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ABSTRACT

This second part of a final report delineating policy issues and analytical problems in evaluating vocational education, includes three extensive appendixes and a wide range of tables. The appendixes include: (1) the methodology of cost-effectiveness analysis and a critique of the methodology of major studies, with illustrations; (2) selected statistics on the cost-benefits of vocational education at the secondary, post-secondary, and junior college levels from various sources; and (3) an annotated bibliography on the socio-economic background of students in vocational programs, changing enrollment patterns in vocational education, career opportunities, manpower projections, planning in vocational education, and finances and priorities in vocational education. The first part of this final report is available as VT 017 228 in this issue. (AG)

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POLICY ISSUES AND ANALYTICAL PROBLEMS IN EVALUATING VOCATIONAL EDUCATION

PART II

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POLICY ISSUES AND ANALYTICAL PROBLEMS IN EVALUATING VOCATIONAL EDUCATION

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U.S. DEPARTMENT OF
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Appendix A

The Methodology of Cost-Effectiveness Analysis and a Critique of the Methodology of Major Studies with Illustrations

Introduction

This chapter lays out the basic methodological issues of cost-benefit or cost-effectiveness analysis. It employs the actual practices used in the major extant studies of vocational-technical education to illustrate the methodological issues. Since this is a critical review, the focus is often on what has failed to be the use of ideal methodology. There is no attempt here to treat the various studies in a balanced fashion -- showing equivalent examples of good and bad methodology for each study. Rather, where a particular study has made a proper (in our judgement) use of methodology, this is discussed. If only negative examples are available from a given study, this, too, should be valuable for furthering the science of evaluating the social, economic and educational effects of investments in human beings, such as vocational education. The general format of this chapter deviates from previous chapter formats in this report. Here methodological concepts and issues will be discussed in a related order. Individual studies will be used to illustrate particular points.

What is Benefit-Cost Analysis?

Benefit-cost analysis or cost-effectiveness analysis is simply a popular term for economic analysis of any program or action. This analysis can be part of a larger decision making strategy, such as systems analysis or of program budgeting, or it may be performed within its own narrower framework. In either case, it is quantitative analysis whose intent is to provide a criterion or standard for decision making so as to allocate in a rational and optimal way a given set of scarce resources among numerous competing needs.

Thus, benefit-cost analysis is a technique which concerns itself with the optimum allocation of resources. It is a tool of analysis which assesses the alternative courses of action in order to help decision makers maximize the net benefit to society. The essence of this analysis lies in its ability to evaluate the total value of benefits against the total costs.

Optimum Allocation of Public Expenditures for Vocational Education

A basic assumption in economics is that goods are scarce and that persons prefer to have more goods rather than less. Therefore, it is generally desirable to employ resources in those uses which have the highest productivity. Given the total amount of resources available for public and private education of all types, it is relevant to determine the optimum allocation of expenditures on these different programs.

Theoretical Criterion. Assuming that the goal of society is, given its values and objectives, to maximize its social welfare, which includes

both economic and non-economic components, it is possible to demonstrate the rule by which this welfare may be maximized. Society has a variety of goals and objectives, some of which are complementary to each other and some of which are competitive. For educational programs alone, there are several goals. These are the goals of 1) economic efficiency--achieving the maximum output for a given set of inputs, 2) immediate consumption and future consumption--the enjoyment of the process of education and the ability to achieve greater or more varied enjoyment in the future due to one's education, 3) equity--the realization of a more socially desirable distribution of wealth, and 4) socialization--the inculcation of socially desirable values and behavior. 1/

1/ An educator per se is apt to express these goals in a slightly different fashion, but the result boils down to the same thing. The following quote is suggestive.

"For Lehman and Dressel, the overriding concern is the impact of a particular educational program in implementing such global goals as: "...the development of skills in critical thinking and problem solving and the development of such attitudes and values as may be acquired by the understanding of the physical universe, of the methods of science, of social organization and the process of social control, and by a study of man himself." The only goal explicitly not accounted for in this statement is the equity goal.

See I. J. Lehman and P. L. Dressel. Changes in Critical Thinking: Ability, Attitudes and Values Associated with College Attendance, East Lansing, Michigan: Michigan State University, 1963, p. 2. Quoted in Arthur Gerst and James W. Trent, An Analytical Review of Longitudinal and Related Studies as They Apply to the Educational Process, Preliminary Report, Volume I, Los Angeles, California, Center for the Study of Evaluation, Graduate School of Education, University of California, no date, p. 8.

Another standard treatment is to specify the outputs of education into cognitive and noncognitive effects. While many of the noncognitive effects could be considered to be the final outputs of an educational process, such as the development of a well-balanced personality, an economist recognizes most cognitive skills as intermediate outputs which can then be considered as inputs into the production of ultimate satisfactions such as the consumption of literature, music, the exercise of a skill as a hobby to create final satisfactions or utility or as inputs into the production of further intermediate outputs such as earnings and employment.

(footnote 1 continued next p.)

These goals can be measured by appropriate indices of output. These outputs can be combined to represent an overall measure of welfare or satisfaction. Thus, we can specify a social welfare function either with respect to the outputs of all social programs, including education, or we can specify a more restricted social welfare function which expresses only that part of social welfare affected by a particular set of programs.

Thus, the social welfare function can be written in the form:

$$(1) \quad W = w(g_1, g_2, \ldots, g_n)$$

where W represents social welfare (or can be denoted as social benefits) and the g's represent the output of different social programs. The maximization of function (1) is subject to the constraint of the social budget, namely

$$(2) \quad B = \sum_{i=1}^{n} (a_i + c_i g_i)$$

where a_i is the fixed cost of the ith social program c_i is the marginal cost of the ith social program, and B is the total resources available to society

The Lagrangian multiplier is used to solve the maximization problem, that is:

$$(3) \quad w(g_i, g_2, \ldots, g_n) - \lambda \left[\sum_{i=1}^{n} (a_i + c_i g_i) - B \right] = 0$$

where λ is the Lagrangian multiplier. Differentiating this expression with respect to g_i, then:

$$(4) \quad w_i - \lambda c_i = 0$$

(footnote 1/ continued from p. 3)

What must be clear at this point is that the given purpose of a study will define the nature of the goals to investigate as well as the stage of the process wherein one should focus his analysis. The analysis above in general, however, and if one wants to maximize cognitive skills rather than utility or social welfare, one need simply substitute the terms in the model and specify the appropriate inputs which create cognitive capacities in a person.

where $w_i = \frac{\partial W}{\partial g_i}$ is the marginal benefit of the ith program. From this it follows that:

$$(5) \quad \frac{w_i}{w_j} = \frac{c_i}{c_j} \qquad (i, j = 1, 2, \ldots, n)$$

and also that:

$$(6) \quad \frac{w_i}{c_i} = \lambda^*$$

Thus, in equilibrium, as shown in equation (5), the maximization of social benefits is achieved if the ratio of marginal benefit in this example of two government programs is equal to the ratio of the marginal cost of these programs; that is, the marginal benefit is proportional to the marginal cost. (Marginal means the incremental increase in total cost or benefit due to adding one more unit of output to a program.)

