs to education. These studies are conducted for purposes such as costing and testing the economic feasibility of an educational plan, measuring the start-up costs and operating costs of a major educational intervention, and estimating the short-term and long-term cost impacts of a project.

Studies in the second category are concerned with relationships among inputs and how inputs are utilized in the educational production process. The major tasks are to determine the distribution of costs among education levels and educational inputs, identify the various factors affecting total costs and unit costs, estimate the impacts on cost of the level of utilization of educational inputs, and analyze the relationship between educational costs and the size of an education establishment. These analyses provide a diagnosis of the behavioral characteristics of educational costs. They assess the level of resource utilization and thus the opportunities for improving technical efficiency. They can also uncover problematic cost patterns to identify strategies for improving economic efficiency.

And finally, studies in the third category relate inputs to educational outcome. By comparing both the costs and benefits or effects of alternative educational

interventions, cost-benefit or cost-effectiveness studies can inform educational decisionmakers about efficient allocation of educational resources. The studies reviewed here include those that consider improvement in economic efficiency through the use of different mixes of inputs under a given technology of educational production, for example, more textbooks or smaller class size in the traditional school. They also include those considering efficiency improvement through the use of alternative educational technology, such as educational media.

In reviewing educational cost studies in each of these three categories, the paper attempts to clarify the issues involved, synthesize the findings, and indicate knowledge gaps for further research. The purposes of the review are twofold: to document how educational cost analysis can contribute to improved policymaking in education and to identify the informational needs for cost analysis.

The rest of the paper is divided into four sections. The following three sections review the three categories of cost studies. The last section summarizes the major findings of the review.

Educational Costing and Economic-Feasibility Testing

Costing and testing the economic feasibility of educational interventions are common applications of cost analysis in education. Analytically, they are concerned with identifying the various inputs to educational production and measuring the costs of these inputs. In this section, we first discuss the applications of educational costing and then consider the various conceptual and practical issues relevant to the estimation of educational costs.

Costing and Economic-Feasibility Testing of Educational Interventions in Developing Countries

Before reviewing studies in the costing of education interventions, it is necessary to provide a brief discussion of the methodology of costing.

The cost of an intervention can be estimated using a simple and logical approach called the ingredients or resource approach (Levin, 1983). According to this approach, the ingredients used in the intervention are identified and costed. In cost analysis, the cost of an ingredient is its opportunity cost, that is, the cost incurred as a result of the ingredient's being used in the given intervention and thus not being available for use in alternative activities. It is measured as the worth of the ingredient in its best use. The sum of all the ingredient costs is the total cost of the intervention.

In the ingredients approach, it is important to differentiate between the total cost of an intervention and the costs incurred by those who pay for it. Each ingredient is paid for by someone (e.g., the central government, a local government, an individual, or foreign aid). The total cost of the intervention is thus often distributed among several sources of support. Information about the sources of support for an intervention is needed to assess the economic feasibility of the intervention. A frequent error in educational costing is to estimate the total cost of an intervention by considering costs incurred by the government only.

Consider educational-costing studies in developing countries. An early example is provided by the 1962 reform of primary education in Madagascar (Ta Ngoc, Hallak, & Coombs, 1972). In trying to achieve the goal of universal primary

education, the leaders of Madagascar realized that a strategy of linear expansion of the existing primary-education system was economically infeasible and would not meet the needs of the country. To expand educational opportunity for rural children, a reform of primary education was introduced. It had four major features: (1) reorienting of the primary-school curriculum to better match the needs of rural life in Madagascar, (2) reducing the cycle of primary school from 6 years to 4 years for rural areas, (3) reducing teacher costs by creating a new category of teachers with lower qualifications, and (4) adopting a new pattern of financing which placed more financial responsibilities on provincial governments and rural communities.

A detailed costing of the reform found that the plan placed an excessive burden on provincial governments and poor rural communities. It also showed that the potential savings would be smaller and slower because of costs of training teachers for the new curriculum and low-salaried teachers could not replace high-salaried teachers quickly. Thus, parts of the initial 1962 reform had to be redesigned. The study indicated that cost estimation was considerably constrained by the lack of relevant information on the breakdown of school enrollments by grade levels and school cycles, on the variation of teacher-pupil ratios by different types of school and grade levels, and on the age and salary distribution of the teaching force. The ability of each participating unit to finance the reform was also a major consideration. Nevertheless, the example shows that a sound economic analysis can be useful in alerting decisionmakers to the potentially serious errors in educational policies and in indicating the type of data needed for policy formulation.

Another early example is the costing of an educational innovation in elementary schools in Barbados in the 1960s (Durstine & Hudson, 1972). In 1965, Barbados undertook a 5-year experiment in team teaching to promote student learning. The experiment was carried out in five schools, with a budget of $297,500. Each school had an average of about 650 students, with five teams of four teachers each. The Barbados teachers involved were trained to work effectively in a team. Before the end of the experiment, a decision had to be made whether or not to extend team teaching to all elementary schools. A cost analysis was conducted to inform decisionmakers about the cost implications of expansion. Because a "marginal" decision (whether or not to expand team teaching beyond what already existed) was at issue, the "marginal cost" (additional costs) of the expansion was estimated. The calculation found that the additional cost per student in the expansion of team teaching would decline considerably to about one quarter of that of the original experiment. This estimate, when combined with subsequent findings of pedagogical evaluation, would constitute the information basis for decisionmaking. It should be noted, however, that the estimate was an improper measure of the cost per student because it was based on the budget alone; resources from other sources were not considered. This is a frequent error in educational costing.

The costing of new educational media is another important application of cost analysis in education. Traditional primary schools are characterized by a very labor-intensive technology of educational production; in other words, schools rely heavily on teachers and other personnel to educate children. The capability of mass media (radio and television) to educate a large number of students at presumably low cost and to reach children in thinly populated areas has made it an attractive innovation in developing countries (e.g., Nicaragua, El Salvador, Brazil, Mexico, Korea, Ivory Coast, Senegal, Malawi, Kenya, and Thailand). A significant amount of cost-

analysis work has been done on new educational media projects (Carnoy & Levin, 1975; Eicher, Hawkridge, McAnany, Mariet, & Orivel, 1982; Jamison et al., 1978; Perraton, 1982; UNESCO, 1977, 1980; Wagner, 1982). The findings indicate that the unit cost (cost per broadcast hour) varies significantly among countries (Eicher et al., p. 56) and that the cost per student usually decreases with student enrollment (Eicher & Orivel, 1980a). Also, these projects usually involve high start-up costs. A positive result of the costing effort is the standardization of the measurement and classification of the costs of new educational media. But quite a few of these projects were implemented without a prior evaluation of the cost-effectiveness of new educational media. The cost-effectiveness of new educational media will be considered in the subsection titled "Cost-Effectiveness Studies in Education in Developing Countries."

As a last illustration, let us consider the costing and feasibility testing of the education plan of Thailand in the 1960s (Reiff, 1972a, 1972b). Thailand's National Economic and Social Development Plan for 1967–71 called for a set of development objectives and quantitative targets for the Thai education system (1972b, pp. 268–272). These objectives and targets were developed, however, without examining their cost implications. A cost analysis was conducted only after the targets were set. Crude cost data for the analysis came from budgetary data of the central government as well as a sample survey of more than 100 schools.

Some of the findings of the study were supportive of the educational plan. For example, the planned capital expenditure for new educational facilities and the planned public funds for the recurrent costs of public schools at the pretertiary levels were adequate for meeting the financial requirements. But findings also emerged that questioned the feasibility and desirability of some of the targets of the plan. For example, the per-student recurrent cost of higher education was 10 times that of secondary education. Because the plan called for a 30% increase in university enrollment over the 5-year period, a significant portion of the educational fund would have to be devoted to higher education. One might thus question whether the benefits of higher education in Thailand were large enough to justify the proposed allocation between the education levels. Also, because of the neglect of repetitions and dropouts in schools, the enrollment targets would fail to meet the targets in graduates. Revisions of the plan had to be made subsequently. The process of decisionmaking could have been improved by incorporating cost analysis in the planning stage.

We can go on and on.[4] But the above examples illustrate the broad scope of applications of cost analysis in education, from an intervention in the classroom and an innovation in education to reform of primary education and the planning of an entire education system. In looking back over the previous experiences in developing countries, we can quickly point out the importance of cost analysis in informing decisionmakers about the cost implications of an educational intervention and whether or not the intervention is financially feasible. Incorporating cost analysis into the educational-planning process is highly desirable.

Previous experiences, however, have also demonstrated the existence of a number of barriers that could limit the usefulness of cost analysis for informed decisionmaking in education. For example, many educational plans were drawn up by decisionmakers for symbolic purposes, to legitimize the actions and power of a political regime, and to comply with the requirements for external financial

assistance. The economic feasibility and implementation issues were of secondary importance (Weiler, 1978). A well-executed cost analysis might present findings inconsistent with the hidden intentions of decisionmakers. Besides, educational production also takes place within a social and political context. A detailed cost analysis of education might also reveal significant inequities in the distribution of educational resources by social class, gender, ethnicity, and region (Tilak, 1985). This could potentially lead to social tensions that a regime would like to avoid. The use of the findings of a cost analysis might thus be restricted. These barriers are sociopolitical in nature.

But we could also easily point out how previous evaluations of genuine educational interventions were undermined by a failure to consider educational costs. This failure often resulted from a lack of awareness of the importance of cost analysis on the part of decisionmakers, a shortage of competent cost analysts, or from the lack of good data for cost analysis (Eicher, 1984, Part 1; McMeekin, 1975, chapter 3). The barriers are "technical" in nature. They are more likely to be overcome than the political ones.

Cost Estimation in Education

Even though there is no dearth of studies on educational costing, determining the costs of education is not a simple matter. Previous studies have made it clear that there is no single response to the question What is the cost of education (Psacharopoulos & Woodhall, 1985, chapter 7)? Although considerable progress has been made in conceptual understanding of the costs of education, significant practical and theoretical issues remain that make educational costing less than a hard science. Besides being familiar with basic cost concepts and analytical skills, a competent cost analyst needs to be ingenious about using existing cost data (which are often crude for developing countries), able to make simplifying but not-off-the-mark assumptions under conditions of incomplete information, and be sensitive to the reliability of available data (Coombs & Hallak, 1987). In the following, the conceptual and practical issues in cost estimation in education are reviewed under these headings: concepts of cost, classification of costs, data collection and measurement, and ways of expressing costs.

Concepts of cost. From the viewpoint of economic analysis, the proper definition of cost (real cost or economic cost) of an input to education is its opportunity cost, which is measured by the value of the input in its best alternative use. Applying this concept to the cost of an education system, the real cost of education includes not only public expenditure on education but also private costs (Bowman, 1966). Private costs of education include both direct monetary expenses for tuition, textbooks, and other maintenance items and the indirect cost of students' time measured by the foregone earnings in employment. Public educational expenditure can significantly underestimate the real cost of education. In a recent study of India, Tilak (1985, p. 22) estimated that the indirect private cost in terms of foregone earnings accounted for about 40% of the real cost to education, based on 1977–78 data. For nine eastern African countries, the total direct private cost of secondary education per student averaged 80% of government educational expenditure per student (Wolff, 1985, pp. 51–55).

Private costs of education are important to consider not only because they

constitute a significant part of the real cost of education, but also because they can affect the demand for schooling. For children in rural communities in developing countries, going to school means not helping parents in farm work and other household chores, with a reduction in family welfare. This private sacrifice explains the high dropout rates in rural primary schools, frustrating the government's attempt in providing universal primary education (Haddad, 1979). Also, under the current tight budgetary constraints, governments may have to rely on additional private contributions to education. Information on the existing burden on parents is necessary in designing alternative finance strategies (Tan, 1985b). Given the importance of private costs, it is an unfortunate fact that data on private costs are lacking in most developing countries.

What costs to measure depends heavily on the decision context in which cost analysis is conducted. A key issue to consider is the cost to whom. If one is concerned with the social efficiency of educational investment, then both public and private costs have to be included. If, however, one is concerned with the fiscal implications of an educational intervention, then it is the costs to the government that have to estimated, even though fiscal costs and real costs may differ considerably. Another key issue to consider is which cost measure is appropriate, average cost or marginal cost. If the decision is to determine whether or not to expand an existing program (Barbados example), the amount of the additional cost is what is at issue; marginal cost analysis is appropriate. Average cost analysis is relevant if the decision involves a choice between different programs, for example, for providing in-service training for unqualified teachers (Taylor, 1983).

Classification of educational costs. The classification of educational costs remains an unsettled area of cost analysis. Except for the costs of new educational media, there exists no internationally standardized classification of educational costs. Presumably, educational costs can be classified according to criteria that are economic (the real resources used), institutional (the sources of support), financial (the timing of expenditure), and technical (the function of inputs) (Psacharopoulos & Woodhall, 1985, pp. 169–170). But the complexity of these issues and the variations among countries make a standardized classification difficult. Each developing country tends to have its own system of cost accounting. This creates problems for a cross-national comparison of educational costs.

