

Utility and Self-Sufficiency in the Selection of Educational Alternatives

Roger Kaufman, *Professor of Educational Research and Development, College of Education and Director, Center for Needs Assessment and Planning Learning Systems Institute Florida State University Tallahassee, FL 32306*

Andrew S. Carron
*Brookings Institution
Washington, DC 20036*

Abstract. Methods of deciding among educational programs usually have taken too narrow a focus or have been unsystematic. A set of guidelines for selecting among alternative programs would be helpful to the decision-maker who must design new programs, continue existing ones, or modify and synthesize the old and the new. This paper provides a possible set of decision rules for identifying and choosing among educational programs based on the underlying requirement that each learner reach at least self-sufficiency. It proposes a two-level decision model that is intended to accommodate people in society who are self-sufficient or who are "on target" for reaching that state and those in society who are neither self-sufficient nor moving toward that state. Both a rational and mathematical model are presented; both require empirical validation and continued thought.

Introduction

Dissatisfaction with the results of our public educational system has triggered a search for better ways to instruct learners. Moreover, there is a growing awareness that merely tinkering with classroom methods will not suffice. Attention is being expanded from "how to

teach" to include formal consideration of "what to teach" and, finally, justifying "why teach what we teach" (Kaufman & English, 1979). The "why" is a critical issue, only now receiving the attention it has long deserved. Contemporary concern is becoming more focused on determining goals and objectives for education that are both measurable and justifiable.

Schools have begun to identify goals and objectives using a variety of approaches. School boards may set goals using "arm-chair" philosophy (which unfortunately often turns out to be some form of "develop each child to his or her own capacity") or they may use a more sophisticated "needs assessment procedure" (cf. Witkin, 1977). Almost all existing statements of need (and of derived goals and objectives) refer to "how-to-do-its;" it is more productive, however, to look at "needs" as gaps between current outcomes and desired outcomes (Kaufman, 1972; Kaufman & English, 1979). By so doing the agency is more likely to design interventions that will successfully meet these needs not just develop "wish lists" of desired resources or processes. The purpose of this paper is to suggest criteria for the "required outcomes" portion of a rigorous need assessment (i.e., goals, objectives) so that needs will be properly identified and interventions appropriately selected.

We suggest that objectives best relate to useful and acceptable social goals, namely preparing learners to survive, be self-sufficient, and contribute in today's and tomorrow's world. Although successful completion of a particular educational course may be a precursor to the student's ability to succeed in society, it is the success in the societal context itself which is desired. Therefore, it is suggested that both planning and evaluation criteria for education and associated curriculum and programs be based on the performance of the learner in society, rather than within the more

restricted ambit of the educational system. Some educators (cf. Popham, 1975) reject the usefulness of the concept of the societal referent for planning and evaluation, claiming that employing it is too complex. We submit that it is just this complexity that must be addressed, understood, and serve as the basis for further research, development, and evaluation (Kaufman & Thomas, 1980). This paper proposes a simple model for evaluating educational interventions based on such wider "social" indicators.

Education as "Public Good"

Education is a "public good" in the microeconomic sense (cf. Nicholson, 1972; Henderson & Quandt, 1971); some of the benefits of education flow to one's neighbors and associates, and the market system provides no means of individually charging the recipients of these desirable "externalities." Left to the private (nongovernmental) market, individuals would be inclined to underinvest in education, because the benefits they perceive would be less than the true gain to society as a whole. (Education does have a consumption component. Many individuals may pursue education partly for current enjoyment, rather than as a means of enhancing future economic and social prospects. This tendency works counter to the propensity to seek suboptimal education, although it still may be argued that the schooling

Authors' Note. This work was supported in part by a grant from the Florida State Department of Education, Division of Vocational Education.