An application of this principle to the optimum allocation of public expenditures on vocational education versus, say, manpower development training is to spend resources on each program to the point where the marginal benefit-marginal cost ratio of vocational education is equal to the marginal benefit-marginal cost ratio of manpower development training. In other words, other conditions being equal, such as the population of persons being served, if the ratio of marginal benefits to marginal costs of vocational education is higher than that of manpower development training, then the government should increase its expenditures on vocational education up to the point where the two ratios are equal. This can be done within a fixed budget by shifting funds from manpower training to vocational education or by expending any extra public funds on vocational education as additional funds become available. More explicitly, the optimum amount of public expenditures for

vocational education and manpower development training is at the point where the additional benefits from an additional dollar spent on these two educational programs would be equal.

This analysis points out the necessity of contrasting the marginal benefits with the marginal costs of competing educational programs in order to discover which among a set of alternatives is relatively more desirable. That is, the additional benefits of adding one more unit of output (a student) must be contrasted with the marginal or extra cost of that unit of output (a student).

Marginal cost-benefit calculations are not sufficient, however, to make a complete decision with respect to investing in social programs such as vocational education. In addition to the relative effectiveness of a program as measured by marginal benefits and costs, it is often important to know what the absolute level of effectiveness of a program is; that is, in the long run does the program operate in the black. To make this determination of absolute effectiveness, a measure of average costs and benefits must be performed, for a program could be relatively more effective than some set of alternatives, yet it may not be covering its long run average costs. Such a condition will be reason for rejecting the educational program if other non-efficiency goals do not intervene. Thus, average costs, that is, total cost divided by the total units of output, must be compared with average benefits, total benefits divided by the total units of output. And, the present value of net average benefits (benefits minus costs) should be zero or positive.

A Diagrammatic Exposition. These principles can, perhaps, be best illustrated by means of graphs.[2/] Given that a decision is to be made on whether to spend an additional sum of social resources on either vocational education or manpower development training, the problem is to choose between the two. That is, which will yield the greater addition to benefits for the alloted additional resources? Figure 1 shows the difference between average costs and benefits and marginal costs and benefits. Figure 2 contrasts the marginal and average costs and benefits of the two programs. The diagrams are hypothetical.

In Figure 1, assume the vocational education program is operating at a level where total costs are equal to oc_1 and total benefits are equal to ob_1. The average benefit-cost ratio is given by $\frac{ob_1}{oc_1}$. This ratio is also equal to the slope of the line segment oa_1.

Suppose the program is expanded out to point a_2 by adding resources equal to c_1c_2. Then c_1c_2 represents marginal costs, the addition to total costs, and b_1b_2 represents marginal benefits, the increase in total benefits, due to the increase in costs. The marginal benefit-cost ratio is equal to $\frac{b_1b_2}{c_1c_2}$ and slope of the arc a_1a_2.

Thus, it can clearly be seen that marginal and average costs and benefits and hence, their ratios, usually differ, the difference depending on the level of output.

In Figure 1, given that costs and benefits are measured in the same units, average benefits are greater than average costs, as depicted in the graph. The next question is to compare two programs--vocational education and manpower development training.

In Figure 2 at the current funding level of oc_1, manpower training has a higher average benefit-cost ratio, $\frac{ob'_1}{oc_1}$, than does vocational education

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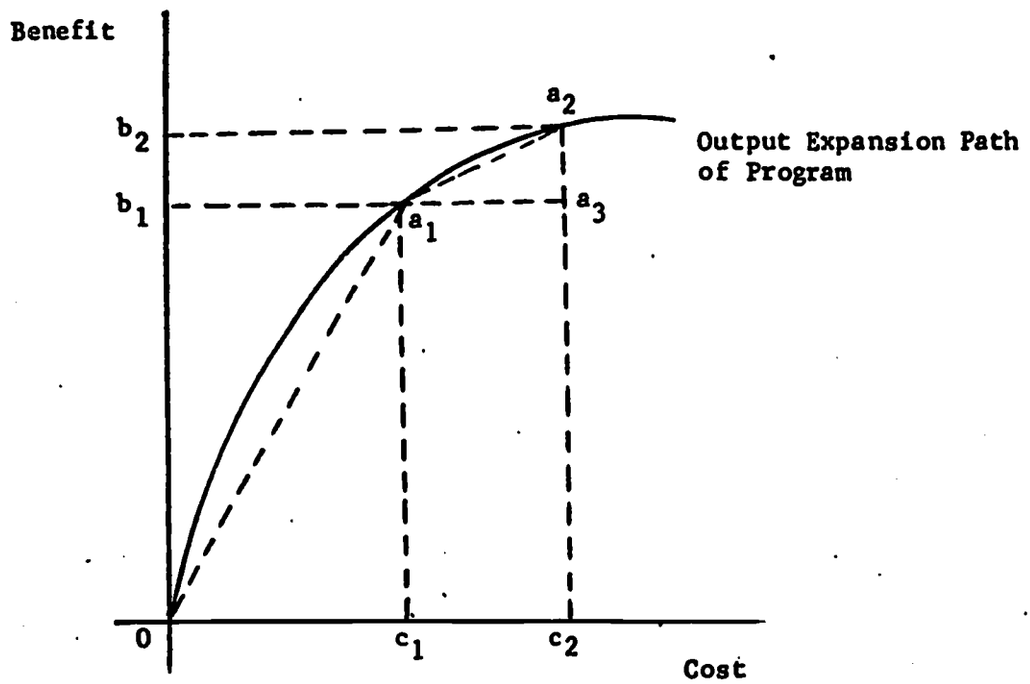
2/ Glennan, Thomas K., Jr. Evaluating Federal Manpower Programs: Notes and Observations. Santa Monica, California: Rand Corporation Memorandum RM 5743-OEO, September, 1969.