Nevertheless, these are some generally accepted distinctions among educational costs (Coombs & Hallak, 1972; Eicher et al., 1982, chapter 3; Vaizey & Chesswas, 1967). These include, for example, the distinctions between economic cost and expenditure, direct costs and indirect costs, recurrent expenditures and capital expenditures, variable costs and fixed costs, unit costs and marginal costs, public costs and private costs, personnel costs and nonpersonnel costs, as well as instructional costs and noninstructional costs.

Tilak (1985) suggests a taxonomy for organizing different kinds of educational costs. The taxonomy begins with an institutional distinction (costs by sources) between public costs (referred to as institutional costs by Tilak) and private costs. Institutional costs consist of direct (visible) institutional costs and indirect (invisible) institutional costs (referred to as opportunity costs by Tilak). Visible institutional costs are divided into two categories: recurring costs and nonrecurring costs. Recurring costs consist of teachers' salaries, salaries of other staff, scholarships and stipends, depreciation, and other expenditures. Nonrecurring costs include costs

for buildings, furniture, equipment, and others. The invisible institutional costs are not specified.

On the other hand, private costs are costs borne by individuals. They consist of direct (visible) private costs and indirect (invisible) private cost. Visible private costs consist of tuition cost (tuition fees plus other fees) and nontuition cost (maintenance cost related to individual spending on books and stationery, hostel, transport, uniforms, and others). Invisible private cost is the earnings foregone by individuals.

There are two distinguishing features of this taxonomy. First, it is suitable for measuring the real or social costs of education. Second, it focuses on both the sources of educational costs and the costs of various input items to education. But there are also some deficiencies. It ignores other sources of support for education, such as contributions from private organizations and industry, as well as external aid. For some developing countries, external aid may account for a significant portion of public expenditure on education (Coombs & Hallak, 1972, pp. 106–107; World Bank, 1980, chapter 8). Also, there is no consideration of how institutional costs are utilized technically; thus information is not provided about the functions of the inputs in educational production. A similar but more detailed classification of educational costs which addresses these deficiencies is proposed by Tsang (1987a) and is presented in Figure 1. Figure 1 highlights the financial sources

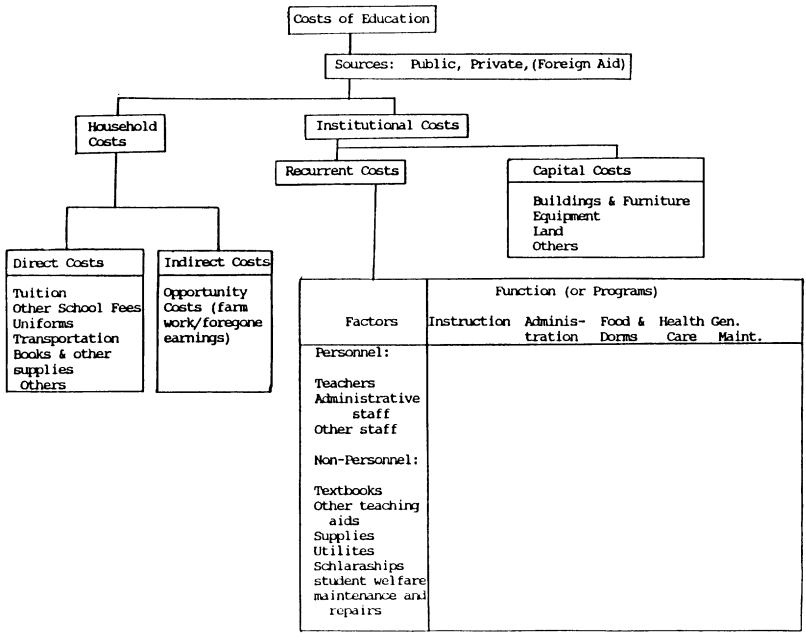

FIGURE 1. *A classification of costs of education*

Note. From "A Cost-of-Education Data System for National Educational Planning and Policy Analysis" (p. 19) by M. Tsang, 1987, an unpublished report prepared for Project BRIDGES, Harvard University, Cambridge, MA. Used by permission.

of educational costs, because information on financial sources is crucial in assessing economic feasibility of educational interventions. The figure indicates that recurrent costs are to be broken down into a matrix of input items and their functional uses.

New educational media are an area where there is now a generally accepted classification of costs. Beginning in 1977, UNESCO undertook a comprehensive review and synthesis of the works done on new educational media (Eicher et al., 1982; UNESCO, 1977, 1980). One of the outcomes of the effort is a standard procedure for costing new educational media. This procedure reflects a technical approach to cost accounting. Costs are divided into four categories: costs of general administration, costs of production, costs of distribution or transmission, and costs for reception (Eicher et al., 41–64).

Data collection and measurement. To date, the information basis for educational costing remains in a primitive state in developing countries, and wide gaps exist between what data are needed and what data are available (Eicher, 1984, Part 1).

In many developing countries, budgetary data from the central government are usually all that is available for educational costing. The shortcomings of these data for educational costing are by now well known. First, the data are often given for planned educational expenditures, not actual educational expenditures. Experience has shown that there could be significant differences between them. And when actual expenditures are available, they are more difficult to obtain and may be too late to inform a decision at hand (Eicher, 1984, p. 7).

Second, expenditures from other levels of government are often not available. The underestimation of public expenditure on education can be significant in a country with a decentralized educational finance system like India (Tilak, 1985).

Third, attentiveness must be exercised in identifying public costs of education from the central government. Expenditures on education are made not only by the Department or Ministry of Education, but also by other departments or ministries. For example, building costs may come from the Public Works Department, and teacher pensions may be paid by the Finance Department. On the other hand, some of the expenditures by the Department of Education are not related to education, for example, allocations for museums and the arts (Vaizey & Chesswas, 1967, pp. 14–16). Proper inclusion of expenditure by noneducation departments and exclusion of expenditure by the Department of Education are warranted.

Fourth, central-government data can be too aggregative to be useful. For example, they usually provide information on teacher salaries, but other inputs are lumped into one broad category ("other current expenditures"), thus not showing separate expenditures on the other inputs. Also, the central-level data for the expenditures on various inputs are not relevant for determining the costs of individual items such as textbooks or equipment at the school level. "Micro" data on costs are needed to conduct a cost-effectiveness comparison of alternative educational interventions at the school level (Eicher, 1984, p. 9). Costs can vary by schools in different regions.

Fifth, central-government budgetary data are not usually classified into categories that are relevant for some applications, for example, cost analysis of educational programs or subjects. Cost data are available for some input items, but they do not show how the costs are spent for different programs or subject areas.

Sixth, the data are expenditures, not economic costs. They do not include the

costs associated with the direct and indirect private costs of schooling. Such data are thus insufficient for estimating the social costs of education.

And finally, central-government budgetary data can be unreliable. There are often inconsistencies in how cost categories are defined over time, and different governmental sources may yield contradictory results (Eicher, 1984, chapter 2).

Several guidelines for collecting cost data were suggested by McMeekin (1975, chapter 3). First, data should be collected and processed on a timely basis and be easily accessible. Second, it is important to have reliable data. Because there are incentives for respondents to misrepresent information, such as inflating attendance rates and deflating dropout rates, data must be carefully checked against possible biases in reporting. Third, while the most accurate information should be gathered, data collection should also be guided by a cost-effectiveness mentality. One should weigh the additional gain in the precision of a data item against the additional resources devoted to its collection. And fourth, data collection should be made economical, if possible. For example, surveys can replace census-type data collection on schools and households to determine school costs and private costs, respectively.

Finally, experience has shown the existence of a number of problematic areas in the measurement of educational cost. An important one is the measurement of capital costs. In many educational projects, capital costs are not properly estimated (Psacharopoulos & Woodhall, 1985, pp. 178–184). One problem is the failure to treat capital investment as a flow by annualizing it (using a social discount rate and making an assumption on the expected life of service). Another common problem is the underestimation of capital costs by ignoring future expenditures that are required as a result of the capital investment (e.g., maintenance, repair, and staff). The economic evaluations of new educational media in the early 1970s often underestimated capital costs and thus led to misleading findings about the attractiveness of new educational media (Carnoy & Levin, 1975). Another common error in cost measurement to be avoided is double counting, usually involving transfer payments. A transfer payment is a shift of purchasing power from one agent (an individual, an institution, or a unit of government) to another agent, without generating additional income or national product. Double counting occurs when the expenditures from a higher level of government and a lower level of government are both counted without subtracting the transfer payment between the two levels of government. It can also occur in the transfer payment between a university and a student, that is, student scholarships, fellowships, and other subsidies (Coombs & Hallak, 1987, pp. 50–51).

Ways of expressing educational costs. The cost of an educational innovation or plan is often expressed in terms of its total cost to indicate the total value of real resources devoted to it. But in many situations, unit costs are more meaningful, especially for diagnostic, comparative, and evaluative purposes. A unit cost of education is the cost of an education unit. Here we have to define what an education unit is.

From the economic framework of educational production, a unit for educational cost refers to a unit of output of educational production. Yet education has multiple outputs. These outputs have been measured in terms of student achievement, number of graduates, student literacy, numeracy, and others. Given the diffuse

nature of outputs of education, cost analysts have often turned to inputs to educational production as units of analysis, for example, students enrolled and teachers. Previous works have identified a number of unit costs of education (Coombs & Hallak, 1972, chapters 7, 8; Hallak, 1969, pp. 41–44; Jamison, 1977, Section 3; Tilak, 1985, pp. 6–8): (a) cost per pupil enrolled, (b) cost per pupil actually attending school, (c) cost per graduate, (d) cost by level of education attained, (e) cost per pupil of the relevant age-group population, (f) cost of education per capita, (g) cost per class, (h) cost per hour, (i) average recurrent cost per teacher, and (j) capital cost per place.

In the unit costs listed above, cost per pupil enrolled is sometimes known as the "normal" cost of education. It is the most commonly used unit cost in planning education at all levels. But because there can be a large gap between reported enrollment and actual attendance in lower levels of schools in developing countries, actual attendance of pupils is also considered. Cost per pupil attending school indicates the unit cost associated with attendance. Cost per graduate is referred to as the "effective" cost of education. The gap between cost per pupil enrolled and cost per graduate is a measure of the extent of repetitions in school. The ratio between them is sometimes taken as an indicator of the internal efficiency of education (Psacharopoulos & Woodhall, 1985, chapter 8). Cost per graduate is particularly relevant for manpower-planning purposes as it relates to school completers. Whereas cost per graduate measures the unit cost at the end of an education cycle, cost per education level measures the unit cost of a given level of education. The use of cost per education level reflects the view that a pupil who quits school at a certain level of schooling has nevertheless acquired some useful skills. Cost per pupil of the relevant age group and cost of education per capita are measures of the coverage of an education system or a subsystem. Sometimes cost analysts find it convenient to use cost per class in cost projections. But its usage should be discouraged when there is significant variation in class size (in different regions, by education levels, and across countries). Cost per hour is often used to express the cost per broadcast hour in new educational-media projects; it is seldom used elsewhere. Average recurrent cost per teacher is also used in costing because of the labor-intensive nature of educational production and the dominance of teacher salaries in public educational expenditure. Finally, capital cost per place is used in projecting the costs of construction and equipment per pupil place provided.

Although each unit-cost measure has its own application, and no one measure is suitable for all purposes of costing, cost per graduate and cost per pupil enrolled should probably be considered in most educational costing work. From the viewpoint of educational production, cost per graduate is the appropriate unit cost of education. Although its computation is sometimes hampered by the lack of information about the number of graduates (by level of education, type of program, and type of school—e.g., public vs. private schools, rural vs. urban schools), its usage can be promoted by a better effort in data collection. Despite the fact that it is an input measure, cost per pupil enrolled is of great practical value to policymakers in that it estimates the cost of putting students into the classroom. Data on student enrollments are usually available. In the rest of the paper, unit cost refers to cost per pupil enrolled, unless stated otherwise.

Another major issue in expressing education costs is the distinction between cost in current dollars and cost in constant dollars. Cost in constant dollars differs from

cost in current dollars in that the former reflects the real value of resources and is obtained by adjusting the latter with price indices for changes in the price level.

In many developing countries, high rates of inflation often nullify a large portion of the considerable increase in public expenditure on education in current dollars. In India, for example, educational expenditure increased by about 30 times in current dollars between 1950 and 1975, but it increased by only 7.5 times in constant dollars for the same period (Tilak & Varghese, 1983, p. 5). In Ethiopia, the 380% increase in current expenditure between 1970 and 1982 was reduced to a 46% increase in constant expenditure. And for Mexico, the increase in expenditure for the period 1970–82 was 3,866% in current dollars and only 941% in constant dollars (UNESCO data). These figures demonstrate the importance of estimating educational costs in constant dollars in order to assess the amount of real resources to education. Teachers are often victimized by inflation as their salary increases lag behind the rates of inflation.

The need to adjust costs for price changes with price indices was recognized early (Vaizey, 1958). In developed countries, significant advances have been made in the theoretical development of price indices and applications to education (Chambers, 1979; Wasserman, 1963). Suggestions for constructing price indices for developing countries have often been made (Hallak, 1969, pp. 52–53; Johnstone, 1981, pp. 104–106; Tilak, 1985, p. 14), but educational price indices are rare in these countries.