The authors wish to thank the following people for helpful comments and suggestions to earlier drafts: Robert G. Stakenas, Bruce G. Stone, Michael Knight, Howard Tuckman, Matthew Marlin, Irvin Sobel, Morton S. Baratz, Richard Kraft, and Abba Learner.

pursued for consumption purposes has few positive public benefits, i.e., externalities.) This characteristic argues for public education; only when aggregated to the level of society as a whole will benefits be correctly measured and allocation decisions optimally made.

The educational agency is established as the means of efficiently producing the socially optimal quantity and quality of education. But the agency is nothing more than that: an instrumentality—its goals should be consistent with and contributive to society's goals. So on the one hand we must charge the agencies with the proper allocation of the public good aspect of education. And conversely there is a presupposition that public enterprises should not be used to generate purely private returns. Virtually anything one might learn could have spillover (private) benefits, and public education certainly has this characteristic. In order to focus on the public good aspects, however, we shall suggest that the identification and ranking of objectives for the educational system would begin with those having the greatest social (as opposed to private) effects. We propose two hypotheses:

- The goals of an education agency should be external to the agency itself, rooted in the current and future values of society; and
- Those goals should emphasize the public good aspects of education relative to those aspects conferring more purely personal benefits.

The following two sections of the paper will amplify these points, and a model for achieving them will be developed subsequently.

Organizational Goals and External Criteria

From a societal perspective an organization is a means to achieve social ends. Organizations may function smoothly yet fail to meet the goals which society has set for them. Typically, programs and resource allocations are based on efforts within the organization and results—inputs, processes, products, and outputs—and thus measure the success of the organization in meeting internally set goals rather than formally considering the usefulness of that which the organization delivers to society. We hold that organizations should plan and be evaluated in terms of outcomes—the value of its outputs external to the organization (Kaufman & English,

1979). In considering this important relationship between means and ends the following definitions are useful:

An *input* is any resource (ingredient, raw material; factor to production; goal or objective to be achieved; need) which is available for possible use or mandated to achieve valued results (e.g., product, outputs, outcomes).

A *process* is any method, procedure, tool, or technique which is used to convert inputs into "products" (see below).

A *product* is any en-route (to an output) result obtained, usually at the course or course element level.

An *output* is a set of organizational accomplishments for which inputs have been obtained, processes run, products achieve, and all three aggregated to yield a total organizational result. Examples of outputs would be numbers of college students graduated, high school diplomas awarded, or vocational certificates granted.

An *outcome* is the impact and utility of any one or set of outputs in society, as indicated by an individual's ability to survive and contribute in society. (In earlier work this term "survive" was used. We will, in the balance of this paper, substitute "self-sufficiency" for "survival." Included in "self-sufficiency" is the ability to be self-reliant and not dependent upon others for handouts or charity.)

Figure 1 presents these relationships between internal and external factors.

Many existing educational programs exclusively use goals and objectives which are internal to their agency or system. Thus, goals for a school might be to produce graduates, or provide those finishing the program with job-entry-level skills. These goals—actually educational system *outputs*—are likely to be more useful if first related to external *outcomes*, such as enabling each learner to be self-sufficient and to contribute in society upon legal exit from the educational agency. Seen in this manner, organizational outputs are useful to the extent they are related to useful outcomes (Kaufman, 1979).

In society today, some reach or exceed self-sufficiency (earned income enough to survive without public assistance) and some do not with current curriculums and programs, even though learners may be meeting the internal goals of the educational system. Thus we see high school graduates who cannot find and hold jobs. Moreover, even the organizational goals themselves are not all being met (e.g., learners who fail to graduate from high school).

Educational agencies must not only change some of their objectives to align them with current and future social utility, but they must also become more effective at achieving the objectives that are set. As a first step, socially desired

Continued on page 23.