Figure 1. Hypothetical Benefit-Cost Curve for the Vocational Education Program



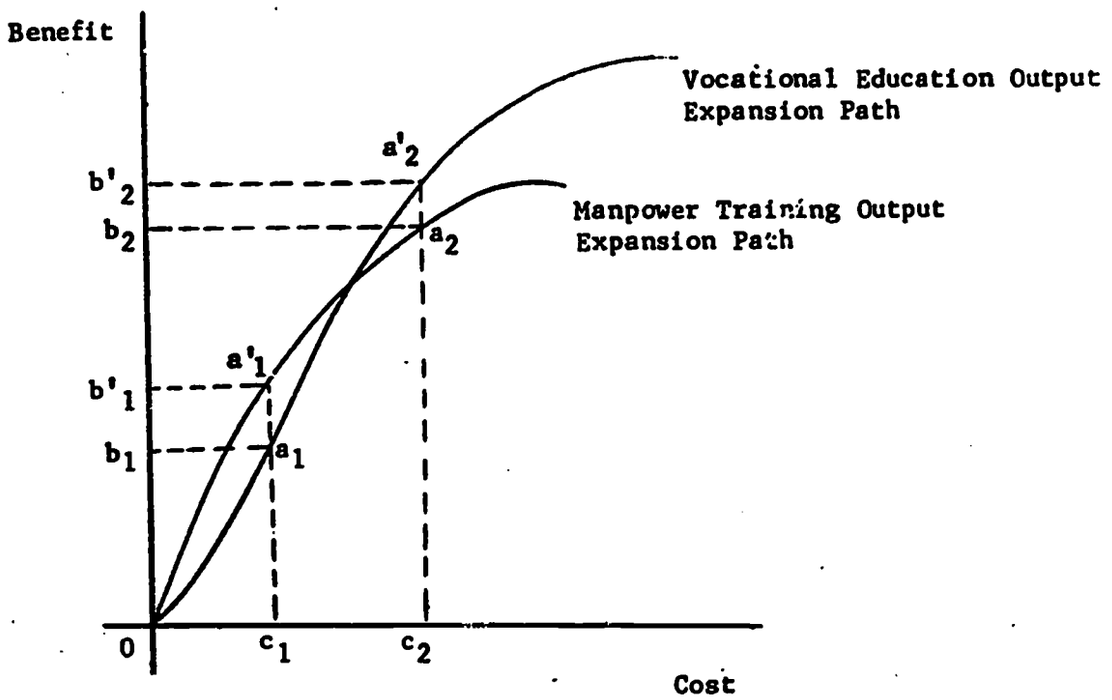
with an average benefit-cost ratio of $\frac{ob_1}{oc_1}$. However, if we expand both programs by the same amount of increased resources, c_1c_2, the incremental or marginal benefit-cost ratio of vocational education, $\frac{b_1b'_2}{c_1c_2}$, is greater than the marginal benefit-cost ratio of manpower training, $\frac{b'_1b_2}{c_1c_2}$. Thus, since both programs are covering their average costs, i.e., each is operating in the black, the extra resources should be applied to the vocational education program and not to the manpower development training program in this hypothetical example. To apply the extra resources, c_1c_2, to manpower training rather than to vocational education would result in a smaller addition to total output.

Most evaluative studies of vocational education do not set forth such a model as the above, though it must be implicit in their analysis. Also, most studies do not recognize the distinction between marginal and average costs and benefits and hence are incomplete as evaluations. As can be seen from Table 1, marginal costs and benefits are not commonly measured. It is important to note, however, that the methodology exists to do this. In the case of these studies, it simply was not used, or the research design precluded the use of the methodology as in, say, the case of the Corazzini study where benefits are based on average starting wage differentials and total cost functions (from which one derives the estimate of marginal costs) were not estimated.[3/] And, one must note that the studies usually fail to distinguish the fact that they are not estimating those costs and benefits which would allow an appropriate choice among alternatives. Thus, for instance, the Schriver and Bowlby study indicates its rate of return measures, but doesn't clarify for the reader whether they are average or marginal.[4/] On the other

3/ Corazzini, A.J., Vocational Education, A Study of Benefits and Costs (A Case Study of Worchester, Massachusetts) Princeton, New Jersey: Industrial Relations Section, Princeton University, 1966.

4/ Schriver, William R. and Bowlby, Roger L., The Effects of Vocational Training on Labor Force Experience. An Analysis of the Tennessee Vocational-Technical School System. Memphis, Tennessee: Center for Manpower Studies, Memphis State University, February, 1971, p. 107 ff.

Figure 2. Hypothetical Benefit-Cost Curves for Vocational Education and Manpower Development Training Programs



hand the study of Pejovich, et al.[5] clearly labels its rates of return as averages. The denominator, costs, and averages, but the numerator, benefits are differences between average before and after training wage rates.

5/ Svetozar Pejovich, et al., "Investment in Human Capital: Skill and Training Development," Proceedings of a Conference on Regional Economic Development, Svetozar Pejovich and Sydney C. Reagan, editors, College Station, Texas: Department of Economics, Texas A and M University, June, 1969, p. 53.

Table 1

Methodology of Cost and Benefit Estimation

Study	Average		Marginal[1/]		Difference between Averages	
	Cost	Benefit	Cost	Benefit	Cost	Benefit
Hu, et al.	x		x			x
Schriver and Bowlby	x	x				x
Eninger		x				x
Vincent	x	x				x
Persons, et al.	x			x		
Kraft	x	x				
Kaufman and Lewis			x			x
Carroll and Ihnen	x					x
Taussig	x	x				x
Somers, et al.	x					x
Corazzini	x	x				x
Pejovich, et al.	x					x

Notes: The strict definition of marginal cost (benefit) is assumed here, i.e., the change in total cost (benefit) as output changes by one additional unit. Sources: see bibliography at end of chapter.