Conceptually, educational price indices are based on the actual mix of physical and human resources consumed in educational production and their price levels. The mix and prices of these resources are likely to be different for other buyers or the typical consumer. In developing countries, price adjustment for educational costs is usually done by using either the cost-of-living price index or the wholesale price index. However, this practice can have misleading results because these two indices do not necessarily reflect changes in price levels in education. The problem is often compounded by basing these indices on urban prices; rural prices and urban prices can differ significantly.

For educational decisionmakers, educational price indices are important not only for estimating the real resources to education, but also for understanding the patterns of the real value of various educational inputs, especially teacher costs, to inform the wage bargaining process. Despite the usefulness of price indices, they have not been constructed in developing countries.

In reviewing the cost studies on educational costing in developing countries in the past two decades, we have mixed feelings about the progress made in cost estimation.

We may take some comfort in the fact that significant advances have been made in the conceptual understanding of educational costs. These include the explication of an economic concept of cost, an understanding of the impact of the decision context on the costs to be estimated, the progress in the classification of educational costs in general and costs of new educational media in particular, an appreciation of the relative advantages of alternative ways for expressing educational costs, and clarifications in the procedure for measuring costs, especially capital costs. Further work is warranted in the development of cost classification and price indices applicable to developing countries.

But we definitely cannot take comfort in the primitive state of the information

basis for cost analysis in many developing countries today. We cannot avoid being struck by the tremendous gap between what data are required and what data are available for cost analysis. In the face of severe fiscal constraints and the call for efficient utilization of scarce educational resources, the need to strengthen the informational basis of cost analysis for educational decisionmaking is both self-evident and urgent. A cost-of-education data base is not adequate if it does not contain reliable information on the relevant categories of public costs (broken down by input items and functions) and private costs (both direct and indirect costs) for various levels of education, over time, and at various administrative levels (school, local, regional, and central levels of government). There is obviously a cost for developing or improving such a data base; but the cost for uninformed educational decisionmaking is considerably higher, in the long run.

Behavioral Characteristics of Educational Costs

This section reviews cost studies in education in developing countries for their analysis of the behavioral characteristics of educational costs. Although educational costs in developing countries can vary significantly among levels, programs, and regions, they also exhibit common patterns or "behavior" because schools in these countries are operated in similar ways. From the economic framework of educational production, these studies are concerned with the relationships among inputs and the utilization of inputs in the production process. They cover a wide range of analyses, from "macro" investigations of national education systems to "micro" investigations of individual schools.

The review is divided into two parts. The first part considers studies on the patterns and determinants of educational expenditures and unit costs of education. This part pertains mainly to the application of cost analysis for diagnostic purposes and for improving economic efficiency. The second part considers studies on the analysis of resource utilization in schools. It is concerned primarily with the technical efficiency of schools.

Educational Expenditures and Unit Costs: Patterns and Determinants

Comparative studies based on national time-series data represent a major approach to the analysis of educational expenditures and unit costs (Eicher, 1984; Eicher & Orivel, 1980b; Gandhi, 1971; Mingat & Psacharopoulos, 1985; Schiefelbein, 1986; Wolff, 1985; Zymelman, 1976a, 1982). The emphases are on understanding the trend in educational expenditure, uncovering the patterns in unit costs, and identifying the factors that determine educational expenditures and unit costs.

Eicher (1984, chapters 2, 3) points out a number of methodological issues to be considered in making a cross-national comparison of educational costs. The first issue has to do with specifying the measures of educational expenditures and unit costs to be used in the comparison. Total public educational expenditure is not a meaningful variable for understanding the trend in cost because changes in public educational expenditure depend on the initial percentage of government budget devoted to education and on changes in the government budget over time. What is needed is some indicator of the "effort" of countries devoted to education under given resources. Two measures are commonly employed in the literature: public

educational expenditure as a percentage of national income (national-effort indicator) and public educational expenditure as a percentage of total public expenditure (fiscal-effort indicator). Our discussion in the subsection titled "Cost Estimation in Education" has also identified a number of measures for unit cost. The most common measure used in these studies is the cost per pupil enrolled.

The second issue concerns data sources. Most of the analysis was based on the time-series data collected by UNESCO and the World Bank. Although UNESCO and the World Bank have made significant contributions to the standardization of the procedure for data collection, caution must be exercised in using these time-series data for international comparison because of the following problems associated with the data collected: (a) Inconsistencies in a time series can occur because of changes in definitions and/or administrative organization for data collection; (b) UNESCO and World Bank data are sometimes not comparable because of some differences in their data-collection procedure; (c) for a given country, contradictions in costs exist as a result of using different data sources (provisional account vs. final account) or differences in the choice of a base year for enrollments (calendar year vs. school year); and (d) variation exists in the quality or reliability of the data collected.

The third issue relates to comparison of findings for different country groups. Countries are often grouped together and the group averages compared. Experience has shown that the values of group averages are sensitive to the ways countries are grouped (by region, GNP per capita, number of countries in a group, etc.), the choice of the base year for comparison, and especially the choice of the averaging method (arithmetic and geometric averages, weighted and unweighted averages). Different ways of grouping and averaging often lead to very different findings and different policy recommendations. For example, by using arithmetic averages weighted by GNP in each country, a UNESCO study found that the ratio of educational expenditure to GNP has increased from 3.3% in 1970 to 4.0% in 1979 in developing countries (UNESCO, 1982). Zymelman (1982) found the ratio to fall from 3.29% in the early 1970s to 3.16% in the late 1970s in developing countries; his computation was based on geometric averages. Similarly, a World Bank study found the unit cost of higher education in China in 1979 ($880 in 1975 prices) to be high relative to two comparable country groups ($534 and $675 in 1975 prices) (World Bank, 1983). But if a different averaging procedure were used, China's unit cost would be relatively low.

Finally, it should be pointed out that educational expenditures are not the same as educational costs; they do not capture the resources contributed by private sources to education.

These issues suggest care in interpreting cross-national findings on educational costs. Nevertheless, cross-national comparison is still very useful for indicating the relative magnitude of educational costs and for uncovering the patterns and determinants of these costs.

Patterns and determinants of educational expenditures. Most cross-national studies have focused on public—not private—educational expenditures, because of a lack of data for the latter. They are almost exclusively based on data collected by UNESCO and the World Bank and contain analyses of both developed and developing countries. A common approach to cross-national comparison is based on country groupings by geographical regions. Prominent examples include Zym-

elman's study of 68 developing countries and 13 developed countries for 1970–72 (Zymelman, 1976a) and the late 1970s (Zymelman, 1982), Eicher and Orivel's study (1980b) of about 140 developed and developing countries for 1960–76, and compilations by UNESCO (1982) for 1970–78, and the World Bank (1980) for selected years and intervals between 1960 and 1974. Whereas detailed results on the patterns of the expenditure indicators for individual countries and country groups can be found in these works, the major findings regarding the pattern of public educational expenditure over time, the distribution of public educational expenditure, and private educational expenditures are briefly summarized here. Consider first the pattern of public educational expenditure over time.

Three significant findings emerge from Eicher's review of the time pattern of public educational expenditure (1984, pp. 45–47). First, despite differences between countries and regions, the overall effort in favor of education in the past two decades has been nothing less than phenomenal. Total public educational expenditure increased by 250% in real terms. Public educational expenditure as a ratio of national income increased by 75% in developing countries and by about 50% in developed countries. Public educational expenditure as a ratio of total public expenditure increased by more than 30% in both developing and developed countries.

Second, there are some discernible trends in the national-effort and fiscal-effort indicators. Consider first the national-effort indicator. Between 1960 and 1970, the average indicator (arithmetic average) rose from 2.9% to 4.2%. In both developed and developing countries, public educational expenditure increased faster than GNP. The upward trend continued in the 1970s. Between 1970 and 1974, the rate of increase of the indicator slowed down, and the indicator reached an average of 4.3% in 1976. But in the 1970s, especially after 1974, the patterns between countries began to differ. The indicators for developed countries and Asian countries started to stabilize, but the average indicator for sub-Saharan Africa continued its upward movement while the average indicator for Latin American countries was moving downward.

Similar developments have happened to fiscal effort. Between 1960 and 1974, the average fiscal-effort indicator increased from 11% to 15%; the pattern was similar for both developed and developing countries. But in the 1970s, almost every developed country had begun to reduce their level of fiscal effort for education. In contrast, developing countries continued the upward trend until the mid-1970s and started to stabilize their fiscal effort afterward.

Third, the effort in favor of education is now leveling off. Most countries have stabilized their national and fiscal efforts. Only the sub-Saharan African region maintains its upward trend. But the slowdown in educational effort is widespread.

Two sets of factors appear to be relevant in explaining the level of total public educational expenditure and its changes over time (Coombs & Hallak, 1972). The first set relates to the supply of education and the amount of funds available to the government for financing education. The determinants of educational supply and budgets are quite complex. They include factors such as the rate of inflation, the range of competing demands of other public services, the rate of growth of the national economy, the diversity of the tax bases for education and the sensitivity of educational revenue to changes in national income, the impact of foreign trade, and the availability of foreign aid to education. The second set of factors relate to

the demand for education. They include the growth in population and its age distribution, the importance of education for social mobility and national development, the choice and development of technology for economic production, the level of coverage of education to diverse segments of the population, the direct and indirect impacts of national and international development policies, and others. These two sets of factors are "external" to education in that they lie outside the locus of control of school administrators and policymakers.

Eicher and Orivel (1980b) and Zymelman (1982) have provided statistical analyses of the determinants of the effort for education. Using data for 122 countries for 1960–76 and three models, Eicher and Orivel found that the most important explanatory variable for the national-effort indicator was enrollment ratio in the 6–11 age group, and the rate of change in the enrollment ratio was the most important explanatory variable for the increase in effort between 1960 and 1976. The variable GNP per capita was found to be less important and its coefficient was small. Finally, "culture" appeared to be a significant factor; Francophone Africa had higher effort than Anglophone Africa (1980b, pp. 42–55).

Zymelman found that educational expenditure did not depend on the level of economic development (measured by GNP per capita), but was influenced by unit cost as a ratio of GNP per capita and by the enrollment ratio. The relative importance of these two factors varied by countries and by regions. His study was based on data for 81 countries in seven regions for the 1970s. From the above studies, Eicher suggested that the slowdown in total public educational expenditure in developing countries was due to a combination of three factors: slower rates of economic growth, a relative decrease in the demand for education, and a change in government attitude toward education (1984, p. 55). Having considered the current fiscal constraints and demographic trends, he concluded that "the need for cost-reducing measures and, more generally, for policies turned toward cost-effectiveness is everywhere present and is becoming urgent in many countries" (1984, p. 59).

The distribution of public educational expenditure is also of interest to decision-makers. Table 1 presents the distribution of public educational expenditure by levels of education for seven regions in the world at two time intervals. For developing countries, public expenditure on primary education accounts for half of total public educational expenditure, whereas secondary education claims about one third and higher education absorbs about one fifth of the total. The distribution of public educational expenditure among levels of education is stable over the two time intervals. In OECD countries, higher education accounts for slightly less than one fifth of the total, whereas the remainder is split about equally between primary education and secondary education. Because enrollments differ considerably among levels of education, these distributional figures mask significant disparities in unit costs for various levels of education (to be discussed later). In developing countries, public expenditure for higher education has increased at a faster rate than that for primary education.

The distribution of public educational expenditure between personnel and non-personnel categories is also striking. In all educational systems, public educational expenditure is dominated by personnel costs, especially teacher salaries, although the ratio of personnel costs to nonpersonnel costs decreases with the level of education. This obviously reflects the labor-intensive technology of educational

TABLE 1

Public educational expenditure as a percentage of GNP by level of education in the early 1970s and late 1970s

Region (number of countries in parentheses)	Total		Primary level		Secondary level		Higher level	
	A[a]	B[b]	A	B	A	B	A	B
Eastern Africa (14)	3.76	4.16	2.04	2.23	1.13	1.25	.59	.67
Western Africa (12)	3.33	3.61	1.64	1.75	1.20	1.19	.49	.66
East Asia & Pacific (7)	3.42	3.45	1.87	1.57	.96	1.06	.59	.81
South Asia (6)	2.12	1.60	.72	.87	.89	.39	.51	.34
EMENA[c] (12)	4.09	3.40	1.71	1.58	1.54	1.18	.84	.64
Latin America (17)	3.02	2.78	1.63	1.39	.84	.80	.55	.59
"Average[d] region" (68)	3.29	3.16	1.60	1.56	1.09	.98	.59	.62
OECD (13)	4.18	4.93	1.68	2.18	1.79	1.80	.71	.95

[a] A = early 1970s.

[b] B = late 1970s.

[c] EMENA includes 12 countries around the Mediterranean region including northern Africa and the Middle East.

[d] Based on geometric average.