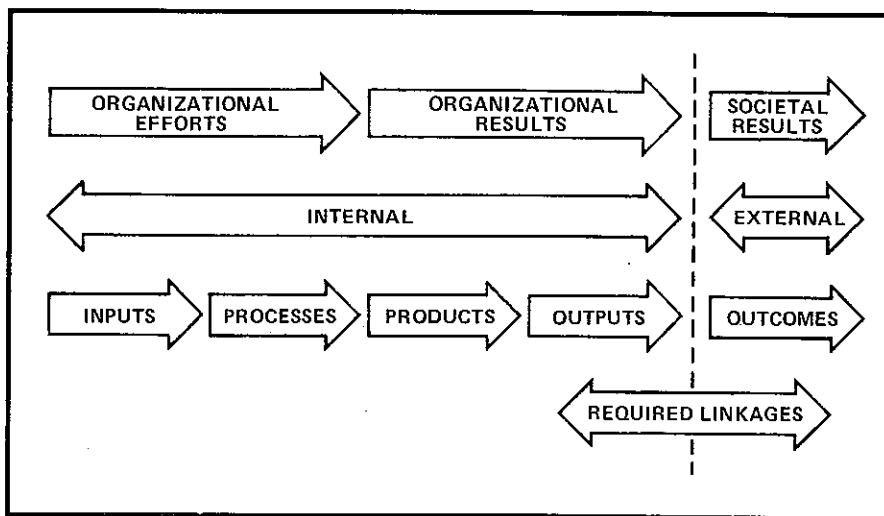


FIGURE 1. The relationship between organizational efforts and results and societal results. "Internal" refers to the organizational efforts and results because these pertain to what goes on within and results from any organization. The elements of organizational efforts and results are: inputs, processes, products, and outputs. The effects and impact of the sum of these "internal" elements in society (external) are termed "outcomes." (Based upon Kaufman, 1979, and Kaufman & English, 1979)

outcomes should be identified for the agency; this important step is often ignored or accomplished only informally. The next task is to identify measurable outputs of the agency which are linked to the identified desirable social outcomes. Researchers in education have only recently begun studying the links between outputs and outcomes, and effort requiring new skills for those who have heretofore been concerned solely with the links between processes (e.g., teaching methods) and products (e.g., courses completed) and/or outputs (e.g., diplomas granted).

Only after these crucial preliminary steps have been completed and the outcomes identified and justified does the "traditional" role of the educational agency begin: achieving the organizational objectives in an efficient manner. Here, too, there have been failings but the problem at least is well known. With outputs more appropriately chosen, producing them may become more successful if for no other reason than that learners might be more motivated by the promise of tangible, valued, and useful rewards.

This paper concentrates on the first step: the definition and justification of outcomes. We leave to a later work an analysis of the output-outcome linkages and to the researchers already at work the problems of meeting organizational objectives. We turn now to what we consider the most important and possibly least appreciated problem.

Setting Social Goals

In a world of scarcity, not all desired goals can be achieved. That which we consume today cannot be consumed next year and that which one group consumes precludes its use by others. Society develops rules for balancing the worth of one outcome against the worth of another.

Social goals should be explicit, although in current practice often they are not. Different people may have different goals and the goals may change over time. Goals are selected implicitly as new consensus are reached among the various groups which have power in society. It is typically (and perhaps sometimes inappropriately) left to the politicians to allocate resources and to select the criteria for accomplishment (Pechman, 1980). The many programs

for the poor, disadvantaged, and unlucky in society, however, indicate a strongly held belief that society should redirect some resources from the "haves" to the "have-nots."

Consistent with the hypothesis that the public aspects of education should have precedence over the private aspects, we would propose as the principal (but not only) requirement for an educational program that each learner be able to maintain a level of earned income sufficient to support life in the biological sense and to support the individual in the social sense, given the economic environment. Society must concern itself with aggregate performance, but also with the performance of those on the bottom of our social and economic strata.