A Model for Cost-Benefit Evaluation of a Program

An evaluative model is needed to achieve the estimates of costs and benefits to perform the analysis above. This evaluative model should have several components. First, it should examine the nature of the output processes of competing programs which are designed to fulfill a given set of objectives for a target population. Second, the model should determine which program and its output process is most efficient. As suggested above, this type of evaluation has several major characteristics. First, it is quantitative. There must be some estimate of costs and benefits. Usually, but not necessarily, these costs and benefits are expressed in monetary terms. Second, the evaluation must be directly related to the specific purposes being served by the program. The appropriate specification of the objective or set of objectives of the program is crucial to the evaluation. An improper specification of objectives as well as an ill-conceived choice and construction of indices to measure the attainment of objectives will result in an invalid evaluation of the program. Third, the benefit-cost evaluation must link benefits with costs. Treatment of either benefits or costs in isolation cannot provide valid information in making choices among social programs. Vocational education is not less efficient or less desirable simply because it costs more, both on the average and in marginal terms, to educate a student in a vocational program than it does to educate him in an academic program in a comprehensive high school.

In summary, an appropriate model to evaluate any program within vocational education or a similar social program in education should have the following steps:

1. The program objectives or desired program outcomes must be specified.
2. The processes or activities used to implement the program must be specified. In economic terms, this means that the production function or production process must be specified whereby the output of any given activity is related to a relevant set of inputs to that activity.
3. A cost function or cost relationship based on the production functionsgiven for each activity must be specified.
4. A benefit functions(s) must be specified based on an appropriate index or set of indices designed to measure program outputs.
5. Costs and benefits must be compared.

Program Objectives and Output. The objectives of a social program such as vocational education must be made explicit. If objectives are stated in terms of all-encompassing goods such as "the improvement of happiness," the program cannot be evaluated since there is no way to measure such a broad outcome as "happiness," let alone define it with clarity.

Vocational and technical education are, however, more efficiency oriented and lend themselves to a benefit-cost framework more readily than other types of education except manpower training. However, the objectives of vocational education are still multi-dimensional and the specification of a single functional relationship which uniquely encompasses all of these simultaneous objectives is extremely difficult and remains, as yet, to be done. It is for this reason that the estimation of program benefits is generally so much more difficult than the estimation of program costs, although, as we shall see below, some of the relative simplicity in the estimation of costs is more apparent than real, since costs and benefits are simply two sides of the same coin. Costs are negative benefits and benefits are negative costs. The same general economic principle of foregone alternatives or opportunities governs the conceptual identification of each.

Nevertheless, without a single index of benefits (and costs) to measure the multiple dimension of objectives (and both economic and non-economic costs), the practice has been to estimate a single dimension, such as earnings or wage rate per hour, and treat it as an index of the objective of "efficiency." Thus, wage rates or a similar unique measure implicity ignores other dimensions of the efficiency concept such as the reduction of unemployment or the potential increase in output due to increased labor mobility or job satisfaction.

To continue, the output of vocational, technical or manpower training is the acquisition of certain behavioral capabilities. The objectives of these types of education, whose fulfillment depends in a functionally related way on the acquisition of these capabilities, have been enumerated above but bear repeating. These objectives are:

a. Economic efficiency (h_1)

b. Consumption (h_3)

c. Equity (h_2)

d. Socialization (h_4)

The program objectives (W for welfare or well-being) can be expressed as:

$$W = w(h_1, h_2, h_3, h_4)$$

A specification of the relative weights of each component of welfare, their general functional form, that is, whether they are linearly or non-linearly related to welfare, as well as knowledge of the interactions, complementarities and conflicts among them would complete the specification of this "objective function." The next step would be to maximize the total value of this function, given one's limited resources.

However, to repeat, the problem is that we do not have a unique index to measure W and, in fact, we do not even have a unique index to measure the components of W, such as h_1 or h_2. Also since certain aspects of these objective components are almost surely jointly created, that is, a given input simultaneously creates more than one type of output, the choice of an index to represent a component which is jointly determined with another component will likely result in an error in ascribing costs.

Some studies, such as Hu, et al. and Carroll, explicitly recognize this problem and discuss it but do not resolve it.[6] However, for instance, the Persons, et al. study in effect considers only the efficiency goal and, more narrowly, places major emphasis on money benefits.[7] See Table 2.

Dr. Teh-wei Hu of the Pennsylvania State University has suggested the following methodology to attempt to combine jointly determined pecuniary and non-pecuniary returns to human resource investments such as vocational education. What follows is a direct quotation from a preliminary working paper of his.

As indicated above, researchers often use earnings, wages, or the duration of employment as measurements of labor market performance of graduates from different educational backgrounds. As we have noted, these measurements do not provide a complete picture of a graduate's labor market performance. Other factors such as how an individual values leisure, job status, and job security can also be considered as a part of his occupational reward.[8] For example, one might choose a job which will increase his leisure time, or take a lower-paying pleasant job in preference to a better-paying unpleasant one, or take a lower-paying job which offers job security. The money income can be called pecuniary returns while the non-monetary rewards can be called nonpecuniary returns. If the objectives of an educational or training program are to maximize

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6/ Hu, Teh-wei, et al. A Cost Effectiveness Study of Vocational Education: A Comparison of Vocational and Non-Vocational Education in Secondary Schools, Final Report. University Park: Pennsylvania State University, Institute for Research on Human Resources. March, 1969, p. 6 ff. See also Carroll, Adger B., Value of Human Capital Created by Investments in Technical Education. Unpublished doctoral dissertation. North Carolina State University at Raleigh, 1966, p. 6 ff.

7/ Persons, Edgar A.; Swanson, Gordon I.; Kittelson, Howard M. and Leske, Gary W. An Economic Study of Investment Effects of Education in Agriculture. Final Report. Project No. OE 427 65. St. Paul, Minnesota: Department of Agricultural Education. University of Minnesota, April, 1968.

8/ Freidman, Milton (1962), Price Theory, A Provisional Text, Chicago, Aldine Co., pp. 211-225..