Note. From *Educational Expenditures in the 1970s* (p. 49) by M. Zymelman, 1982, Washington, DC: World Bank, Education Department. Used by permission.

production. For example, in Eastern Africa, around 1980, teacher emoluments alone accounted for 87%, 64%, and 40%, respectively, of public expenditure on primary education, secondary education, and higher education (Wolff, 1985, pp. 45, 59). In the 1970s, Latin American countries spent an average of 88% and 85% of their funds on teacher salaries for primary education and secondary education, respectively (derived from Schiefelbein, 1986, p. 9). The dominance of teacher costs is also found in Asian countries (Alles et al., 1972; Bennett, 1975; Tilak, 1985).

Also, given the salary increases associated with automatic promotion in the pay structure for teachers, there is a built-in tendency for teacher costs to rise over time in these countries. Moreover, compared to developed countries, developing countries spend a higher percentage of their budgets on teacher costs. During periods of tight budgets and pressures from teachers for higher salaries, developing countries have often shifted resources away from nonsalary items such as textbooks and other teaching aids to salary items. Thus nonsalary expenditure as a portion of total public expenditure tends to decrease over time in many developing countries, probably affecting the optimal mix of inputs in educational production.

Finally, the lack of information on private costs of education makes any attempt to compare private educational expenditure difficult. Central-government accounts sometimes provide data on private educational expenditure, but such data are problematic in that they often include other private consumption expenditure or are unreliable. In a recent study, Tan (1985a) used such data to examine the macrotrend in private expenditure for 1960–78. Her sample included 42 developed and developing countries. The study found that there was significant variation in private educational expenditure in developing countries and that it ranged from less than 1% to about 3% to 4% of total private-consumption expenditure.

Schiefelbein reported some data on private educational expenditure in Latin American countries. The ratio of private educational expenditure to the total expenditure of the ministry of education was found to be 1.11, .51, .32, .13, and .04 for Brazil, Colombia, Chile, Venezuela, and Argentina, respectively (1986, p. 29). In a detailed study of rural primary schools in Colombia, private contributions accounted for an average of 30% of the total education cost per pupil (Paulsen, 1981).

Wolff provided measures of the direct private costs for students in secondary schools in nine eastern African countries (1985, pp. 51–55). The ratio of total direct private cost to total cost per student varies according to the type of secondary schools and country. It ranged from 0% for day schools in Somalia for 1981–82 to 81% for assisted Harambee schools in Kenya for 1981–82. The ratio for boarding schools was consistently higher than that for day schools. On the average, direct private costs accounted for one third of the total cost per pupil. High direct private costs were also reported in Tan's study of secondary schools in Tanzania (1985b). She found that even though state school students paid no fees, their school-related expenditure added up to US $139 per student in 1981. The direct private costs for students in private schools were even higher (US $439).

Tilak's (1985) study of the costs of education in India indicates the large amounts of both direct and indirect private costs. For 1979–80, public educational expenditure was found to be about 3.9% of GNP, indirect private cost (foregone earnings) was estimated to be 4.2% of GNP, and household expenditure on education (mostly direct private cost) was as high as 1.9% of GNP. Thus the real cost of education in India in 1979–80 was about 10% of GNP; more than half of it was private cost. The study also computed the share of public educational expenditure for both the central government and state governments. For 1976–79, the central government contributed to less than 10% of public educational expenditure. This underscores the large contributions by noncentral governments, especially for countries with a decentralized system of educational finance.

In summary, although information on private costs of education is still lacking in most developing countries, the available evidence indicates that direct private costs are significant in secondary schools in some countries. If we also take into account the indirect private cost of foregone earnings, total private cost will be considerable.

Patterns and determinants of unit costs. Previous studies have estimated unit costs of education for a wide range of situations: for education at various levels of aggregation (central, state, regional, local, and school), for different levels of education (primary, secondary, and territory), for different types of schools (urban vs. rural, public vs. private, etc.), for different curricula (general vs. vocational), and for different programs or subject areas. Although there are numerous ways of expressing unit costs, the most common one is on a per-pupil-enrolled basis. Two major findings have emerged from these studies: There are significant disparities in unit costs of education in each of the above situations, and there are clearly identifiable patterns in unit costs.

Typical unit costs (per-pupil basis unless stated otherwise) for various levels of education at the country level are given in Tables 2 and 3. Because countries vary greatly in their levels of per-capita income, unit costs are usually compared by using the ratio of per-pupil public educational expenditure to per-capita GNP.

TABLE 2
Costs per pupil of public education at various levels as a proportion of GNP per capita, and cost ratios between levels (around 1980)

Region	Cost per pupil as a proportion of GNP per capita			Cost ratios	
	Primary	Secondary	Higher	Secondary to primary	Higher to primary
Eastern Africa	0.16	0.85	10.40	5.3	65
Francophone Africa	0.29	1.43	8.04	4.9	28
Southeast Asia and Pacific	0.11	0.20	1.18	1.8	11
South Asia	0.08	0.18	1.19	2.3	15
Latin America	0.09	0.26	0.88	2.9	9.8
All developing countries	0.14	0.41	3.70	2.9	26
Developed countries	0.22	0.24	0.49	1.1	2.2

Note. Based on *Controlling the Costs of Education in Eastern Africa: A Review of Data, Issues, and Policies* (Staff Working Paper No. 702, Table 1, p. 2) by L. Wolff, 1985, Washington, DC: World Bank. Used by permission. Cost ratios were computed by this author.

Included also in the two tables are the cost ratios among the three levels of education. Several observations can be made: (a) There are considerable differences in both the effort ratios and the relative cost ratios between developed and developing countries, between regions in the world, and between countries in a region; (b) compared with developed countries, developing countries have shouldered a heavier burden in their provision of education, because they have lower levels of per-capita GNP and higher unit-cost ratios; and (c) the unit cost of higher education is very high relative to that of primary education in developing countries.

Significant variations in unit costs can also exist between states or provinces in a country. For a given country, unit costs are usually compared on a dollar-per-pupil basis. For example, using data for 14 states in India in 1976–77, Tilak found that the ratio of the unit cost of the highest spending state to that of the lowest spending state was, respectively, 5.2, 6.3, 1.9, and 2.4 for primary education, middle school, high school, and higher education (1985, p. 38). Also, the relative cost ratio between higher education and primary education in 22 states ranged between 3.07 in Uttar Pradesh to 40.77 in Sikkim in 1976–77 (p. 45). But this relative cost ratio was not significantly correlated with the level of economic development in each state (as measured by per-capita state income).

Tilak (1985, p. 43) provided further evidence of disparities in unit costs between rural areas and urban areas for several levels of education in the state of Andhra Pradesh in India. He found that for both primary and middle schools, rural areas had higher public cost per pupil than urban areas. But because students in urban areas had higher foregone earnings and direct private costs, the resultant social cost per pupil was higher in urban areas than in rural areas for these two levels of education. But for higher levels of education, both the public cost per pupil and the total private cost per pupil were higher in urban areas, again resulting in higher social cost per pupil in urban areas.

Higher public cost per pupil in rural schools was also reported for Thailand.

TABLE 3
Costs per pupil as a proportion of GNP per capita, and cost ratios, Eastern Africa (around 1980)

Countries	GNP per capita (US$)	Costs per pupil as a proportion of GNP per capita			Cost ratios	
		Primary	Secondary	Higher	Secondary to primary	Higher to primary
Botswana	780	.20	1.03	6.5	5.2	33
Burundi	230	.23	1.52	12.7	6.6	55
Comoros	260	.18	.52	—	2.9	—
Djibouti	480	.63	.80	—	1.3	—
Ethiopia	140	.19	.66	11.1	3.5	58
Kenya	390	.14	.52	9.9	3.7	7.1
Lesotho	540	.07	.43	11.4	6.1	163
Madagascar	—	—	—	—	—	—
Malawi	200	.06	1.08	15.9	18.0	265
Mauritius	1080	.11	.19	2.9	1.7	26
Rwanda	220	.13	1.73	14.0	13.3	108
Somalia	280	.10	.30	3.2	3.0	32
Sudan	360	.12	.29	4.3	2.4	36
Swaziland	760	.09	.36	3.6	4.0	40
Tanzania	280	.12	2.94	30.9	24.5	258
Uganda	210	.03	.20	10.5	6.7	350
Zaire	—	—	—	—	—	—
Zambia	580	.12	.66	6.3	5.5	53
Zimbabwe	870	.16	1.24	12.7	7.8	79
Average	450	.16	.85	10.4	5.3	65

Note. Based on *Controlling the Costs of Education in Eastern Africa: A Review of Data, Issues, and Policies* (Staff Working Paper No. 702, Annex I, Tables 5 & 18) by L. Wolff, 1985, Washington, DC: World Bank. Used by permission. Cost ratios were computed by this author. GNP per capita is in current dollars.

Based on a survey of 10 rural secondary schools and 10 urban secondary schools, Reiff found that the public cost per pupil in rural secondary schools was about 40% higher than that of urban secondary schools. This was because the former schools had a lower pupil/teacher ratio and the latter schools usually had a larger enrollment (1972a, p. 216).

Cost studies of rural schools in developing countries are few. A well-designed study of the costs of rural primary schools was conducted in Colombia (OFISEL, 1982; Paulsen, 1981). The entire study consisted of six individual case studies, one for each primary school in six different rural contexts. The results warned against treating all rural primary schools the same because the costs per pupil varied significantly among the schools. They also indicated that private contributions were a significant part of the total cost for rural primary schools in Colombia, ranging from 15% to 48% of the total cost in the six cases studies.

Generally, local support of public primary schools is an important source of funding, and private contributions in kind are common in rural areas, especially the poorest rural areas (Schiefelbein, 1986, p. 32).

Besides geographical variations, cost disparities also exist for different types of schools. For secondary education, boarding schools are more costly than day schools. In eastern Africa, the relative cost ratio between boarding schools and day schools was found to be 1.1, 1.3, 4.0, 1.4, and 1.03, respectively, for Botswana, Lesotho, Somalia, Uganda, and Zambia in the early 1980s (Wolff, 1985, pp. 51–55). For 14 countries in Latin America, Asia, and Africa, secondary boarding schools built in the 1960s were two to three times more expensive than day schools built in the same period (Hutton & Rostron, 1971). Similar cost ratios were found for secondary schools in Morocco (Radi, 1982). The difference in cost is mainly due to the much higher building costs of boarding schools.

The unit costs of academic education and vocational education at the secondary level have been the subject of many economic analyses, often fueled by the long-standing debate over the relative merits of the two types of curriculum to meet the employment and manpower needs of a developing economy (Grubb, 1985). In general, unit costs of vocational education are found to be higher than those of academic or general education. But because there are different types of vocational training and different institutional arrangements for vocational education (such as vocational schools, company-affiliated vocational schools, schools with a diversified curriculum, etc.) in different countries, the difference in cost between the two types of curriculum varies widely. For example, in Latin America, the ratio of expenditure per pupil of industrial/agricultural education to that of academic education was 4.2 for Paraguay in 1983, 1.5 for Colombia in 1981, and 1.4 for Chile in 1969 (Schiefelbein, 1986, p. 8).

In a recent study of diversified secondary schools (called INEM schools) and traditional secondary schools in Colombia, the unit costs for academic and commercial tracks in INEM schools were found to be higher than those in the corresponding traditional schools, but the situation was reversed for the industrial, agricultural, and social service tracks (Psacharopoulos & Loxley, 1985).

In a cross-national study sponsored by UNESCO (1984), the ratios of the unit costs of technical and vocational education to those of general education were found to be consistently greater than one (p. 84). For example, the ratio for per-student recurrent cost was 1.5:1 for Lesotho. For Turkey, the ratio for per-student recurrent cost was 2–3:1, and the ratio for per-student capital cost was 7:1. The ratio for per-student total public cost (recurrent plus capital) was found to be 1.43:1 for Chile.

In Thailand, data from the late 1960s showed that, at the secondary level, vocational education was significantly more costly than either academic or comprehensive education and that technical education was even more costly. Unit cost averaged 4,869 bahts for technical schools, 2,971 bahts for vocational schools, and only 1,162 bahts for the other academic and comprehensive schools. Compared to academic and comprehensive schools, the average teacher cost per pupil was four times as expensive in technical schools, and twice as expensive in vocational schools. And for nonteacher cost per pupil, the corresponding cost ratios were 8.8 and 6.4, respectively (Bennett, 1975, pp. 50–56). In a study of an automobile company in China, the cost of vocational curriculum was also found to be significantly higher than that of academic curriculum. According to school administrators, the per-pupil cost of a secondary vocational school affiliated with the auto

company is 1,000 yuan per year, whereas that of a secondary academic school is 250 yuan per year (Min & Tsang, 1988).

But in Tanzania, the differences in unit cost between vocational and academic streams in public secondary schools are relatively modest compared with those for other countries. In 1981, agricultural, technical, and commercials streams were only 20%, 13%, and 9% more expensive than the academic stream, respectively (Psacharopoulos & Loxley, 1985).

Obviously, cost comparison alone is incomplete for informing the debate over the choice of curriculum in secondary education; the benefits and effects of different curricula have to be taken into account, too. Cost-benefit and cost-effectiveness studies on this issue will be taken up in the next major section of this paper.