The Dependency-Contribution Model

One previously suggested model calls for an overall minimum objective for any educational agency:

By the time the learner legally exits the educational agency, she or he will be at the independent survival point or beyond. (Kaufman, 1972)

According to this referent, there is a point along a continuum where independent survival may be achieved, and this is indicated by an individual's consumption being exactly equal to production. There are two additional zones of concern: "dependent survival" where an individual's consumption is greater than production, and "contribution" where production exceeds consumption.

While this model communicates easily, it represents an imperfect model for educational design, implementation, evaluation, or planning, because it does not supply any metric for defining a position within the consumption or production zones. It also implies that any intervention (say, a reading program in an urban-center school) where the program fails to enable all learners to perform at least at the independent survival point or where its positive effects cannot be demonstrated will be counted as a failure. Because of this "all or none" criterion, the model does not provide a "degree of failure" index which could be useful for evaluation and revision; the design of successful interventions demands more comprehensive, precise, and rigorous means of measurement.

We next define more precisely what is meant by "independent survival," or self-sufficiency, and then develop a more responsive model.

We usually do not observe directly the "what is" of societal outcomes; we see indicators—levels of income, crime rates, unemployment statistics, and the like. For a model to be useful there must be indicators for the complex array of social goals (self-sufficiency, happiness, freedom of choice, luxury, altruism, leisure, etc.). Some researchers limit studies only to consideration of later-earned salaries and taxes paid, not including other issues such as ability to retain and invest earned monies, and related personal and social results (cf. Alexander, Melcher, & Nickens, 1980). Such considerations as taxes paid and income earned, while being important, are not sufficient for a clear understanding of the utility of educational efforts and programs. (Equations (1) through (6) shown in Figure 2 consider this limited perspective—benefit-cost in terms of salary differentials and taxes paid. Additional personal and social dimensions are added in Equations (7) and (8).)

We have suggested that each learner should be able to maintain at least some minimum level of production and consumption after completion of the educational program. Careful attention must be paid to the selection of external success (outcome) toward which any program will be identified, selected, designed, directed, and evaluated. The goal must represent the consensus of those responsible for and receiving the program and should be based on the best technical evidence available.

The minimum consumption level used for program selection may take into account the relevant demographic characteristics (e.g., age, family size, values, location, health). This quantity might include food, clothing, shelter, and a prorated share of a variety of necessary social goods such as police and fire protection, defense and general government administrative expense. One possible measure would be the poverty level income as defined by the U.S. Department of Labor. If this indicator were chosen, it would be necessary for an agency to decide whether to use the national level or some regional index and make a decision whether to use the indicators for family or individual income and consumption. One might want to use a forecast of

this consumption level some years into the future, to represent more accurately the environment which will exist upon exit from the educational program. To this poverty level income, which is essentially a physical intake and use determination, one might add an amount to cover the individual's share of the costs of social goods. Such an amount would be limited to public goods (those such as defense from which it is impossible to exclude any citizen from enjoyment of the benefits) and even further restricted to those required for a minimal level of survival (fire protection but not parks, street lighting but not agricultural price supports). It would not be appropriate to include in income amounts paid by governments in income redistribution programs—welfare, unemployment compensation, social security. These are funds transferred from individuals with surpluses (taxpayers) to other individuals but are funds which do not involve production or consumption. Likewise, taxes which go toward transfers should not be considered a "necessary" component of minimum consumption.

In general, then, we might evaluate the success of particular programs according to how well they succeed in pushing a learner's level of production up to and beyond some minimum level of consumption: self-sufficiency. We measure production and consumption in dollars conceding that some workers are overpaid and others underpaid, that some consumer goods are overpriced and others underpriced, and that some types of production and consumption have no price tags on them at all.

Relating dollars and educational productivity has been neither simple nor entirely successful (cf. Sobel, 1978). The definition of educational "product" and the appropriate unit of analysis have been elusive. In many cases education has been viewed as a total system result instead of as a subsystem of a larger system. For the limited purposes of this model, we want to make a case for using money income of graduates or "learners" as an *indicator* of the performance of an educational program.