Table 2

Type of Benefit Estimation of Specific Concern in Selected Cost-Effectiveness Studies of Vocational Education

Study	Efficiency [1]	Consumption [2]	Equity [3]	Socialization [4]
Hu, et al.	x			x
Somers, et al.	x	x		
Corazzini	x			x
Fernbach and Somers	x			
Sharp and Myint	x	x		
Persons, et al.	x			
Eninger	x	x		
Kraft	x	x [5]		
Kaufman and Lewis	x	x		
Schriver and Bowlby	x			
Vincent	x			x
Carroll and Ihnen	x	x [6]		
Taussig	x	x [7]	x [7]	x [7]
Pejovich, et al.	x	x [8]	x [8]	x [8]

Notes:
1/ Includes such items as increased earnings, reduced unemployment or increased college attendance
2/ Includes such items as job satisfaction, increased socio-economic job status.
3/ Includes such items as reduction in poverty, relative or absolute.
4/ Includes such items as voting behavior, reduction in delinquency, and a reduction in drop-out rates
5/ Discusses but does not attempt to measure. See p. 64 ff
Source: See bibliography at end of chapter
6/ Discusses but does not attempt to measure. See p. 862.
7/ Discusses but does not attempt to measure.
8/ Discusses but does not attempt to measure. See pp. 48-49.

an individual's total satisfaction, then it is meaningful to consider both his pecuniary and nonpecuniary income. Most previous empirical works have not fully explored the estimation of nonpecuniary income to supplement the money income estimation. It is possible to develop a theoretical model which takes into account both pecuniary and nonpecuniary income as the measurement of a program achievement.

Assume that an individual's utility is a function of a set of tangible commodities and intangible commodities such as leisure, job satisfaction, and job security. One wants to maximize his utility subject to the prices of these tangible and intangible commodities and the constraint of his total resources. The prices of intangible commodities can be measured in terms of earnings foregone or lost by consuming these commodities. Total resources can be considered as money income and the amount of time not used for production for a given period. In mathematical terms, the above statement can be formulated as follows:

$$(1) \qquad U = f(X_1, X_2, \ldots, X_n; T_1, T_2, \ldots T_k)$$

Subject to:

$$(2) \qquad \sum_{i=1}^{n} P_i X_i + \sum_{j=1}^{k} T_j W_j = Y + T$$

where U is the total utility; $X_1, \ldots X_n$, are various tangible commodities; P_i is the price of these various tangible commodities, and W_j is the foregone wage rate for various intangible commodities, Y is measured in terms of money income and T is the amount of time not used for production measured in terms of foregone income.

The Lagrangian multiplier is used to solve the maximization problem, that is:

(3) $U = f(X_1, X_2, \ldots, X_n; T_1, T_2, \ldots, T_k) - \lambda [\Sigma P_i X_i + \Sigma T_j W_j - Y - T]$

where λ is the Lagrangian multiplier. Differentiating this expression with respect to X_i and T_j, then:

(4) $U_i - \lambda P_i = 0$

(5) $U_j - \lambda W_j = 0$

where $U_i = \frac{\partial U_i}{\partial X_i}$ or $U_j = \frac{\partial U_j}{\partial T_j}$ is the marginal utility of the additional consumption of ith tangible or jth intangible goods. From this it follows that:

(6) $\frac{U_i}{U_j} = \frac{P_i}{W_j}$

Thus in equilibrum, the maximization of an individual's total utility is achieved if the ratio of the marginal utility of tangible and intangible goods is equal to the ratio of prices of tangible and intangible goods.

If we consider an individual as not only a consumer, but also a producer (producing income), as suggested by Becker[9], then pecuniary income and nonpecuniary income becomes endogenous variables as they are mutually determined by an individual as he seeks to maximize his total satisfaction or utility. Given information on market wage and prices of commodities, the demand for income and intangible goods becomes:

$$(7)\quad Y = f(T_j, W_j, P_i, V_1)$$

$$(8)\quad T_j = f(Y, W_j, P_i, V_2).$$

where V_1 and V_2 are random disturbances. In addition to the factors of W_j and P_i other factors such as tastes, educational background, and socio-demographic background $(Z_1, Z_2 \ldots Z_m)$, can also affect the endogenous variables Y and T_j. Since we are not particularly interested in the effect of prices of various commodities on Y and T_j, the general function can be modified as follows:

$$(9)\quad Y = f(T_j, W_j, Z_1, Z_2, \ldots, Z_m, V_1)$$

$$(10)\quad T_j = f(Y, W_j, Z_1, Z_2, \ldots, Z_m, V_2)$$

Since a person's utility function is not measurable in practice, statistical analysis begins directly with equations (9) and (10).

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[9] Becker, Gary S. (1965), "A Theory of the Allocation of Time," Economic Journal, September 1965, pp. 493-517

By using equation (9) we can examine the difference in pecuniary returns given graduates having different utility functions and different curriculum and socio-demographic factors. Variables T_j are used to control for different utility functions such as leisure, job satisfaction, and job security. With equation (10) we can examine the differences in nonpecuniary returns (the intangible commodities), given graduates have different income levels and different curriculum and socio-demographic factors.

There are two methods to estimate equations (9) and (10). The first method is to apply the simultaneous equation technique since both Tj and Y are considered to be endogenous variables. Note that they are mutually determined. Y is a function of T and vice-versa. A two-stage least-square regression technique can provide consistent estimates for this model of behavior.[10/] The second method is to apply canonical correlation for this model of behavior analysis, by grouping Y and T_j as one vector and W_j and Z_1 as another vector, and then computing two sets of weights of these two vectors are maximized. Given the availability of data, we can carry out the above analysis empirically.

Of course, as yet none of the extant cost-benefit studies have used this simultaneous equation model approach to estimating the benefits of vocational education. Data from the Vocational Impact study should allow experimentation with models similar to the above.

Production and Cost Functions

Production Functions. Cost functions can be estimated directly from cost and output data without performing the intermediate step of specifying the

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10/ Goldberger, Arthur (1964), Econometric Theory, New York, Wiley Co., pp. 329-336.

production function, the process whereby the program produces the desired output. However, without an understanding of the production process, that is, the way in which program inputs are related to program outputs and any interactions among the inputs, it is very difficult to estimate the impact of different elements or inputs to a program. This is a critical stage in the evaluation process since only by understanding how program inputs affect outputs can rational changes in program structure be made.

