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ABSTRACT

Although there is high interest in determining whether or not an educational program provides good value for its cost, it is difficult to make this determination, since people are not generally conceptualized as products and since educational benefits are not easily translated into financial terms. Economic principles suggest that the cost of obtaining something is the value placed on whatever must be sacrificed to obtain it. This opportunity cost varies among individuals, changes with time, and depends upon the individual's prior learning. The value of learning can be computed by approximating the banker's compound interest formula; the opportunity cost and the number of times the learning is used are considered in this formula. Once the costs are computed, the cost-benefit model should consider the service provided, as well as all those who benefit from it and those who pay for it. Although this procedure has not been empirically validated, it provides a simple and objective method of examining multiple outcomes over time. (Ten steps for carrying out a cost-benefit evaluation are described). (GDC)

A COST-BENEFIT METHODOLOGY FOR SUMMATIVE EVALUATION

David Churchman

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One of the most frequent distinctions made by evaluators is that between formative and summative evaluation (Scriven, 1967). The former usually is thought of in relationship to making improvements in an educational program; the latter with determining whether or not to adopt a particular program for some purpose. Stake (1967) points out that formative evaluation is of interest to authors, developers and publishers, while summative evaluation is oriented to teachers, administrators and consumers.

One of the major factors that teachers, administrators or consumers are interested in is whether or not an educational program provides good value for the money spent on it. This is difficult enough in any circumstance--for example, selecting the best tire for the type of car you have and the type of driving you do, where the criteria are relatively few, relatively clear and performance of the product can be predicted with reasonable accuracy. But, it is exceedingly difficult in the case of an educational program. There usually is little difficulty in determining the costs of providing the program with reasonable accuracy, but it often is unclear just what the benefits are and even less clear how to value them.

There are two important reasons for this difficulty. First, educators often object to thinking of people as "products," preferring instead to speak in terms such as "the full potential of the individual." Despite a difference in language, neither educators nor economists want to see

educational resources wasted. Both tend to agree that a more efficient way of educating is preferred to a less efficient one, providing that cultural and social norms are taken into account in determining efficiency.

The second difficulty is that of translating educational benefits into financial terms in some objective fashion. Schultz, one of the pioneers in quantitative measurement of returns to investment in education, demonstrated that it is necessary to take education into account in explaining economic growth (1963). But, Schultz studied education only as it contributed to the production of goods and services. Educators would agree that this is one purpose of education, but not that it is the only purpose.

The real difficulty lies in determining a cash value for education that contributes to quality of life for the individual. Just what is it worth in dollars to learn to enjoy a Rembrandt? Or to be able to play soccer? Or to know the language of a country when travelling abroad? Each of these will enable some very small number of people to earn their living. Each will enlarge GNP in some small degree by creating a market for certain types of products and services. But, for most people the three types of learning are non-economic. How can a money value be determined for each, and for similar types of learning, in some replicable and objective fashion?

The Cash Value of Educational Benefits

The solution lies in the economists' idea of opportunity costs. The cost of obtaining *anything* is the value placed on whatever must be sacrificed to obtain it (Heyns, 1973). The value of having learned to enjoy a Rembrandt is what it would cost to induce the individual to forego the opportunity to see a Rembrandt. This cost will vary in three important ways.

First, opportunity cost for any product or service will vary among individuals. Therefore, it is necessary to determine an average opportunity cost among all individuals who have completed whatever program is being evaluated. This can be done by sampling students at the end of the course and determining the opportunity costs by presenting them with various hypothetical situations. The assumption is that the more successful the program has been the higher the opportunity costs associated with its goals will be.

Second, opportunity costs will vary with time. Some learning becomes obsolete very quickly. This is true in rapidly developing fields such as computer technology, and it is true of liesure time fads, such as roller skating, disco dancing and roller disco, very much in fashion as this is written but hopefully sufficiently outmoded by the time this is read to prove the point. Other liesure activities have more lasting appeal but require physical stamina, so that there is a tendency to switch from active participant to spectator then to lose interest entirely. Soccer might be an example. Other liesure activities, particularly cultural ones such as appreciation of art, tend to increase rather than diminish with time. It is necessary to estimate, for each educational outcome, whether it will increase or decrease over time in its effect on the individual, and it is necessary to estimate the "service life" of the learning.

Third, the opportunity for an individual to make use of different types of learning will vary considerably. The individual who has learned to enjoy Rembrandt, enjoy soccer and speak a foreign language will not

do all three every day. Some estimate of the frequency that each educational outcome will prove useful to an individual is equally important in determining its value. A reasonable way of making an estimate for each type of learning must be made, there being no simple way that will provide a suitable average for every conceivable educational outcome.