Money is merely a convenient token of exchange; we cannot eat it, use it to shelter us, or wear it. Money is a means by which we may trade our time or possessions for the time or possessions of others. In some cultures we use dol-

$$U_i = f(Y, M_1, M_2, \dots, M_k) \quad (1)$$

where Y = income,

M_j = all goods, services, and states of the world ($j = 1, 2, \dots, k$) not available for purchase to which the individual attaches utility, and

f = a function relating the quantities of Y and the M 's to U_i , a utility number for individual i .

$$U_c = f(Y, M_1, M_2, \dots, M_k) \quad (2)$$

for the contributing group, $Y \geq C^*$;

$$U_d = f(Y) \quad (3)$$

for the dependent group, $Y \leq C^*$;

where C^* = the defined minimum level of required consumption.

$$R = R_c + R_d \quad (4)$$

where R_c and R_d denote the current allocation of resources to programs serving the contributing group and the dependent group, respectively.

$$U'_c = f(Y', M'_1, M'_2, \dots, M'_k) \quad (2')$$

with cost R'_c where $U'_c < U_c$ and $R'_c < R_c$.

$$U'_d = f(Y') \quad (3')$$

with cost $R'_d = R - R'_c$, where $U'_d > U_d$.

$$U = \begin{cases} 1 & \text{if } Y \geq C^* \\ 0 & \text{if } Y < C^* \end{cases} \quad (5)$$

where U = social utility.

$$U = \sum_{i=1}^N (Y_i - C^*) \quad (6)$$

$$U = \sum_{i=1}^N \min [0, (Y_i - C^*)] \quad (7)$$

where *min* means the lesser of the quantities in the brackets, zero or $(Y_i - C^*)$.

$$U = \sum_{t=1}^T (1+r)^{-t} \sum_{i=1}^N \min [0, (Y_i - C^*)] \quad (8)$$

where r = the discount (interest) rate.

FIGURE 2. Equations.

lars, in others pesos, rice, or shells—in each case we allow some token of exchange to be traded in lieu of the non-monetary items.

In addition, money has the virtue of reducing all goods and services to a one-dimensional scale of value: price. Those things which are scarce and valued will command a higher price than those items which are abundant and not as prized. Given an efficient market system, the laws of supply and demand will assure a direct correspondence between worth (or utility) of an item and its price. Not everyone has the same value system, of course, and so not everyone buys the same things. But the market system continuously allocates and reallocates resources from low-valued to high-valued items.

There are some things to which we may attach high levels of utility but which are not available through the market system: such qualities as happiness, love, inner peace, and the like. While we do not quarrel with the worth of these states of being nor with the difficulty of incorporating them into the present model, we exclude them from the concept of self-sufficiency for the limited purposes of this model. This point will be treated explicitly later.

A program will be successful, then, if the production level of the learner after exit exceeds some minimum level of consumption, both levels measured in dollar terms. It is not required that income exceed minimum consumption in every year, only that it does so in terms of lifetime income (including any interest paid on loans).

It is useful to explore the implications of a "failure:" lifetime minimum consumption exceeding lifetime production (income). The individual may have persuaded private lenders to advance that amount, or private givers (family, charity) to donate support. Of greater concern to public institutions are the income maintenance payments (welfare, food stamps, social security, unemployment compensation) to which the individual might be legally entitled. Or the individual may be earning enough to pay for personal consumption requirements but may be paying no taxes to support his or her share of necessary social costs. In all cases these funds must come from surpluses generated by productive ("contributing") members of society.