Cost disparities by curriculum also exist in higher education. Data for a sample of developing countries show that university subjects like agriculture, sciences, and engineering are on the average more than twice as costly as general subjects. And in terms of the magnitude of recurrent cost per pupil, the descending order for the subjects was as follows: agriculture, sciences, engineering, arts, humanities, and social sciences (Psacharopoulos, 1982). Subjects near the top of the list have higher recurrent expenditures because of lower student-teacher ratios and higher capital expenditures.

The above discussion documents the significant disparities in unit costs of education between countries, states/provinces, regions, levels of education, types of school, and curricula. But it also displays consistent patterns or behavioral characteristics in unit costs that reflect similar operations in education across countries.

For education systems in developing countries, expenditure per pupil exhibits the following patterns: (a) It rises with the level of education; (b) it is dominated by personnel costs, although the proportion for personnel costs decreases with the level of education; (c) it is higher for boarding schools than for day schools at the secondary level; (d) it is generally higher for vocational education than for academic education at the secondary level; (e) it is higher for engineering and science subjects than for arts and humanities at the tertiary level; and (f) it has a built-in tendency to rise over time.

The factors affecting unit costs in developing countries have been considered by a number of studies (Chesswas, 1972; Coombs & Hallak, 1972; Eicher, 1984; Tibi, 1986; Wolff, 1985). The findings of these studies are synthesized in the following.

A major factor affecting educational costs is the technology of educational production. In countries across the world, education takes place predominantly in the traditional school and university, with similar organization, curriculum, pedagogical methods, management, and monitoring procedure. Alternative technologies of education, such as out-of-school distance teaching, operate only at the margin of the education system. The adoption of a common technology is the major reason for the similar patterns of unit costs found around the globe. Changes in educational production in terms of the staffing pattern, class size, school organization, and other actions will affect unit costs.

The labor-intensive technology of traditional education explains the dominance of teacher costs. Teacher compensation is an important cost determinant. Expenditure on teacher salaries depends on a number of factors. These factors include the

salary structure, the current pattern of qualifications of teachers, the age composition of the teaching force, the average salary of teachers, and the pupil-teacher ratio. In most developing countries, salary levels are graduated on scales based on qualifications and years of service.

The average salary of teachers is determined by the supply of and demand for teachers, alternative employment opportunities, and the bargaining power of teacher unions. There are significant regional differences in the average level of teacher salaries. For example, primary school teachers' salary as a proportion of per-capita GNP is low in Latin America and Asia, but quite high in West Africa and francophone Africa. In many developing countries, teacher salaries in current dollars have risen over time, but the real level of teacher salaries has actually declined as a result of high rates of inflation.

Two other factors that affect unit costs are the rates of utilization of educational resources, and rates for dropouts and repeaters. If educational resources are more fully utilized, then more pupils can be schooled at a given level of educational expenditure, and thus expenditure per pupil will drop. Studies on utilization rates are reviewed in the following subsection. Similarly, rates of dropouts and repeaters affect the effective cost of educating a pupil. Lower rates of dropouts and repeaters imply lower unit costs of education.[5]

Thus, for developing countries, per-pupil expenditure on primary education depends mostly on teacher salaries and the pupil-teacher ratio. The effective cost of expenditure per graduate is affected also by rates of dropouts and repeaters. At the secondary level, nonteacher costs such as boarding facilities for boarding schools and equipment costs for vocational schools are significant cost determinants besides teacher salaries and the pupil-teacher ratio. At the higher education level, teacher salaries, the pupil-teacher ratio, and capital costs are all important factors. The higher unit costs at higher levels of education can be attributed to higher teacher salaries, lower pupil-teacher ratios, and higher per-pupil capital costs.

Utilization of Education Inputs

The rates of utilization of educational inputs in schools also have direct implications for unit costs and educational efficiency. To the extent that there is considerable underutilization of school resources, educational expenditures can be reduced without affecting the number of students served. Alternatively, the number of students served can be increased without incurring additional cost. In either case, unit cost is lowered and the technical efficiency of the school is raised.

Studies on the utilization of educational inputs in developing countries can be classified into two groups. The first group consists of school-level studies that survey the rates of utilization of school resources like teachers, and school facilities. The second group estimates cost relationships to explore the existence of economies of scale. These two groups of studies are reviewed separately in the following.

Rates of utilization of school resources. An early study of resource utilization in secondary schools was conducted by the Asian Regional Institute for School Building Research (1969) for the government of Ceylon, now Sri Lanka. The study consisted of a survey of 11 schools in four provinces, encompassing both rural and urban schools, as well as schools at different altitudes. It found significant wastage in the utilization of space because of a number of factors: the use of large rooms

for small classes, the use of some teaching spaces for only part of the school day, and the failure to use available facilities in neighboring schools. Also, in some schools, an excess of teachers led heads of schools to deliberately provide more subjects and small groups so as to create enough class periods for teachers to qualify for salary. The report recommended that an "area check" be used by the government to evaluate requests by local school administrators for additional facilities. The area check was based on a standard space of 14 square feet per place for primary schools and 32 square feet per place for secondary schools.

Significant underutilization of school resources at the secondary level appears to be a widespread phenomenon in many developing countries. In a comprehensive survey of 100 schools in 14 countries in Latin America, Asia, and Africa, Hutton and Rostron (1971) found low rates of utilization: Teacher contact time ranged from 8 to 19 hours per week, laboratory utilization had a median time of 18 hours per week, and the median time for the use of the whole school was less than 3 hours per day. The low rates of utilization were probably due to (a) a standardized classroom size for all grades even though the number of pupils decreased with the grade level, (b) each class's having its own general classroom, and (3) special classrooms' and laboratories' not being used for general teaching. The authors estimated that by utilizing school resources more fully, most of the countries in their study could easily increase secondary enrollment by 30%.

Both of these two early studies call for better management and planning capability for school resources. But the problems of utilization have not disappeared over time in developing countries. In a recent study of 12 countries in Latin America, Asia, and Africa, low rates of utilization were still reported in some schools. The study found that the variation in teacher utilization was strongly influenced by the quality of educational administration and its ability to affect the distribution of teachers across educational institutions and services. In general, the utilization of resources in schools is dependent on the relationship between available resources to education and the provision of school places to pupils, as well as on the distribution of available resources (Tibi, 1986).

Actually, a wide variety of cost-reduction strategies for primary and secondary education have been put forward (Agency for International Development, 1974; Eicher, 1984; Mingat & Psacharopoulos, 1985; Wolff, 1985). They include strategies that focus on teacher salaries (lowering teacher salaries when they are considered high and revising pay scale), low-cost teachers (volunteer teachers, teachers with lower qualifications, and setting a lower requirement for teacher licensing), increasing teaching load (more hours per day and more days per year), increasing class size (if it is small), school reorganization (double shifts, school consolidation, and cluster school/regional cooperation), and alternative educational technology (use of new educational media). A common drawback of these strategies is that they are not based on empirical evidence of the impact of cost-reduction actions on school output like student achievement.

Estimates of the rates of utilization of resources in higher education are available for a number of developing countries (Psacharopoulos, 1982, pp. 114–115). For example, in Sierra Leone in 1975, actual utilization in four institutions ranged from 40% to 71% of capacity. In Zambia in 1978, faculty wastage rate ranged from a low of 17% in agriculture to a high of 48% in natural sciences. But conditions vary among countries. In 1978–79, the student-per-faculty ratio was as low as 5 for

universities in Botswana, Burundi, and Tanzania, but it was 20 for Cameroon, 30 for Madagascar, and 72 at a university in Sudan (Hinchliffe, 1985, pp. 81–82). Student contact hours are much lower at the University of Malawi than they are at Kenyatta University in Kenya (Hinchliffe, pp. 53–54).

Several observations can be made from these utilization studies. By revealing costly wastage practices in schools and universities, a careful examination of resource utilization can lead to significant cost savings. Universities, in particular, should receive close scrutiny because of their high unit costs. Given the large number of secondary schools, the costs of finding out the utilization rates at the secondary level can be greatly reduced by surveying a representative sample of schools. And lastly, in analyzing strategies for cost reduction, careful attention should also be given to the potential impact of these strategies on school quality. Cost reduction at the expense of school quality does not raise the technical efficiency of the school.

Educational cost functions and economies of scale. An education cost function (ECF) relates the minimum cost of education to the level of educational output, given input prices and the technology of educational production. An ECF can be estimated statistically to determine the relationship between average costs and marginal costs and, thus, the economies or diseconomies of scale. If educational output can be increased at relatively low additional costs, marginal costs will be lower than average costs. Then each additional unit of output becomes cheaper to produce; there are economies of scale. Economies of scale can result from improved technology or organization of production as output is increased. If, however, educational output can be increased only at relatively high additional costs, marginal costs will be higher than average costs. Then each additional unit of output becomes more expensive to produce; there are diseconomies of scale. Diseconomies of scale often result from inefficiency of technology or organization of production as output is increased. Finally, if marginal costs are equal to average costs as output increases, there are constant returns to scale.

Previous studies on ECFs have been subject to a number of empirical and theoretical difficulties (Fox, 1981). To begin, the unit of analysis often does not correspond to the research question at issue. Data limitations have forced researchers to use data at a higher level of aggregation (e.g., state or school district level) than they would like (e.g., school level). Because of the multidimensional nature of educational output and measurement problems, researchers have resorted to using alternative "output" measures, such as student enrollment or average daily attendance. Also, inputs related to capital costs are often omitted, and this can lead to significant estimation errors. Moreover, the use of expenditure data as a cost proxy raises a serious conceptual difficulty in that expenditure levels are often determined in a political context and are thus unlikely to be cost minimizing. The estimated equation would not be an ECF, and economic interpretation of the results is difficult. Furthermore, restrictive functional forms are employed in estimating an ECF. These functional forms impose prior assumptions on the technology of educational production that can be unwarranted.[6] Finally, in estimating an ECF, most studies do not control for the quality of schooling or school effectiveness. This significant flaw undermines the validity of the findings.

Since the late 1960s, numerous studies have been conducted to estimate cost functions and economies of scale for the traditional school and university in

developed countries (see, for example, Cohn, 1968; Hind, 1977; Kenny, 1982; Maynard, 1971; Riew, 1966). But such attempts have been relatively recent and few in developing countries.

A recent study has looked at traditional primary and secondary schools in two Latin American countries, Bolivia and Paraguay (Jimenez, 1986). The sample consisted of 43 primary and secondary Bolivian schools and 41 Paraguayan schools. By estimating an ECF based on a flexible functional form (translog function) and using enrollment data adjusted for school quality (based on student test scores), the study found that the average primary schools in these two countries did exhibit economies of scale; the same finding was also true of the average Bolivian secondary school. The study found that substitution between personnel and nonpersonnel inputs was possible for the Bolivian schools, and that the size of the physical plant for Paraguayan schools was excessive.

The existence of economies of scale, however, was not reported in an earlier study of secondary schools in Uganda (Chesswas & Hallak, 1972). Using data from 11 secondary schools, the researchers found no apparent pattern between per-pupil expenditure and school size. No ECF was estimated by this study.

A review of 34 studies on American elementary and secondary schools concludes that "per pupil school costs appear to be characterized by a U-shaped average cost curve. Scale economies do exist over a limited range of student populations" (Fox, 1981, pp. 285–286). But so far there is not enough empirical evidence to draw any definite conclusions for primary and secondary schools in developing countries.

It appears that there are economies of scale in higher education in developing countries. Using data from 58 developing countries, 18 developed countries, and 7 oil-producing countries, Psacharopoulos (1982) observed that the cost per pupil in these countries declined with the level of tertiary enrollment. The estimated cost function indicated that unit cost declined rapidly with university enrollment up to a 3% enrollment ratio and decreased slowly afterwards.

A more recent study also documents the existence of economies of scale in higher education. Using data for 123 developing countries and 20 developed countries in 1979, Lee (1984) found that unit cost for a university would decline dramatically up to an enrollment of 500 students. The rate of decrease remained significant between 500 and 10,000 students, but unit cost would level off after 10,000 students. But contrary to the Psacharopoulos study, Lee found that enrollment ratio had no independent effect on unit cost. Enrollment ratio was correlated with unit cost only because it was highly correlated with total enrollment, which influenced unit cost.

Evidence of significant economies of scale was found in a study of 136 institutions of higher education in China (World Bank, 1986). According to this study, recurrent cost per student declined as enrollment increased. There would be substantial savings in per-student cost if the level of enrollment was raised to about 8,000 to 10,000 students.

Although there are few studies on the cost functions of traditional education in developing countries, extensive analyses of cost functions of new educational media projects exist (Eicher & Orivel, 1980; Jamison, Klees, & Wells, 1978; Jamison & McAnany, 1978; Perraton, 1982). A number of conclusions can be drawn from these analyses. First, unit cost is sensitive to the choice of the social discount rate. Cost comparison should be informed by computation based on a range of social discount rates (e.g., 0%, 7.5%, and 15%). Second, "small media" such as radio are

much less costly than "big media" such as television; the ratio of unit costs is about 1:5. Third, there are clearly economies of scale for new educational media. For example, a study on primary instruction using television in the Ivory Coast found that unit cost decreased sharply with the number of students enrolled until enrollment reached 300,000 students (Eicher & Orivel, 1980a). And fourth, such projects usually involve large start-up costs. To reach levels of unit cost comparable to that of the traditional school, these projects need to have large enrollments and a long period of operation (10–20 years).