Knowing the current value of an educational benefit in terms of its opportunity costs, the frequency that it is useful to program graduates, its service life and whether it increases or decreases in value with time, it is possible to compute the value of the learning by appropriating the compound interest formula of the banker:

$$V = O(1 + f/365)^{\pm n}$$

That is, the the value of learning equals opportunity cost times the quantity one plus the number of times it is used in a year divided by the number of days in a year raised to the power of the service life of the learning. Positive values of n are used if the benefits increase with time, just as the banker uses a positive value of n (we hope) in calculating our bank balances. Negative values of n are used if the value of the learning declines with time, just as the banker uses a negative value of n in calculating your loan balance.

It is unlikely that opportunity costs and compound interest formulas will provide a definitive method for calculating the long-term value of educational benefits. But, it does provide a starting point for finding better ones, and until they are found, it does provide a replicable and objective method that will permit comparisons among vastly different types of learning. Presumably suggestions for improving the formulas that

have an empirical rather than a rhetorical base will prove the more valuable approach in the long run.

A Cost-Benefit Model

The preceding technique makes it possible to assign a cash value to any type of educational benefit, the problem that has plagued those interested in cost-benefit models for education. But, it does not provide a complete solution to the question that concerns Stake's teachers, administrators and consumers. The real question is whether the benefits warrant the costs required to achieve them.

The key to solving this problem is recognition that every benefit to some group or groups is a cost to some group or groups. Students may take a course for which they pay tuition, but the tuition may cover only 2/3 of the costs, the difference being made up by some other group, such as taxpayers or alumni. Benefits accrue to one group, students; costs are met by two groups, students and taxpayers. If necessary, the groups could have been distinguished more precisely. For example, students could have been subdivided into art majors and other majors, full-time students and extension students, or whatever divisions are required to answer the questions being asked about the program.

This approach makes it possible to develop a complete cost-benefit model for any educational program of any size, from a single class to local, state or even national school system (the resources required to complete each varying considerably of course). Three types of information are needed: benficiaries, payers, and services provided. A very convenient way both to develop and to display such a model is a chart such as that in Figure 1. Columns are headed with beneficiaries, in whatever detail is

required. Rows are headed with payers. To insure completeness, column and row headings must be identical.

Figure 1

Sample Program Cost-Benefit Model*

	School	Business	Government	Students	Citizens
School					
Business					
Government					
Students					
Citizens					

Cells are completed by entering educational services. A general evaluation of an entire school would include a vast and diverse number of services, only some educational. In addition, athletic, cultural and social events would be listed, as well as community services such as use of recreational and library facilities, provision of facilities for public meetings, and at the university level, research, consulting and many other services. Cells may have any number of entries (indicating several services paid for by the same group and received by the same beneficiaries). The same service may be entered in several cells (indicating that more than one payer met the cost, or that more than one group benefitted, depending on whether the multiple entry is in a column or a row). Some cells may remain empty, indicating no service paid for or received by that

*Adapted from Caffrey and Isaacs (1971)

combination of payer and beneficiary. Much of the success of an evaluation will depend on the thoroughness with which all services provided by the program being evaluated are identified.

Once the cost-benefit model is established, it is necessary to determine values for each entry. Program costs can be determined directly from organizational records following that organization's standard accounting procedures. Program benefits can be determined on the basis of opportunity costs and the formula suggested above. Costs will equal benefits only in the most unusual circumstance. This implies an unequal exchange has taken place, which is the only circumstance in which an economic exchange *ever* takes place (Heyns, 1973). If two individuals or groups exchange goods or services, they do so only because each values what is being surrendered less than what is being obtained. Viewed from either side, the exchange is unequal, but both sides have more than they did before in terms of their own needs, so are better off than they were before the exchange took place.

Once values are determined, it is possible to compare any combination of benefits with any combination of costs of interest to the audience for the evaluation. Efforts to reduce these figures to a single index, as statisticians using research designs often do, are inappropriate, because no single one can tell the full story or answer every question that may be raised. Ratios of benefits to costs may be calculated for purposes of comparison if desired.

In special circumstances, when it is desired to maximize the combined total learning, and the costs must be kept within specified constraints, it is possible to construct equations from the cost-benefit model of Figure 1, and through linear programming to determine the maximum potential of the program being evaluated. Just as no engine ever achieves its maximum because of

friction, so no educational system ever will achieve its theoretical potential. But, just as an imaginary frictionless engine provides a standard of comparison for real engines, so the extent to which the theoretical maximum is achieved by a particular educational program provides a means for judgine real educational programs. Eventually this may permit development of standards such as those now provided for interpreting statistical tests.

