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ALLOCATING EDUCATION RESOURCES

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One of America's first teachers, an Indian named Squanto, was more concerned with teaching the Pilgrims how to grow maize than he was about allocating education resources efficiently. That he used teaching aids as simple and inexpensive as a hoe, some soil, a few seeds and dead fish didn't detract from the importance of his teaching. With his help, America's settlers learned to grow their own food in a wilderness rich in natural resources waiting for educated human resources to utilize them.

Since then, the education process in the United States has changed; the current outlay per year for direct costs of elementary, secondary and college education is $48.5 billion. Education accounts for about one-third of all workers on civilian government payrolls.

Education is a big business, and economists and educators have long been interested in the economics of education. Adam Smith, one of the first economists, felt because schools did not compete with each other, they did not provide a quality education at a suitable market price. Benjamin Franklin, influential in Pennsylvania education, was also the "first American who deserves to be dignified by the title economist (1.)." His economic philosophy of education was that one of the best ways to achieve material success was to be an educated man. Horace Mann supported the idea of the economic value of education when he said that industrial and national wealth are increased in proportion to the diffusion of knowledge.

Although the purpose of education systems as well as industries is to produce an output using various input resources, there are several ways in which education systems are different. In most industries, in contrast to education, market transactions determine output and input quantities and prices. Politics, however, is the primary force which determines the allocating of resources for education.

Education, like industry, cannot attain high levels of quality production without changes in the organization and employment of human effort (2.). To use limited endowments with an economic rationale, educators should invest resources in those parts of the education process which will contribute most to the quantity and quality of the output. Unlike industry, there is no well-defined education market. Education policymakers, therefore, should have the technical knowledge of relations between available inputs and outputs to maximize production according to the public goals for education.

A recent study by Swanson, Persons, Kittleson and Leske intended, in part, to provide data on changes in farm income as farmers participated for varying numbers of years in farm business management programs in Minnesota (3.). One of the basic reasons for studying income as a measure of education output was to show whether or not farmers should receive instruction for only three years. Because there were a limited number of instructors and many farmers in each community, there was a desire to help as many farm families as possible and another study in Minnesota, by Cvancara, had suggested diminishing returns during the first three years (4).

History of Education Efficiency

Scientific management became a popular concept around 1910 for various businesses and institutions. Efficiency experts such as frederick Taylor became frequent, if not welcome, visitors to the public schools. Cost and inefficiency were the main concerns, and school administrators yielded to public opinion and pressure. Standard tests of efficiency, teacher ratings, and the school survey were some of the effects of the education efficiency experts in action between 1911 and 1925.

The "factory system" and the platoon school eventually led to the adoption of industrial practices for efficient resource use in the school rooms of Gary, Indiana. Bobbit had four principles in his Gary Plan:

a. Use the plant at all time.
b. Maximize the working efficiency of specialized teachers.
c. Eliminate "waste" such as, health programs or services, and parks.
d. Work raw materials into the best adapted finished products (5).

Bobbitt was not using complete economic

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analysis; he was trying to minimize accounting costs, but he forgot to consider social outputs and social costs. If the added education returns to society were greater than the costs, more instead of fewer resources should have gone to education if rates of return on education were higher than other social investments.

As has been true of many education innovations, the factory system in schools declined in popularity to be replaced not by a genuinely superior alternative, but rather with other education fads and a degree of blind faith in American public school systems.

Measures of Education Output

There are two kinds of goods in economics: consumer goods and producer goods. Consumer goods such as food, clothing, and TV sets, are used up in a relatively short period of time and in general directly contribute nothing to the production of other goods. Producer goods, such as tools, machines, buildings, and other intermediate products contribute to producing other goods which eventually reach the consumer. Education output is a joint product: part is a consumption good – the other part is a producer good. To some students and parents, education has prestige value and some students enjoy going to school: both are examples of education as a consumption good. Because education is usually a prerequisite for employment and consequent production of consumer goods and services, part of education is a producer good.