We have suggested that the output goals of an educational agency may

be ranked according to their contribution to social outcomes. That is, they can be ordered by "public" usefulness (magnitude of spill-over effects) and desirability. We have gone on to indicate that self-sufficiency in our economic system might well rank at the top of the list. For expositional simplicity, we now propose to divide the learner population into two groups and apply different rules for program selection to each group. (Programs are seen here as possible processes and products delivering outputs. See Figure 1.) For that group which is contributing, according to our definition (or seems to be on course to reaching that state), with current programs, we attempt to maintain current social outcomes. Some programs with purely private returns may be curtailed, and improvements in technical efficiency will be made—producing the same general social outcomes with a reduced expenditure of resources. Another rule is used for that group which, according to predictors (to be developed), is not approaching self-sufficiency. Programs for this latter group are reoriented with self-sufficiency the only objective. Once self-sufficiency is reached, members of the dependent group move into the contributing group where increments above the minimum survival level of production are added to the list of objectives. In an application of this model, additional goals not directly related to income and production might be added for either group. A straightforward benefit-cost analysis may then be performed, using the suggested array of objectives for each group, to design and evaluate educational programs.

The rules for allocating resources to these two groups are suggested in the following section.

A Description of the Model

Individuals, we assume, have *preferences* among commodities, services, and states of the world. Furthermore, individuals are presumed able to rank those items in terms of increasing preference, although some individuals in some situations may be indifferent among the alternatives. These preferences may be arrayed over a limited set of possibilities internal to a particular system. It is our contention that preference orderings for organizations serving individuals, and for individuals within these organizations, ought to be related to external

("social") rather than internal ("organizational") referents.

Utility is here defined as a "number" or weight assigned by an individual to a commodity, service, or state of the world (or some bundle of same) according to his or her preference ordering of all such items. Then to say that the utility "number" attached item "A" by an individual is greater than the utility "number" for another item "B" is equivalent to saying that the individual prefers A to B. If the individual is indifferent between having A or B, then the utility "numbers" assigned to A and B are identical. It is not required that degrees of preference be measured ("A is twice as good as B"); the utility "numbers" are merely assignments in a preference ordering.

Beginning with individual preferences, we may assign utility numbers to these preferences. For each individual a utility function scale can be constructed. Utility is a function of the quantities of the various goods and services consumed by the individual; the derivation of the utility function can (and perhaps should) include the "state of the world" (i.e., war or peace, feast or famine) as well as income, food, housing, and the like. In general, the utility function for an individual may be written as in Equation (1), Figure 2.

The difficulty arises in comparing utilities across individuals. It is possible for a single individual to have a consistent set of preferences. But there is no unambiguous way to relate the strength of one individual's preferences to those of another. In practice, coalitions of individuals impose their consensus preferences on all of society; we may agree or disagree with the resource allocations which are then made.

In this model, we have sidestepped most difficulties of this nature by making strong assumptions. A few clear choices remain, and our model is explicitly biased more in the direction of equality of outcomes (for the educational agency) than is current policy. It stops well short of pure egalitarianism, however.

Define a level of consumption necessary for survival, possibly according to the measurement criteria suggested above. We then advance the following proposition: the social value of an individual's own utility increases as enjoyment of nonpurchasable items in-

creases only if income is above the self-sufficiency level. (Self-sufficiency is the goal; income is the indicator.) We thus consider two groups of individuals and the problems of allocation between them, rather than the considerably more difficult problem (both technically and philosophically) of allocations among all individuals affected by the intervention agency. (See Equations (2) and (3).) Further, assume that total resources are fixed, and that it is possible to determine the costs of generating each indicated outcome. (See Equation (4).) We then apply the rules developed above.

For the contributing group, we identify the current outcomes and indicators thereof and make the existing programs more efficient and find new programs to produce the same outcomes at lower cost. Then a (political) decision is made that some programs with a social utility-cost ratio below some specified level will no longer be funded, even if some members of the contributing group will have lower (private) utility. There may be alternatives outside the public educational system for restoring those individuals' prior utility level. (See Equation (2').) In this manner, the cost of programs for the contributing group have been reduced, generating surplus resources to be reallocated to the dependent group. So the problem is to find the most efficient way of maximizing the utility of the dependent given the original resources plus these reallocated from the contributing group, with the proviso that the marginal cost of a program does not exceed the additional income which that program might be expected to produce. (See Equations (3') and (4').)