A step-by-step methodology for carrying out an evaluation based on these principles is provided below, followed by a listing of the advantages and disdavantages of the approach.

Steps for Carrying Out a Cost-Benefit Evaluation

1. *Isolate the geographic region to be studied.* The evaluation must be limited to a reasonable area in terms of the resources available to conduct the evaluation and, more important, one credible to those whose interests will be affected. Natural geographic boundaries, school or tax district boundaries and school service areas based on residence of students and staff can be considered in identifying the geographic region to which the evaluation will be limited. The region selected should be outlined on a map. If the boundaries are likely to be disputed when results are published, then public comment and adjustment should take place before the study begins.

2. *Identify payers and beneficiaries.* A chart similar to that in Figure 1 must be constructed with identical column and row headings consisting of the groups in the geographic region that incur costs or receive benefits from the program being evaluated. It is vital to anticipate at this point the level of detail required during analysis of the data, so that all groups of interest will be named on the chart.

3. *Identify services provided by the program being evaluated.* Cell entries indicate who pays (by reading the row heading) for and who benefits (by reading the column heading) from the service named. There is no limit to the number of entries that can be made in any one cell and no requirement that there be an entry in any particular cell. It may be necessary to make the same entry in several cells to indicate multiple beneficiaries, multiple payers or both. It is essential to the success of the evaluation that all services of the program be identified. Usually the most appropriate method is a brainstorming session in which key staff having even remote connections with the program participate.

4. *Construct benefit and cost equations.* Benefits to any group consist of the sum of benefits in any given column. Costs to any group consist of the sum of costs in any given row. Either to reduce over-long equations or to develop logical ones with respect to questions being asked about the program, these may be separated into as many equations as appropriate.

5. *Estimate frequency that service is used by graduates.* Some appropriate means of estimating how often the service is useful each year on average to program graduates must be found. In many cases, local or national demographic information will provide the answer. The reader not familiar with the wealth of information existing without the need for conducting another survey should contact a regional office of the U.S. Census Bureau, a *major* university library where this information is available, or consult the very abbreviated summaries in the annual *Statistical Abstract of the United States* or *The Statistical History of the United States* (1976).

6. *Estimate service life of benefits and amortization period of costs.* Each benefit will be valuable for a varying amount of time, and this period

must be estimated for each benefit. Some benefits have life-time value, which can be estimated from life expectancy tables. Many educational costs will be annual, but some capital costs may be amortized over a longer period, usually by paying off bonds that simplify the task of estimating the period involved.

7. *Determine whether benefits increase or decrease with time.* Skills or knowledge that becomes obsolete or is forgotten are defined as decreasing with time; those that do not become obsolete or become greater through use are defined as increasing with time. In making use of the formula (Step 9), the exponent is given a negative sign for decreasing skills, and a positive sign for increasing ones.

8. *Determine current values of costs and benefits.* The current value for each cell entry must be determined both as a cost and as a benefit. Institutional records will provide the required cost estimates. The concept of opportunity cost discussed above (page 2-3) can be used to determine values for entries for which direct information on value is not available. A representative sample of program students must be obtained, and they must be given a questionnaire asking them to indicate how much they would have to be paid to forego program-related opportunities.

9. *Determine long-term costs and benefits.* The formula $V = D\ (1 + f/365)^{\pm n}$ is used as discussed above (page 4). Value for various time periods can be calculated, and ratios of benefits to costs determined.

10. *Prepare evaluation report.* A report of the evaluation should be written so that it will answer a wide range of questions as to who benefits at what cost from the program under evaluation. Every effort should be made to make the report as readable as possible and care should be taken to insure that the detail provided is appropriate to the audience that will receive the report.

Advantages of the Methodology

The methodology descrived above has five significant advantages over other approaches to conducting a summative evaluation:

1. It provides an objective way of estimating educational benefits in monetary terms.
2. It provides an approach to evaluating the long-term effects of education.
3. It is not limited to behavioral objectives, but addresses multiple outcomes of education.
4. Results are presented in terms that people can understand without special training, rather than in the esoteric statistical language of many evaluation reports.
5. It provides a starting point for improved methodologies.

Disadvantages of the Methodology

Compensating for these advantages are two significant disadvantages:

1. There is no empirical basis for assuming the formula is appropriate, or that educational effects are compounded annually.
2. There is no equivalent to statistical tables and their underlying probability distributions to facilitate interpretation of results.

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