As yet there is no widely accepted theory as to how vocational capabilities are imparted and what variables are critical to the efficiency and effectiveness of the learning process. Therefore, the production process is usually one which in practice is specified through trial and error by attempting to statistically "fit" various empirical relationships. This is unsatisfactory, however, since the available independent variables which can serve as candidates to explain a given learning process are limited only by the researcher's ingenuity at generating additional variables, as is demonstrated by more than one study discussed below.

However, leaving these problems aside, if educational administrators act so that they try to maximize a set of objectives of vocational education, then the production process can be specified as:

$$Y_i = f(X_{i1}, X_{i2}, \ldots, X_{in})$$

where Y_i is a complex index of output performance of vocational education for the ith student, and the X_i's are the inputs used to produce the output of vocational education for the ith student.

Bowles identifies three broad sets of input variables: "variables measuring the school environment;...variables representing environmental influences on learning outside the school;...variables representing the

student's ability and initial level of learning...prior to...the type of schooling in question."[11/]

Typically, the extant cost-benefit studies say nothing about the underlying educational production function. Several authors, such as Eninger and Kraft, do develop models which contain the essence of a production function. However, neither implements the function. In his Process volume Eninger simply displays a variety of cross tabulations which relate a given output to one or more input variables. But there is no precise specification of econometric estimation.[12/] This work must be considered as preliminary and suggestive. The analysis is descriptive rather than analytical in the context of a model of the educational production process. Thus, Eninger tells us about such things as the frequency of use of lecture, film strips or demonstrations, but we don't find out about the relative impact of such things on student performance.[13/] In fact, the analysis never extends beyond step-wise multiple regression analysis in which no theoretical model is imposed on the data. In fact, the analysis never extends beyond

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11/ Samuel Bowles, "Towards an Educational Production Function," in W. Lee Hansen, editor, Education, Income and Olaman Capital,

National Bureau of Economic Research Studies in Income and Wealth, No. 35, New York: Columbia University Press, 1970, p. 13. See also the article of Zvi Griliches, "Notes on the Role of Education in Production Functions and Growth Accounting," in the same book. The bibliography of the Bowles article is extensive though considerable work has been done since that time.

The above model is in single equation form. However, again, the outputs of any educational process are multiple and suggest, therefore, that a simultaneous equation model also be used to estimate the production process. The flow diagrams of Eninger and others suggest such an approach, of course.

12/ Eninger, Max U. The Process and Product of T & I High School Level Vocational Education in the United States: The Product. Pittsburgh, Penn.: American Institutes for Research, AIR-D71-1 9/65-FR, September, 1965. See also, The Process and Product of T&I High School Level Vocational Education in the United States: The Process Variable. Vol. II, Pittsburg, Penn.: Educational Systems Research Institute, 1968.

step-wise multiple regression analysis in which no theoretical model is imposed on the data.

Kraft displays elaborate flow diagrams which model the entire decision-making process and which include an unspecified production function nor does his data analysis explicitly consider the exact nature of the production relationship.[14/]

Cost Functions. If inputs can be expressed in money terms, costs can then be expressed as a function of the production process, as follows: $Z_i = f(V_i)$ where Z is total costs, V is program enrollment, i stands for the ith program of a given type. This cost function could be expressed in linear or nonlinear form, and variables other than enrollment could be added to the function to account for cost-influencing factors whose effects one may wish to hold constant. The result of estimating a total cost function will be an estimate of marginal cost--the extra cost of training one additional student.

With one exception, none of the major studies estimate total cost functions. Without such estimates, one cannot get true measures of marginal cost. All one can do is measure the difference between two average cost figures. The Hu, et al. study does estimate a total cost function with respect to average daily attendance for two of the three cities involved in its analysis.[15/] However, they make no effort to analyze the underlying production function. Average cost functions are also estimated in order to investigate the problem of optimal school size -- that size of school where

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14/ Kraft, Richard H. P. Cost-Effectiveness Analysis of Vocational-Technical Education Programs. Tallahassee, Florida: Department of Educational Systems and Planning Center, Florida State University, 1969.

15/ Hu, et al., op. cit., Chapter VII.

average cost per student is the lowest. The Kaufman and Lewis study uses the cost estimates of the Hu, et al. study.[16/]

An even more critical lack is the availability of costs for particular vocational skills. Thus far, only average costs have been estimated for among all the vocational education evaluations. No total cost functions and, hence, no marginal costs have yet been estimated as a function of vocational skill or occupation.[17/]

The Linkage of Costs and Benefits. If benefits are nonmonetary, then for a particular program the achievement of a target level of program performance at the lowest cost (both monetary and nonmonetary) identifies the desirable program. Or, a given cost can be set and that program which achieves the greatest increment of improvement in output performance is the desirable program. For situations where costs and benefits are in monetary terms, the general economic rule is to maximize the present value of net benefits. However, several investment criteria exist to achieve this, such as the internal rate of return, the benefit-cost ratio, or net present value. In the real

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16/ Kaufman, Jacob J., The Potential of Vocational Education: Observations and Conclusions Based on a Study of Three Selected Cities in Pennsylvania. University Park, Pennsylvania: Pennsylvania State University, Institute for Research on Human Resources, 1968.

17/ See Hu, et al., op. cit., p. 130 for estimations of marginal teacher salary costs for selected vocational-technical course. Also, Pejovich, et al., op. cit., reports estimates of average costs for a variety of vocational-technical skills.

The study by Cohn, et al., does estimate marginal costs for a variety of educational courses such as English, Mathematics, Health Occupations and Agricultural-Auto Service or Auto Body Mechanics but these are not related to benefits.

The authors also develop the concept of "added costs" which are simply differences between marginal or average costs for two types of skills or programs. While this notion may have some value as an administrative tool in cost reimbursement , it has no meaning in the context of economic decisionmaking. See Elchanan Cohn, Teh-wei Hu and Jacob J. Kaufman, The Costs of Vocational and Nonvocational Programs: A Study of Michigan Secondary Schools, University Park, Pennsylvania; Institute for Research on Human Resources, The Pennsylvania State University, 1972.

world, constraints usually exist which invalidate each of these criteria to a degree. These problems are discussed below.

The Generality of the Model. This simple model outlines the general approach one would take to evaluate the efficiency of vocational and technical education programs. Given that objectives are clearly specified and that performance indices to measure the achievement of the objectives can be devised, then alternative projects designed to achieve the objectives can be investigated. Input combinations between alternative projects will likely vary. Also, input combinations can be varied within a given project. The effects of both types of variation can be noted on both output and input costs. Ideally, the combination of inputs for a given cost which will maximize a given type of output can be discovered and overall educational efficiency can be improved.