A large proportion of the education output of adult farm management programs in Minnesota is a producer good. The most obvious and easily measured component is the increase in income which means more sales in the rural community and more demand for production goods such as feeds, seeds and fertilizers. Indirect but perhaps equally as important in the long run is the effect of farm management education on better education for farm youth, and higher standards of living.

Similar to the Consumer Price Index and measures of national productivity, some writers and researchers have developed indexes of education output. A few try to measure educator productivity and others try to measure college quality. Benson and Lytton defined productivity indexes as quantity of output divided by quantity of input, allowing for some general quantity and quality components in both measures (6, 7).

Another measure of education output is the difference between pre and post scores on achievement tests. Mental measurements could tell students what they purchased and could give the public some measure of control by showing how the education system performs. Published ratings could show the institution's quality without merely representing different natural abilities of the students.

In spite of several claims to the contrary, many American goals and values are related to the dollar. Most parents, when they demand better education for their children claim that they want their offspring to "have it better than we did," "to get ahead," or "to do better in life." These and similar statements of aspirations for children are related directly to the ability of children to make satisfactory incomes. This is not to say that a large income is the only goal of students and their parents. Income, however, is comparatively easy to objectively define and measure, and it is related to other education goals, such as a higher standard of living, which lack these characteristics.

Although income is a useful measure of education output, educators, psychologists and sociologists eagerly remind economists of nonmonetary benefits which are not easy to evaluate in dollar terms. Citizenship, honesty and a general ability to get along with one's neighbors are only a few of the personal qualities educators and others hope to ingrain in students.

The whole range of alternative measures of education output indicate a problem in allocating resources and problems within the education process itself. How can decision-makers allocate resources to education without having a clear concept of the desired output and an objective method of measuring whatever output parents, educators and politicians might agree upon?

One of the first steps in attempting to make rational decisions might be to re-evaluate and redefine education goals so there can be responses to three questions Robert Mager posed: "What is it that we must teach? How will we know when we've taught it? and What materials and procedures will work best to teach what we wish to teach?" (8).

Measures of Education Inputs

As in measuring outputs, there are two categories of inputs: direct costs and indirect or opportunity costs. This, however, did not prove

to be the case. When the general public is asked about expenditures for education, they respond with comments on elementary and secondary, college and vocational training. Total education costs, however, involve much more. Jacob Mincer found that on-job-training for males, for instance, required as much direct cost as formal schooling (9). Although direct costs are important, Schultz considered opportunity costs in the form of income foregone for formal schooling to constitute sixty percent of the total costs of education (10). If informal types of education such as on-the-job training or vocational school education had to cover the charge for income foregone, the total opportunity costs in the education process would be extremely significant. An example of the opportunity costs in Minnesota adult farm management education are the values of the farmers' time while they were traveling to and from the class meetings, their time spent in classes and their extra time spent keeping detailed financial records.

The direct costs in an education process of any type are relatively simple to compute. By adding up the operating, instruction and capital costs, a reasonably accurate measure of input costs would be the result. A difficulty might be in dividing total direct costs into particular levels or phases of the education process. For example, it is not easy to divide electricity bills according to which part of the education system used the electricity.

Although there is not complete agreement on which costs and inputs come under the expenditure column of a budget for the education process, these measures of inputs are relatively objective and there is less diversity of opinion concerning appropriate measures than is true of attempts to measure outputs. The basic problem in measuring inputs is to agree on the correct opportunity costs. This is a much less serious problem, however, than an attempt to agree on a dollar value of a 10 point gain score on an achievement test or a "better" attitude toward government, society or religion.

How To Study Input-Output Relationships

Economists and educators have studied the inputs and outputs of the education process, but few have attempted any control of quality differences and even fewer have tried to study input-output relationships. In production economics with a relatively general goal of profit maximization and relatively exact ,technical relations between inputs and outputs, mathematical formulas can serve as tools for efficiently allocating resources. Because of the present "state of the science" in education, however, exact production relationships are unavailable. The complex nature of the education production system, with outputs and inputs which are difficult to objectively define, means the immediate use of a study outline is to provide a framework for determining which variables really play an important role in the education process.