We now have a means of evaluating educational programs. A program will be considered desirable ("has a positive utility") if it generates learners who are (or who are en route to being) self-sufficient. We can determine the utility of a given program by assigning an arbitrary utility number to a success and another, smaller, number to a failure; the rule is then "maximize utility." (See Equation (5).) Note that we have initially defined the desired outcome (self-sufficiency) and then related it to a measureable output (money income). But this measure lacks sensitivity to the interpersonal and intertemporal distributional issues discussed above and, unfortunately, makes no distinction between a "near miss" and missing the

target completely. We might simply add up all of the surpluses and deficits of all individuals, as in Equation (6). This is a frequent stopping point for most cost-benefit studies; we suggest it is premature to stop here.

This rule, however, would not distinguish between two results of the following types: (a) all graduates perform moderately above the survival level, and (b) most graduates perform below the survival level and a few became millionaires. It is possible to develop a utility function that more heavily weighs the failures. Decisions based on such a rule would then allocate more resources toward getting every learner up to at least the self-sufficiency level. A possible rule would be: Social utility is the sum of negative surpluses (i.e., the deficits); a value of zero is assigned for a positive surplus. (See Equation (7).) This concept is actually quite basic: No additional utility is realized by exceeding the survival point. (Since utility functions are arbitrary, there is no reason the scale cannot fall entirely in the negative range.) If, as suggested, we are also concerned with performance over time, we can apply the standard present value criterion from investment theory to this utility function, as in Equation (8). This refinement merely adjusts future income to allow comparisons across time, income today being more valuable (all other things being equal) than the same income received instead next year.

Further corrections would be necessary to adjust for changes in the entry population characteristics, inflation, and returns that society finds desirable (i.e., income above survival, nonmarketed items). Ideally it probably would be most appropriate to use these rules to evaluate programs in comparison with a control group not exposed to the problem.

No mention has been made so far of the costs of various programs. As minimum criterion for *any* education program (including vocational ones) we propose that its costs not exceed the increased earning power (current and future) of the participating learners. If the cost exceeds the returns to society, it would be cheaper to pay off the learners in cash.

We now have a possible way of evaluating proposed programs: Predict the utility of each program based on the anticipated job market for the graduates of such a program; predict the cost of

each program based on known salaries and material costs; rank all programs according to the ratio of utility to cost; implement programs beginning with the largest ratio and continue down the list until available funds are spent or until the cost of a program exceeds the incremental returns.

References

- Alexander, K. Melcher, T., & Nickens, J. A computerized system for benefit-cost analysis in vocational education. Final report, Project No. DVE 9-1C11. Gainesville, Fla.: Institute for Educational Finance, College of Education, University of Florida, 1980.
- Henderson, J. M., & Quandt, R. E. *Microeconomics theory*. New York: McGraw-Hill, 1971.
- Kaufman, R. A. *Educational system planning*. Englewood Cliffs, N.J.: Prentice-Hall, 1972.
- Kaufman, R. A. *Identifying and solving problems: A system approach*. (2nd ed.) La Jolla, Calif.: University Associates Publishers, 1979.
- Kaufman, R. A., & English, F. W. *Needs assessment: Concept and application*. Englewood Cliffs, N. J.: Educational Technology Publication, 1979.
- Kaufman, R. A., & Thomas, S. *Evaluation without fear*. New York: New Dimensions, Franklin Watts, 1980.
- Nicholson, W. *Microeconomic Theory*. Hinsdale, Illinois: The Dryden Press, Indiana, 1972.
- Pechman, J. A. (Ed.) *Setting national priorities: Agenda for the 80's*. Washington, D. C.: Brookings Institution, 1980.
- Popham, J. W. *Evaluation*. Englewood Cliffs, N.J., Prentice-Hall, 1975.
- Sobel, I. Human capital revolution in economics development: Current status, expectations and realities, *Comparative Education Review*, 25th Anniversary Issue. November, 1978.
- Witkin, B. R. "Needs assessment kits, models and tools", *Educational Technology*, 8(11), November, 1977.