Obviously, we cannot compare new educational media with the traditional school on the basis of unit costs alone; measures of effectiveness are also relevant. The cost-effectiveness of new educational media is reviewed in the sectioned titled "Cost-Benefit and Cost-Effectiveness Studies in Education."

In conclusion, the above discussion indicates clearly that there are gaps in our understanding of cost relationships in traditional education in developing countries. Further research on cost functions and economies of scale in traditional education should be encouraged. But such an effort should not be confined solely to a statistical estimation of cost functions and their properties, it should also be complemented by detailed in-school studies of resource utilization. Statistical analyses can reveal patterns of cost relationship, but not the mechanisms that underline them. In a substantial way, the limitations and methodological issues related to ECFs parallel those of educational production-function studies of student achievement (Hanushek, 1979). What is needed is an understanding of the "process," not correlations only.

Behavioral Characteristics of Educational Costs and Educational Policymaking

The last two subsections have reviewed cost studies on the behavioral characteristics of educational costs in developing countries. The implications of the major findings of these studies for better policymaking in education are considered here.

The review documents the existence of cost patterns in education. A careful examination of these cost patterns can uncover opportunities for improving the efficiency of educational investment. Consider a number of examples.

Unit costs of higher education are considerably higher than those of primary education. A close look at public expenditures in higher education reveals large subsidies to university studies. We may question whether or not the significant cost gaps are compensated by higher social benefits of higher education. We need to reexamine the mechanisms for financing education. Reallocation of resources between educational levels and alternative financing strategies may be called for.

Many educational systems have vocationalized or diversified their schools on the presumed productivity and employment advantages of the vocational curriculum. In light of the significantly higher unit costs of vocational training, we need to examine the evidence for the presumed benefits and effects of vocational training.

The dominance of teacher costs in recurrent expenditure implies the importance of keeping teacher costs under control. In many developing countries, teacher costs account for more than 90% of the recurrent expenditure on primary education, leaving very limited funds for nonteacher items. The negative consequence of an imbalance in the mix of educational inputs for student achievement has to be confronted.

The significant underutilization of educational inputs in some schools in developing countries should also be of concern to educational policymakers. By more fully utilizing teachers and school facilities, more school outputs may be produced without incurring additional costs.

Last, the costly nature of a linear expansion of traditional education has prompted policymakers to explore alternative technologies of education. Given a large enrollment and a long operating life, new educational media can achieve low unit costs. It may also be a strategy to reach students in thinly populated areas.

Thus, an understanding of the behavioral characteristics of educational costs can contribute to the identification of three distinct classes of strategies for improving efficiency in education: strategies for utilizing existing resources more fully (technical efficiency), strategies for reallocating resources in education (economic efficiency), and strategies involving alternative technologies of education.

Although opportunities for increased efficiency in education exist, the findings of studies reviewed here also imply limitations and cautions for educational policymakers. Among the many factors affecting expenditures on education, there are important "external" determinants that lie outside the locus of control of educational policymakers. Also, given the practice of automatic promotion and salary increases for teachers, there is a built-in tendency for rising teacher costs. In fact, in a given year, the proportion of discretionary expenditure in the total recurrent fund is quite small.

Policymakers are well advised to recognize the impacts of past and present decisions on cost requirements in the future. A decision, for example, to raise teacher qualifications now implies a commitment to meet the substantial additional teacher costs in many years to come.

Another major finding of the studies is the considerable disparity in educational expenditures and unit costs across diverse settings. This finding has several policy implications. First, policymakers should be warned against designing an "average" policy to be applied to diverse settings. The policy is likely to have very different cost implications for schools in different settings. Schools may have different needs that require different policy treatments. Second, the diversity of educational settings implies the importance of basing policies on accurate information from these settings. Third, disparities in educational costs also reflect inequities in the distribution of educational resources across regions and social classes. Reducing such inequities can be a desirable policy objective. And fourth, differences among countries and regions warn against the danger of uncritically adopting practices found useful elsewhere.

Finally, our review demonstrates the usefulness of indicators of educational costs for understanding the behavioral characteristics of educational costs. Indicators of educational costs include, for example, measures of national effort and fiscal effort, unit costs by level of government, level of education, type of education, curriculum, region, and time, as well as indicators related to the distribution of costs by sources and input categories. These cost-of-education indicators provide an anatomical examination of the resources used in education. From the perspective of policymakers, indicators are useful for a number of diagnostic purposes: They indicate the state of affairs in education, uncover areas of abnormalities, and provide the bases for gauging progress in educational interventions (Johnstone, 1981; Oates,

1986). Thus there are strong arguments for regularly constructing and examining these indicators.

Cost-Benefit and Cost-Effectiveness Studies in Education

In contrast to the studies reviewed in the previous two sections that focus on input costs and characteristics of educational costs, respectively, the studies reviewed here consider both input costs and outcomes of education. Two classes of such studies can be identified: cost-benefit studies that compare educational benefits such as increased earnings to educational costs and cost-effectiveness studies that compare educational effects such as student achievement to educational costs. In this section, cost-benefit studies and cost-effectiveness studies are discussed separately.

Cost-Benefit Studies in Education in Developing Countries

Cost-benefit comparison in education is often conducted to assess the external efficiency of education. The theoretical and methodological bases of cost-benefit analysis have received extensive treatment in the literature (Psacharopoulos & Woodhall, 1985; Woodhall, 1967), and cost-benefit studies of education in developing countries are numerous. The following presents a brief summary of the major findings of these studies and their policy implications, as well as of the debate concerning the theoretical and methodological bases of cost-benefit studies in education.

Cost-benefit studies in education are mostly based on the rates-of-return approach to evaluating educational investment and on the human capital theory regarding the economic benefits of education. According to human capital theory, education enhances the skills (human capital) of an individual and thus raises his productivity. There is a direct and positive relationship between education and productivity. In a competitive labor market, a more productive individual is paid a higher wage. Thus, on the average, a more educated individual has higher earnings. The profitability of education can be measured by comparing the benefit of education in terms of additional lifetime earnings to the cost of education (Becker, 1964; Mincer, 1974; Schultz, 1961). One can distinguish between private rates of return and social rates of return. Private rates of return to education compare the benefits of education to an individual to the costs of education to the individual; they inform private decisions regarding educational investment. Social rates of return to education compare the benefits of education to society to the costs of education to society; they guide public policies regarding educational investment.

A convenient way to review the major findings of cost-benefit studies in education in developing countries is to draw upon the work of Psacharopoulos (1973, 1981, 1985), who has collected and analyzed numerous studies from countries in different regions over the years. As an illustration, Table 4 gives average estimates of the private and social rates of return by level of education for countries in different regions. In his most recent compilation, Psacharopoulos (1985) analyzed the results for more than 60 countries. A number of consistent findings can be identified: (a) Investment in education is very profitable, with rates of return to investment in education well above the benchmark (10%) rate of return to investment in capital; (b) the social and private rates of return to primary education are highest among

TABLE 4
Average returns to education (percentage)

Region/country type	Social			Private		
	Primary	Secondary	Higher	Primary	Secondary	Higher
Africa	26	17	13	45	26	32
Asia	27	15	13	31	15	18
Latin America	26	18	16	32	23	23
Intermediate	13	10	8	17	13	13
Advanced	na	11	9	na	12	12

Note. From "Returns to Education: A Further International Update and Implications," *Journal of Human Resources*, *20*(4), p. 586, by G. Psacharopoulos, 1985. Used by permission. na = not available because of no control group of illiterates.

all education levels; (c) private rates of return are higher than social rates of return at all levels of education, particular at the university level; (d) in developing countries, the average return to a given level of education is higher than that in developed countries; (e) the rates of return to investment in women's education are higher than those for men in developing countries; and (f) at the secondary level, the average return to the traditional academic curriculum (16%) is higher than that of the vocational-technical curriculum (12%). At the higher education level, rates of return for programs in humanities and social sciences are higher than those for technical subjects.

Psacharopoulos discussed the implications of these findings regarding policies on educational investment. The rates of return indicate underinvestment in education at all levels in developing countries, particularly at the primary-education level. Investment in primary education should receive top priority. The significant gap between social rates and private rates at the university level reflects considerable public subsidies to university students. Both efficiency and equity in education can be improved by reducing public subsidies to students (mostly from well-to-do families), reallocating the savings to primary education, and providing scholarships to students of low-income families (World Bank, 1985). The findings also support expanding women's access to education. They also cast doubts on the presumed economic advantages of vocational training over academic training, though vocational training is still profitable (Metcalf, 1985).

The social rates-of-return approach to public educational investment is attractive to cost analysts in that it is analytically simple, its results have explicit economic interpretations, and it is grounded in conventional economic theory. But even within the theoretical framework of human capital theory, most rates-of-return studies are subject to a number of methodological problems. First, the results are based on past conditions; they may not be reliable predictors of future rates of return in dynamic settings. Second, most studies use cross-sectional data instead of longitudinal data in assessing the earnings level of an individual over time. Third, most studies use the quantity of schooling as a measure of human capital and ignore issues of educational quality and relevance, thus creating difficulties in interpreting the findings. Fourth, most studies ignore significant noneconomic benefits of education and factors other than education that influence an individual's employment and earning opportunities, resulting in biased estimates of the rates of

return to education. Although some studies have tried successfully to resolve these methodological problems, most of the rates-of-return studies, especially those in developing countries, have not. And fifth, in using earnings as a proxy for productivity, rates-of-return studies assume that the labor market is perfectly competitive. This is not likely to be true in developing countries where governments are big employers. It seems unlikely, however, that these methodological problems will invalidate the conclusions of the rate-of-return literature discussed above.

But alternative analyses of the economic benefits of education have emerged since the early 1970s which challenge human capital theory and question the relevance of social rates of return to education for guiding public educational policies. Psacharopoulos has rightly observed that the "rate of return subject is still highly controversial in the literature" (1981, p. 329). Some analysts have put forward different explanations of the relationship between education, productivity, and earnings;[7] they question the theoretical basis of the social rate-of-return approach.

Thurow (1972) presents a job-competition model that suggests that earnings and productivity are determined by demand factors (job structure), not supply factors (e.g., education). Productivity is a characteristic of a job, not an attribute of an individual. Education does not raise the productivity of an individual. He argues that, if everything else is the same, a more educated individual requires a lower cost of on-the-job training; he or she is put into a more productive job with higher earnings. Thus the positive relationship between education and earnings is not due to the enhancement of human capital, but is a result of the correlation between education and training costs.

Spence (1973) explains the positive relation between education and earnings by pointing out the screening function of education in a labor market characterized by imperfect information. Education does not raise an individual's productivity. Rather, it reflects the ability of an individual. If everything else is the same, more able individuals have lower costs of acquiring education and thus have higher educational attainment. Employers use education as a signal to identify more able individuals and pay them higher wages because of their better performance. Because education reflects ability only, expenditures on education will not raise the productivity of individuals. Dore (1976) points out that job screening using educational credentials often creates intense pressure on the education system to expand. The expansion process is a vicious cycle; as the growing crowd of young people secure diplomas, ever higher educational credentials have become necessary to obtain jobs. At the same time, educational expansion leads to a severe financial burden on the government.

The existence of dual or segmented labor markets can mediate or even fundamentally change the relationship between education and income (Carnoy, 1980). This perspective argues that the labor market is not homogeneous. Instead, it is divided into segments. Workers in some segments (e.g., primary labor market) have stable and well-paid jobs, whereas workers in other segments (e.g., secondary labor market) have temporary employment and meager income. Education is an important factor in deciding in which segment a worker is located. Thus, the economic benefits of education depend on the divisions in the labor market. These divisions are the results of a historical process shaped by economic and political forces.

According to this perspective, the assumption of a single, competitive labor market on which the social rates-of-return approach is based is untenable.

Recent analyses indicate that the relationship between education and productivity is more complex than the direct and positive relationship suggested by human capital theory (Tsang, 1987b; Tsang & Levin, 1985). Empirical evidence has shown that underutilization of education in production can lead to lower work effort and lower productivity. Thus the economic benefits of education depend not only on the quantity and quality of education but also on the utilization of education in the workplace. Underutilized education can be counterproductive.

Finally, some analysts have pointed out that the focus on the productivity and earnings benefits of education is too narrow and is improper. It ignores the analysis of the central function of education in reproducing the social relations of production in a capitalist economy (Bowles & Gintis, 1976), and the analysis of the dialectical process of and tensions in educational developments in the context of a capitalist, democratic state (Carnoy & Levin, 1985). In reality, decisions on public educational investment are influenced by broader economic and political considerations, not based on social rates of return.

Given the complexities of the issues involved, controversies regarding the relationship between education and the economy will likely remain. Educational decisionmakers should be informed about the advantages and limitations of cost-benefit analyses in education that are based on the rates-of-return approach.