Of course, such wide variation in project design can seldom be structured within the context of controlled experiments with double blinds and placebos so as to eliminate self-selection bias and other effects which obscure program effects. However, the wide variety of projects, input combinations and treatments provide what are, in effect, "natural experiments".[18/] Thus, a nationwide program such as vocation-technical education has wide heterogeneity among its various expressions. This heterogeneity together with appropriate analysis using multiple regression techniques, can, with proper data, identify optimal combinations of educational inputs, or alternatively, identify the most optimal programs for given target groups such as white males or Mexican-American females. Thus, it is meaningful to analyse those programs which

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18/ See Glen G. Cain and Robinson G. Hollister, "Evaluating Manpower Programs for the Disadvantaged," in Gerald G. Somers and W. Donald Wood, editors, Cost Benefit Analysis of Manpower Policies, Proceedings of a North American Conference, May 14-15, 1969, Kingston, Ontario: Industrial Relations Centre, Queen's University, 1969, p. 146 ff.

either appear very successful or very unsuccessful in order to isolate critical input variables or combinations of variables which have dramatic positive or negative impacts. Thus far the Project TALENT data and the Coleman Report Data have come closest to providing the necessary data base for the primary and secondary education process but the appropriate data are yet to be collected and analyzed for secondary vocational education.19/

The Specification and Measurement of Inputs. The specification and measurement of inputs into the process by which vocational capabilities are imparted to students suffer from the lack of a widely accepted theory of learning. In the absence of an unambiguously acceptable theory, the problem of specifying the input variables becomes more complex. However, as stated above, there are, three broad classes of variables to consider, and, of course, there are unknown interactions among them. These three sets of variables can be classified as student inputs, educational process inputs, and socio-economic influences.

The educational process starts with students, each of whom differs with respect to characteristics which affect his ability to learn at the time he enters the particular vocational program. Students differ in levels of learning prior to program entry, relevant aptitudes, achievement, motivation, and health which create variation in their ability to learn. One must adjust for the effects of these factors on anticipated program outputs.

The educational process in which the students are engaged has characteristics which provide the learning experience. Students are encouraged to respond in particular ways, all under the guidance of an instructor with

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19/ See, for instance George W. Mayeske, et al., A Study of Our Nation's Schools, Washington, D.C.: U.S. Office of Education, U.S. Department of Health, Education and Welfare, undated; and J.C. Flanagan, et al., The American High School Student, Pittsburg, Pennsylvania: University of Pittsburgh 1964, as well as the other multitudinous publications based on the TALENT data.

characteristics. Finally, the activity takes place in particular physical and psycho-social learning environments.

In addition to the student characteristics and the specific educational process which is to be evaluated, the act of learning is affected by other experiences and conditions in the students' environment which could influence the proper identification and measurement of net educational outcomes. These experiences can take place at any time after the educational process begins and before the outcome is measured. For example, students might take a variety of other courses which differentially alter their ability to learn the content of the given educational process which is to be evaluated. Or, for instance, economic conditions could alter the availability of particular kinds of jobs after graduation. Of course, of one is able to structure an experimental model with a properly formed control group, the last set of influences may not be too serious an obstacle. Or, alternatively, one may identify a clearcut target population and test the relative impact of different program approaches on this group.

In summary, dozens of variables can be used to account for the three types of influences noted above, and thus far, little conceptual guidance exists to dictate their choice or their functional form.

This fact is reflected in the analyses which have been performed to date. If we discuss for the moment only socio-demographic variables we will find that even only a few variables, such as age, sex and ethnic origin argue for inclusion in a model in every case. Most other variables are troublesome because they usually contain elements which have both positive and negative influences on the output variable in question. The more careful the study, the more likely it is that the researcher will become aware of this fact himself. In the excellent study by Carroll and Ihnen, two troublesome variables are included

in their analysis -- military service and size of high school class. (School size is also a favorite variable in many of these studies, but its educational and economic significance is seldom explained. See Eninger, for instance, op. cit.)

Carroll and Ihnen include military service in their model to explain the earnings of post-secondary technical graduates in the belief that military training would have a positive effect on earnings which one would want to control for. Unfortunately, the expected positive effect of this variable on earnings -- more training implies more earnings -- did not materialize. The effect was negative and statistically significant. The particular formulation of this variable was a misspecification for the purpose intended. Rather, it captured the effect of protracted absence from the civilian labor force which implied that with less experience in the civilian labor force, earnings would be less.

Similarly, the authors use size of high school class as a proxy for quality of high school with the expectation of a positive effect. The effect is negative and statistically significant, which leaves the authors to speculate that either intercorrelation among variables resulted in the unexpected sign or the variable stands for the negative motivational effects on anonymity.[20/] The issue is never resolved.

The Hu, et al. study has similar problems with father's education -- a proxy for socio-economic status. They expected a positive effect between father's education and earnings. However, the variable usually had a negative sign or else was not statistically significant from zero. Repeated tests of different

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20/ Carroll, Adger B. and Ihnen, Loren A. "Costs and Returns for Two Years of Post-Secondary Technical Schooling: A Pilot Study," Journal of Political Economy, 75:862-73. No. 6, 1967.

models failed to uncover the reasons for this, though the original suspect was intercorrelation between curriculum, IQ and father's education.[21]

As a last example in the vocational education field we have the Persons, et al., study. In our judgment, a relatively weak statistical procedure was used here. First, the authors were more intent on maximizing the size of their coefficient of determination (percent of explained variance) than they were in getting an unbiased estimate of the effects of agricultural training on earnings.[22] This is not an advisable trade-off in any evaluation study.

To continue, in pursuit of the goal to maximize the coefficient of determination, the authors eliminated several variables from consideration because their simple correlations with the earnings variable were low. These were years of formal education of the farm operator and his wife, age of farm operator and number of years farmed.[23] Yet, when they are conceptually relevant, such variables ought to be kept in evaluation models, even if they appear to have a small relative effect.