As is the case for production economics, so also must there be a measure of output in studying education input-output relationships. Income can serve as a measure of many of the desirable consequences of the education process. Most of the implied and explicit goals which supporters of education list as desirable are at least indirectly related to monetary values. For example, parents want their children to get ahead and be a success in life; businessmen want an orderly, well-behaved citizen that is not only a good consumer but is also unlikely to disrupt the peaceful orderliness of a profit-oriented society; and most people simply have a feeling that a good education can get a person a high-paying job.

Input Quality

There are several components common to many types of education processes: for example, a teacher component. Other inputs might be teaching machines, classrooms, desks, books, demonstration equipment and numerous other inputs which are more or less specific to a particular type of education process.

Some teachers may be better able to use capital such as visual aids or teaching machines. With particular teachers an increased input of teaching machines would lead to a more than proportional increase in the education output. To study input-output relationships, more must be known about how to measure the effect of varying qualities and quantities of inputs on the education product. One objective, for example, might be to specify that adding one more set of encyclopedias to the library would increase education output by three units, with units being defined as a 3-point gain on an achievement test, a $100 per year increase in income, or whatever other goals policymakers decide upon.

The Minnesota study of education investments in agriculture attempted a crude measure of quality by dividing the farm business management programs into those which were well organized and taught by a full-time instructor, and those which were less well organized. This arbitrary designation showed contrasts in changes in income, sales and return to capital and family labor. In all three cases the well-organized programs showed greater gains.

Levels of Education

If policymakers are analyzing input requirements for education, they need to investigate the education system at a level appropriate for their area of concern. If they are allocating resources to the first semester of the third grade, they must consider input-output relationships at that level. For example, the capital

investments required for the third grade are of a different type and less costly than for a well-equipped diesel mechanics course in a vocational school. Both the type and effect of decisions vary between elementary education decisions about special teachers for reading and physical education, and graduate school decisions concerning establishing a new requirement for a Master's degree.

Individual Income

Differences in individual income are due to many factors such as chance, parental wealth, and education. Many economists and educators have studied relations between income differentials and education backgrounds, but few have outlined the components of an analysis designed to give an empirical basis for allocating social resources.

Several factors in the education process and their relationships must be defined, studied, and measured so changes in organization and investment in education can depend on empirical data and calculated judgments. The procedure is to define measurable education outputs which meet the demands of society, then to define and measure inputs, and finally to study the relationship between inputs and outputs by investigating input quality at specific levels of education. The recent study of the farm management program in Minnesota showed how all the stpes of the procedure have a practical application. The results of the study showed that farmers should not be limited to three or four years of farm management instruction and that, in fact, it was after five or six years of instruction that extreme increases in income became obvious.

With this outline for the factor relationships of the education process and with appropriate methodological developments, it should be possible to proceed to identify the critical variables and their nature. The probable goal would be to maximize individual incomes within the limits of the social and economic investments in education. What this procedure provides is a framework for studying the education process which should eventually lead to the possibility of specifying the effect of a dollar invested in education upon dollars worth of return – thus giving an empirical basis to decision-making in public investment problems involving education.

Conclusions and Implications

There are several implications and suggestions for further research which will be a consequence of attempts to empirically measure education inputs and outputs for purposes of studying their relationships.

a. What is education? How do you measure education output?
b. What are the technical limits of education production?
c. What are the quality components of education inputs and how are they related?
d. Contrary to most decisions in economics, a policy question might be: given the optimum output level desired, what resource level is needed?

Squanto, the Indian, may not have been able to explain the phenomenon that maize production was a function of the pounds of dead fish fertilizer, number of plants per acre, inches of rain, soil type and relevance of on-the-job training. Today, however, advancing technology forces institutions and industries into more sophisticated organization. Education is no exception. Just as large industries have found that to maximize profit they must utilize technological developments and knowledge of technical input-output relationships, so educators need to identify and measure input-output relationships to be in a better position to make education policy decisions.

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