Cost-Effectiveness Studies in Education in Developing Countries

By comparing the costs and effects of alternative educational interventions, cost-effectiveness analysis can inform decisions to improve the internal efficiency of education. Compared to cost-benefit studies, cost-effectiveness studies are relatively uncommon in education in developing countries. Most studies for school improvement have concentrated on school effectiveness, without also combining effectiveness with information on costs. Also, cost-effectiveness studies tend to rely only on the cognitive measures of school effectiveness such as student achievement. In the following, we consider cost-effectiveness studies of both new educational media and the traditional school.

A prominent application of cost-effectiveness analysis in education is in the area of new educational media. The previous two sections of this paper have already discussed the costing and cost functions of new educational media projects; issues of cost-effectiveness are considered here.

A comprehensive overview and synthesis of the studies on the costs and effectiveness of new educational media was conducted by Eicher et al. (1982). The synthesis was based on about 30 case studies and previous partial syntheses by Jamison and McAnany (1978) and Jamison et al. (1978). These case studies cover a dozen developing countries and several developed countries. They analyze a range of media, including radio, television, computer, and multimedia systems. The findings of the synthesis by Eicher et al. can be grouped under three topics: methodology, conclusions on cost-effectiveness comparison, and evaluation of new educational media.

Consider first the issues on methodology. The case studies have followed similar

guidelines in the estimation of costs. However, their measurement of effectiveness is questionable. In general, new educational media have a variety of effects, encompassing both internal effects and external effects. Internal effects refer to effects produced during the learning process, such as cognitive skills, and affective or attitudinal development. External effects (or benefits) concern the impacts on graduates and society at large, such as the impacts on a graduate's earnings and occupational mobility, and effects on economic growth. The case studies tend to concentrate on the cognitive-skill measure, thus ignoring affective and other external effects of new educational media. This preoccupation with cognitive skills reflects partly a narrow assessment of the goals for some of these projects. This narrow focus makes the comparison of new educational media with the traditional school problematic in that the latter also provides other socialization and certification services to its students.

Actually, few projects of new education media escape the criticism of noncomparability with the traditional school. On the one hand, some of them were carried out to serve students not covered by the traditional school, so these projects were not meant to be comparable to the traditional school. On the other hand, few projects were designed in such a way as to control for other variables so that the effects could unambiguously be attributed to the project treatment. Internal validity is difficult to establish for these case studies. But the use of an experimental design for these projects is costly and will create unrealistic conditions for assessing the applicability of the findings of these projects to concrete situations.

Despite these limitations in methodology, Eicher et al. were able to draw several tentative conclusions regarding the cost-effectiveness of new educational media:

1. Students do learn from new educational media. But the use of such media in traditional schools is not cost-effective, at least at the primary level. Without altering the pupil-teacher ratio, new educational media generally add costs without raising effectiveness significantly.
2. "Little media" such as the radio are more cost-effective than "big media" such as television. But advances in microcomputers may change this situation in the future.
3. Distance teaching may be the only way to educate children in thinly populated areas. Distance teaching still requires teachers to provide face-to-face contacts with students, and teachers have to be trained in the use of new educational media. The total cost of primary education cannot be reduced by relying exclusively on these media.
4. The effective use of new educational media requires a technical staff for operation and maintenance. But these technical personnel are in short supply in some developing countries.
5. Given a situation, it is difficult to determine which medium is the most suitable. There is no supermedium, and several media are often combined in a project.

Several observations can be made about the evaluation of new educational media. Previous studies have indicated that it is costly to conduct such evaluations. Also, nonneutrality in evaluation exists, especially for the earlier studies. The close relationship between the evaluator and a project often leads to biases, such as the underestimation of costs and generous assumptions about project effectiveness

(Carnoy & Levin, 1975). Such biases often result in a favorable evaluation for new educational media. The scope of the evaluation is also limited to issues of interest to the sponsoring agency. Moreover, experience has shown that the success of a project is not due to the application of media technology per se, but depends on a series of circumstances of how the technology was applied, that is, on the implementation process. This implies that an important aspect of project evaluation is on the process of implementation and the contexts for successful application.

Eicher et al. (1982) concluded by suggesting further research on both the effectiveness and the costs of new educational media. Effectiveness research is needed in four areas: effects of distance-learning systems, effects of nonformal education, external effects, and problems in design and measurement. Further cost studies should evaluate the costs of adult education and higher education programs in developing countries (pp. 130–133).

Jamison and Orivel (1982) reviewed the cost-effectiveness of 14 distance-teaching projects for school equivalency. These projects lead to standard educational certification at various levels of education. Eight of the 14 projects are in-school projects, and the remainder are out-of-school projects. The distinction between the two types of projects is an important one in that it reflects significant differences in the technology of educational production. In-school equivalency projects involve frequent group meetings between pupils and teachers; media do not substitute for teachers but for the skill of teachers. Out-of-school equivalency projects have infrequent meetings between pupils and teachers; there is more substitution of teachers by media.

The costs of the projects were estimated by employing well-developed costing procedures for new educational media. Again, effectiveness proved more difficult to measure. Evidence on effectiveness is fragmentary. Because these projects are for school equivalency purposes, it is assumed that they provide their students with a service similar to that of the traditional school so that the cost-effectiveness of these projects and their traditional counterparts can be compared by their unit costs only. But such an assumption is problematic, as the distance-teaching projects and the traditional school have different effects on students that cannot be captured by their school-equivalency purpose alone.

Several findings emerge from this review. First, these projects have large fixed costs, often exceeding 50% of the total cost. This cost structure is thus very different from that of the traditional school, which is dominated by teacher costs. Also, projects using radio have lower unit costs than those using television.

Second, given the high fixed costs, cost per pupil is sensitive to enrollment. For these projects to be viable in terms of per pupil cost, they must have large enrollment and long operating life. For example, at the secondary level, projects with fewer than 10,000 pupils per year are risky. But one cannot generalize this figure to all situations. In general, the threshold figure is determined by a number of factors: the level of school equivalency, the choice of media, the cost of the closest alternative program, the ratio of fixed costs to variable costs, and other factors that are country-specific.

Third, distance-teaching equivalency projects appear to be effective and cost-effective. For many employed adults, these projects provide the only way for them to study. The projects also expand the opportunities for education to groups not

previously covered by the education system. Most of these projects have lower costs per pupil than their traditional counterparts. The significant reduction in costs for out-of-school projects is due mainly to the large increase in the pupil-teacher ratio.

In short, new educational media appear attractive when they are used outside the traditional-school setting. But given the lack of a systematic evaluation of the cost effectiveness of distance teaching, firm conclusions are unwarranted.

Applications of cost-effectiveness analysis to traditional-school inputs and conventional educational interventions in developing countries are relatively few. It is only in the past few years that some well-executed cost-effectiveness studies in developing countries have begun to surface. This state of affairs can probably be attributed to a combination of reasons: the neglect of educational costs and an early pessimism about the effectiveness of school factors.

Cost-effectiveness analysis is a methodology for evaluating alternative strategies that takes into account both the costs and the effects of the strategies. But in the past, most of the efforts at improving school tended to concentrate on the study of the determinants of student achievement. General evaluation studies often do not incorporate a cost component in their analyses (Levin, 1987).

The evolution of our understanding of the determinants of school effectiveness is also pertinent. In the past 20 years, a large amount of research was conducted on the determinants of student achievement, mostly based on an input-output or production-function approach. Based on the works of Coleman et al. (1966), Jencks (1972), and others in the U.S., the research reviews in the early 1970s concluded that the most important determinants of student achievement were family background and socioeconomic factors and that school variables had little impact on achievement (Averch, Carroll, Donaldson, Kiesing, & Pincus, 1974). The negative assessment of the impact of school variables on student achievement was reiterated in a review of studies of input-output relationships in nine developing countries (Alexander & Simmons, 1975). This implies that interventions involving school variables are not effective strategies for raising student achievement.

This negative assessment, however, has been challenged by further studies in recent years. In the U.S., studies on school effectiveness have indicated that although school expenditure and teacher qualification are not significant factors, school climate and school organization are relevant factors (Brookover, Beady, Flood, Schweitzer, & Wisenbaker, 1979; Purkey & Smith, 1983). It was also found that school variables had stronger effects on achievement in poor countries rather than in rich countries (Heyneman, 1980; Heyneman & Loxley, 1983). Moreover, studies in developing countries have found that school inputs like textbooks (Heyneman, Farrell, & Sepulveda-Stuardo, 1981), teachers (Husen, Saha, & Noonan, 1978) and school-management variables (Arriagada, 1983) did have an impact on student achievement. Recent reviews have also concluded that school variables can be effective in raising student achievement (Fuller, 1985; Schwille et al., 1986). These recent findings have led some researchers to shift their attention from the consideration of whether or not school variables are effective to analyses of the cost-effectiveness of school interventions (Psacharopoulos & Woodhall, 1985, chapter 8).

A conspicuous example is the provision of textbooks to promote student achievement. Actually, this school intervention is not a new one. In Mexico, for example, the provision of free textbooks to primary-school students was a key part of a

national educational policy (Neumann & Cunningham, 1982). This policy, however, was based on a belief rather than on cost-effectiveness analysis. Supportive evidence came from a recent study of a textbook project in the Philippines (Heyneman, Jamison, & Montenegro, 1984). The study found that the provision of better textbooks and the increase of the ratio of textbook to pupil from 1:10 to 1:2 had significant and consistent improvement in student achievement in science, mathematics, and language. The additional cost incurred was only a modest 1% increase in per-pupil educational expenditure per year. Moreover, students of low-income background appeared to benefit most in terms of learning. The study also found that raising the textbook-pupil ratio to 1:1 was not cost-effective. This and other studies (Jamison, Searle, Golda, & Heyneman, 1981) suggest that the provision of textbooks is a cost effective strategy to improve student achievement, especially at the primary level. And with regard to student achievement, the research indicates that it is a misallocation of resources not to spend (or to spend very little) on textbooks.

Another area for cost-effectiveness analysis is teacher training. A recent study of teacher training in Kenya using correspondence and radio courses (Hawkridge, Kinyanjui, Nkinyangi, & Orivel, 1982) found that this method of teacher training was effective in terms of planned objectives, but it was also very costly. The study, however, did not compare the cost-effectiveness of this method with other teacher training methods.

Taylor (1983) studied two distance-teaching projects for upgrading teacher qualification in southern Africa, the Bophuthatswana Teacher Upgrading Project (BTUP) and the Lesotho In-Service Education for Teachers scheme (LIET). The major tasks were to estimate the costs of these projects and to compare their cost-effectiveness with traditional teacher-training programs. In contrast to the earlier studies which reported significantly lower unit costs for the distance-teaching method, Taylor found that the recurrent cost per pupil for BTUP was not low compared to that of traditional secondary schools in southern Africa. The unit cost of LIET was more than three times that of BTUP, mainly because of a larger staff and higher salary costs. But these comparisons were based on direct costs. Taylor speculated that if indirect costs (foregone earnings) had been taken into account, then the distance-teaching projects would have become relatively inexpensive. BTUP and LIET were also comparable to their traditional counterparts in terms of passing rates in certifying examinations, a crude measure of effectiveness. These two projects would become more cost-effective if their enrollments were substantially increased.

In general, good estimates of both the costs and effects of alternative teacher-training methods are still deficient. Further research in this area is needed in order to draw more definite conclusions.

The cost-effectiveness of alternative curricula at the secondary level is the subject of some recent studies. The interest in this subject is also derived from the long-standing debate over the merits and demerits of the vocational and general curricula. The costs and rates of return of the two curricula have been treated in the subsections titled "Educational Expenditures and Unit Costs: Patterns and Determinants" and "Cost-Benefit Studies in Education in Developing Countries," respectively.

A detailed study of the impacts and costs of curriculum diversification was

conducted in two developing countries, Colombia and Tanzania (Psacharopoulos & Loxley, 1985). In Colombia, diversified secondary schools (INEM schools) were compared with traditional secondary schools on the basis of unit costs and student achievement in academic and vocational subjects: industrial, agricultural, academic, commercial, and social service. Using data on the 1981 cohort, the study found that cost-effectiveness varied with the tracks. Industrial, agricultural, and social-service tracks in INEM schools had lower unit costs than those of the traditional school, and their students had higher test scores in academic and vocational subjects. Academic and commercial tracks in INEM schools had higher unit costs than those of the traditional school, and their students had higher test scores. In short, for the 1981 cohort, INEM schools did raise student achievement, and they were more cost-effective than the traditional school in some curriculum tracks.

In Tanzania, all lower secondary schools provide a diversified curriculum with academic and vocational streams. The study thus compared the costs and student achievements between the streams. Using data on the 1981 cohort, it found that, compared to the academic stream, the technical stream was more cost effective. The agricultural stream enjoyed a modest increase in achievement, but it was 19% more expensive than the academic stream. The commerce stream was 9% more expensive than the academic stream, and it had mixed results on student achievement.

Cost-effectiveness information on other traditional school inputs is lacking.