TABLE 1. Hypothetical programs

	Dental Lab Technician	Marketing/ Merchandising	Administrative Secretary	Auto Mechanic	Hvy. Equip. Operator
1. Cost per student	\$ 3,350	\$ 2,360	\$ 2,730	\$ 2,310	\$10,340
2. Performance for 100 students: number earning less than C*					
a. no training	20	20	20	20	20
b. with training	10	10	15	15	5
3. Average earnings for students earning less than C*					
	\$ 3,500	\$ 3,000	\$ 2,000	\$ 3,000	\$ 5,000
4. C*	\$ 7,000	\$ 7,000	\$ 7,000	\$ 7,000	\$ 7,000
5. U (Social Utility) ^a	-266,000	-304,000	-570,000	-456,000	-76,000
6. Score (U adjusted) ^b	3.75	3.29	1.75	2.19	13.16
7. Score/Cost (Line 6/Line 1)	1.11	1.39	0.64	0.95	1.27

$${}^aU = \sum_{t=1}^T (1+r)^{-t} \sum_{i=1}^N \min [0, (Y_i - C^*)], \text{ where } T = 40 \text{ (number of years in the labor force), } r = 6\% \text{ (assumed interest or discount rate), } N = 100 \text{ (number of students in this example).}$$

^bTo avoid dealing with large negative numbers, but without changing the substance of the results, Social Utility (Line 5) has been inverted and multiplied by -1000 to derive a "Score." A larger score is directly related to a larger (smaller negative) Social Utility.

Illustrative Example

Following is an example of the way the criteria developed in the preceding section might be used by decision-makers to evaluate a variety of possible programs. Data regarding the costs and benefits of five hypothetical programs ("processes") are presented in Table 1. These might represent projected performance for programs in development. Although the data are chosen to bear some resemblance to reality, they have been extensively simplified for the purposes of this illustration and are not intended to represent actual programs in place. At the conclusion of this section, we shall suggest refinements and additions necessary for the implementation of the model.

For ease of example, we make the simplistic assumption that, without additional training, exactly one-fifth (Line 2a) of the students in each program would subsequently earn less than the

minimum required income (C*, Line 4—set arbitrarily at \$7000 in this example). In reality, one would expect different types of people to enroll in the different programs, and that therefore Line 2a would show different numbers for each program. In that case, it would be necessary to adjust the results for variations in entry-level characteristics. We do assume that the training programs have differential effects ("outputs") on the students who subsequently earn less than C*; some do better than others in the Dependent Zone. As noted previously, this model does not consider different levels of performance within the Contribution Zone.

The remaining lines in Table 1 calculate the social utility ("outcome") according to Equation (8) and compare the score to the cost. A separate calculation, not shown here, would be necessary to determine if the added earnings from all students who take the course is sufficient to cover the costs of teaching it.

Another consideration, not mentioned so far, is that a program cannot be expanded indefinitely without encountering diminishing returns. The "Score/Cost" ratio for the Marketing/Merchandising course, though the highest for the five programs, does not indicate that all resources should be redirected to that program. An appropriate strategy, if this self-sufficiency model were one's only criterion of success (rather than a minimum), would be to consider the increase or decrease in the "Score/Cost" ratio from small changes in course enrollment. Programs could then be expanded or cut back until these marginal changes in "Score/Cost" were equal for all programs under consideration. This would be an efficient approach in that any deviation from the levels suggested involves a lower "Score/Cost" in one program that is not offset by a higher "Score/Cost" in another.