What have we learned from the studies of the cost-effectiveness of alternative school interventions for improving the internal efficiency of education? Not a lot. The provision of textbooks has been found to be effective and cost-effective. This finding warns against any decision for cutting nonteacher costs (including expenditure on textbooks) to an extent that upsets the balance in the mix of school inputs. But evidence of cost-effectiveness for other traditional school inputs is either lacking, incomplete, or not yet generalizable. Given the need to utilize scarce educational resources efficiently, particularly during the current period of tight fiscal constraints and unmet demands, this situation is indeed unsatisfactory. The situation can probably be improved by combining efforts to strengthen the research basis of cost-effectiveness analysis and the utilization of research findings in educational policymaking.

The research basis for cost-effectiveness analysis in education can be strengthened by simultaneous actions in three areas. First, evaluation of educational interventions using the cost-effectiveness approach should be encouraged. As pointed out previously, many past evaluations considered school effects only, without taking costs into account and were thus incapable of informing decisions about efficiency in education. Evaluation studies can be improved by adding a cost-estimation component. Also, although the analysis of the costs and effects of an educational intervention can be analytically separated into a prior conventional evaluation of effectiveness and a subsequent cost-estimation component, it is methodologically more superior and probably less costly to make the analysis of costs an integral part of the evaluation process (Levin, 1987).

Second, the usefulness of cost-effectiveness comparison is strongly affected by the availability and reliability of data on costs. Obviously, cost comparison cannot be made without data on costs, and results of cost-effectiveness comparison can be

very misleading if inaccurate cost data are used. For many cost-effectiveness applications, information on the costs of individual items at the school level is needed, such as the price of a textbook or an equipment. Macrolevel budgetary data are of no use for such applications. Only surveys of costs at the school level can yield the required information (Eicher, 1984). Variation in price and other disparities in costs for schools in different regions also warn against using average or aggregate estimates uncritically.

Third, school produces many effects on individuals. But studies of effectiveness, cost-effectiveness, and internal efficiency tend to focus on cognitive effects and ignore other important noncognitive effects of schooling. To the extent that noncognitive effects can influence a person's performance in the workplace or the quality of life after school, they should also be considered in effectiveness research. We should be aware that schools may be internally efficient in raising test scores but externally inefficient in socializing students for adult life. In addition, cost-effectiveness studies depend on informed research on school effectiveness. It is only by adequately understanding the factors that contribute to school effectiveness that we can then appropriately identify the alternatives for improving school and compare their cost-effectiveness.

The utilization of findings of cost-effectiveness research should receive no less attention than the research effort itself. Consideration of cost-effectiveness should be part of the decisionmaking process. Cost-effectiveness analysis is useful in informing decisions in that it provides a framework for identifying, collecting, and analyzing relevant information on both costs and effects. Previous experience has shown that some cost-effectiveness studies were conducted only "after the fact." Such a practice reduces the usefulness of cost-effectiveness analysis in informing decisions.

But cost-effectiveness comparison should not be used as the sole basis for a decision; other considerations are relevant. For example, alternative educational interventions may have different distributions of effects and costs on different social groups not reflected by such comparison. Thus different interventions may have different equity implications. Also, some interventions may be more easily implemented than others (Schwille et al., 1986, pp. 91–97). These considerations can affect the choice and the likelihood of success of an educational policy. These other considerations should be combined with cost-effectiveness comparison in informing a decision.

Summary and Conclusions

What are the costs of education? What are the major determinants of educational costs? In what ways can cost analysis improve policymaking in education? And what are the informational needs for cost analysis in education?

These are the questions we set out to address in this paper. In this last section, we summarize that what we have learned from a review of educational cost studies in developing countries in the past two decades.

An important contribution of the economic analysis of educational costs is the concept of opportunity cost. This enables us to estimate the real cost of education which include not only monetary expenditures, but also the value of other foregone opportunities. In particular, the total cost of education to a country consists of total

public educational expenditure, total direct private cost, as well as total indirect private cost measured in terms of foregone earnings. Past cost studies have sometimes improperly estimated education cost by focusing on government expenditures on education only.

Previous experience indicates that there is no single response to the question of what the costs of education are. In practice, what educational costs to measure depends on the decision context in which the cost analysis is performed. In general, cost estimation is influenced by two issues: the cost to whom, and the choice between average-cost analysis and marginal-cost analysis. For both accounting and analytical purposes, educational costs are usually classified into distinct categories, such as recurrent costs and capital costs, as well as personnel and nonpersonnel costs. To reflect changes in the price level, educational costs are usually expressed in both current dollars and constant dollars. Also, educational costs are often compared on a per-unit basis. The choice of educational unit depends on the purpose of the comparison. The most common basis is the cost per pupil enrolled.

In short, considerable progress has been made in our conceptual understanding of educational costs in the past two decades.

A multitude of factors affect educational costs. Analytically, we can divide these factors into two groups: factors that determine the total amount of resources devoted to education and factors that determine expenditures within education.

Total public educational expenditure represents a large portion of the total amount of resources devoted to education. In general, it is influenced by factors that determine the supply of and demand for education. Supply factors include the rate of inflation, the range of competing demands of other public services, the rate of growth of the economy, tax revenues for education, the impact of foreign trade, as well as the availability of foreign aid to education. Demand factors, on the other hand, relate to the growth in population and its age distribution, the importance of education for social mobility, concern for equality of educational opportunities, the choice and development of technology for economic production, and others. These supply and demand factors are very complex and they are often beyond the control of educational decisionmakers. It does not imply, however, that all these factors are equally important in all settings. Their relative importance is likely to vary over time and among countries.

The other group of factors is concerned with the internal operation of education. Expenditures within education are strongly influenced by the technology of educational production, compensation for teachers, the extent of utilization of educational inputs, as well as rates of dropouts and repetitions. These are the factors over which educational decisionmakers have more control and thus are the targets of educational policies. With the current tight budgetary constraints and unmet demand for education in developing countries, the need to control costs and improve efficiency is obviously very pressing in these countries today. Since the amount of discretionary recurrent expenditure in a given year is usually small, educational policymakers will do well to be aware of the cost implications of past and present decisions, and to adopt a long-term perspective in their plan to control costs and improve efficiency.

Our review has also documented the range of applications of cost analysis which can contribute to better policymaking in education.

Cost estimation has been applied to a wide range of situations, from the costing

of an educational project to the costing of a national education plan, and from the costing of a pedagogical intervention in the traditional classroom to the costing of out-of-school distance education. For a given educational intervention, cost estimation informs the policymaker about (*a*) the total cost required, (*b*) the economic feasibility of the intervention, (c) the short-run and long-run cost implications, and (d) the distribution of the cost burden. A sound cost analysis may also reveal serious policy errors that have to be dealt with.

It also pays to understand the behavioral characteristics of educational costs by regularly constructing and examining educational cost indicators and by studying resource utilization in schools. A close examination of the patterns of educational costs can uncover opportunities for improving the efficiency of educational investment. An awareness of the disparities in educational costs in different settings is necessary for decisionmakers to design proper policies applicable to diverse settings. And the disclosure of areas of excessive wastage or underutilization of educational resources may lead to actions that reduce educational costs without affecting school quality or actions that increase school output without incurring additional cost.

Moreover, the applications of cost-benefit analysis and cost-effectiveness analysis address directly the concern about inefficiency in education. Cost-benefit analysis can be used to assess the external efficiency of education, whereas cost-effectiveness analysis deals with issues of internal efficiency. Prominent applications to date include the estimation of the rates of return to different levels and types of education, as well as the evaluation of new educational media. But cost-effectiveness studies of the traditional school are still lacking. Efforts should be made to improve the research basis of cost-effectiveness analysis and its utilization in educational policymaking.

Previous experience indicates that the practice of cost analysis in educational policymaking often falls short of its potential usefulness. There are "political" barriers that may not be easily penetrated, yet there are "technical" difficulties that are amenable to change. For example, efforts can be made to incorporate cost analysis in educational policymaking, to train competent cost analysts, and to improve the data base for policy analysis.

In short, sound economic research and evaluation can improve the efficiency in the allocation of resources in education.

Finally, analysis of education in developing countries is often plagued by unreliable and incomplete data. In many developing countries, central-government budgetary data are what is available and accessible for cost analysis. Data are often not available on private costs, on costs at the school level or other levels of government, and on the relevant categories of costs. Efforts to collect these data should be encouraged.

Given the wide range of applications of cost analysis, it is impossible to specify fully the data needs of cost analysis. But for most applications for educational planning and policymaking, we can identify five kinds of educational data that are often required.

1. Data on educational costs. The costs of education are supported by public, private, and foreign sources. They can be classified into institutional costs and household costs (see Figure 1). Institutional costs are divided into recurrent costs and capital costs. Recurrent costs are broken down into a matrix of input items and input functions. Household costs include direct and indirect cost items. Time-

series data on institutional and household costs are to be collected for various levels of education, types of institutions, various levels of government, and in current and constant dollars.

2. *Data on educational quantities.* These refer to the quantities of inputs to and outputs of education. They include data on student enrollments, graduates, repetition and dropout rates, number of teachers and other school personnel (by age, experience, and qualification), and physical inputs. They are used in costing educational interventions. Also, they can be combined with cost data to construct indicators of educational costs (e.g., unit costs) for diagnostic purposes.

3. *Data on educational prices.* These refer to the prices of school inputs. They include information on the salary structure and other compensations for teachers and other school personnel and prices for various school inputs. They are needed in educational costing and in the construction of educational price indices.

4. *Data on educational norms.* These refer to the various norms or standards used in school. They include information on class size, the physical specifications of a school, staff-student contact hours, the ratio of senior staff to junior staff, and so forth. They are needed in the estimation of recurrent and capital costs.

5. *Socioeconomic data.* These include data on national output, cost-of-living price indices, and public expenditures. They are used in constructing educational indicators and educational indices.

Data for quantities, prices, and norms are to be provided in sufficient detail to match those of the cost data. Figure 2 summarizes the inputs to and applications of a data base for cost analyses.

There is obviously a cost for managing a proper data base of educational costs, ,but this cost is likely to be more than compensated by the gains of better informed decisions. The need to strengthen the informational basis of cost analysis in both obvious and urgent.

Notes

[1] Public formal schooling is the most dominant mode of education. Private provision of formal schooling is also significant in some countries, especially at the secondary level (World Bank, 1980, pp. 125–126). For some recent cost analyses of private education, see Schiefelbein (1986, pp. 34–42), and Tan (1985a). Nonformal education is not the focus of this paper. See Ahmed (1975) and Hunter et al. (1974) for an economic treatment of nonformal education.

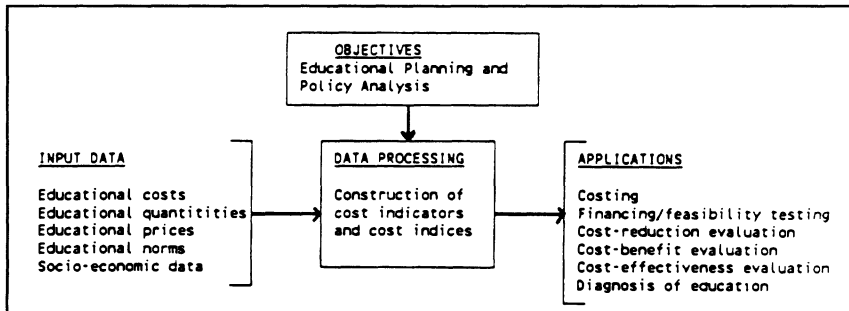

FIGURE 2. *Inputs to and applications of a data base for cost analysis*

[2] A major source in Spanish on Latin American countries is the RAE collection (*Indice de Resumes Analíticos Sobre Educación en América Latina y el Caribe*).

[3] Some analysts have questioned the appropriateness of using the concepts of efficiency and productivity, and the conventional framework of economic production to understand education (Vaizey, Norris, & Sheehand, 1972). Such an approach can be too technocratic and narrow; it also ignores the social and political dimensions of education (Carnoy & Levin, 1985).

[4] See the other case studies in UNESCO (1972), such as Bennett (1972), Proust (1972), Ta Ngoc (1972), Arrigazzi and Simone (1972), Auerhan and Solomon (1972), Fachin (1972), and Woodhall (1972).

[5] High rates of dropouts and repetitions are widespread in developing countries (World Bank, 1980, pp. 116–119). There can be a big difference between the actual number of years to complete an education cycle and the normal length of the education cycle. The ratio between the two is referred to as the inefficiency index. See Haddad (1979) for a review of studies on school wastage.

[6] To estimate an ECF, a functional form is used to relate input and output variables. A functional form is said to be flexible if it imposes no a priori restrictions on the educational production process, particularly regarding the degree of substitution among inputs (elasticity of factor substitution), and how output changes when all inputs increase by the same multiple (homotheticity); otherwise, it is restrictive. The conventional forms, such as the Cobb-Douglas function and the CES function, are restrictive in that they presuppose homothetic technology or constant elasticity of factor substitution. A functional form that is flexibile is the translog function (see Henderson & Quandt, 1980).

[7] For a review of human-capital studies, see Blaug (1976). Blaug (1985) also provides a brief overview of alternative perspectives to human capital theory. For more recent developments, see Carnoy & Levin (1985), and Tsang (1987b).

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