Finally, an improper specification of one's input variables with respect to output can lead to results which conflict with both the economic of investments and with previous empirical results, too. Thus, the Person, et al. study embarks on its effort to "reduce the sum of squares...about the regression line and maximize the power of the function to predict the dependent variable from information provided by the independent variable.[24] To do this, they regressed the dependent variable in stepwise fashion against functions of successively higher degree of the independent variable, in this

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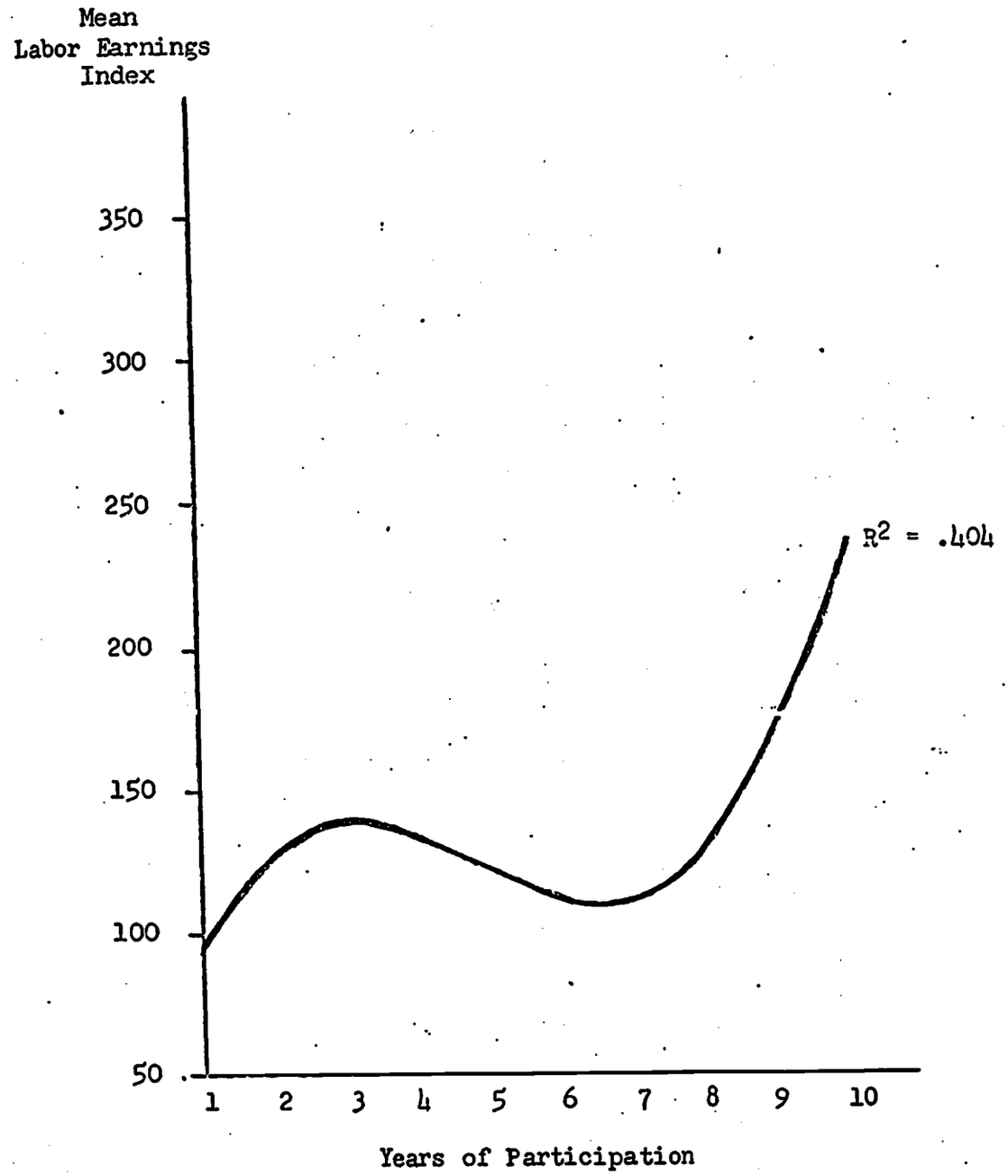
21/ Hu, et al., op. cit., Chapter VIII.

22/ See Persons, et al., op. cit., p. 49. For a contrasting approach, see Carroll and Ihnen, op. cit., p. 866.

23/ Persons, et al., op. cit., p. 68.

24/ Ibid., p. 49.

Figure 3. RELATIONSHIP BETWEEN INDEX OF LABOR EARNINGS AND ADULT FARM BUSINESS MANAGEMENT EDUCATION - WELL-ORGANIZED PROGRAMS a/



a/ Based upon all farmers enrolled in well-organized farm business management education programs in Minnesota, 1959-1965.

case, years of participation in a farm business management program. They quit increasing the polynomial degree of the function when the coefficient of determination stopped increasing in increments they considered large. This resulted in benefit functions as shown in Figure 3. Benefits as a function of years of participation first increase, then decrease, then increase explosively. Most of the functions, whether quadratic, cubic, or of higher polynomials rise exponentially at longer years of participation. In our judgment, this is a clearcut misspecification of the relation between the program output and this or any other measure of program input. Economic theory would suggest that diminishing returns would set in as more resources are devoted to an investment activity. Of course, it is likely that the use of the variable "Years of Participation" represents a misspecification between program inputs and outputs, hence, the curious relationship. What inputs or combination of inputs does years of participation stand for? Are the inputs and their mix the same from year to year? In short, this whole analysis is theoretically suspect and essentially useless.

Yet, if the analysis of the Eninger suffers from an unwillingness to experiment with a variety of relevant variables, the existence of the Project TALENT and Coleman Report data has resulted in the use of a profusion of variables combined in massive regression analyses factor analyses and what not with little overall conceptual structures. Consequently, one often does not know what to make of the results. And, in the absence of a clearcut theory of learning, the temptation to provide one's own ad hoc rationalization becomes overwhelming. One finds in this business that it is easy to rationalize any empirical result that one turns up. The work of Mayeske, Weinfeld and Adams

is a case in point.[26] In addition to a variety of variables which seem to be related to pupil performance, such as years of teaching experience or starting salary of male teachers, the authors generate several synthetic variables. For instance,

> "Ratio of Master's and above (created by adding three times number of teachers with a masters degree only...and once by number of teachers with a doctorate...and divide by total number of full-time teachers...)"[27]

What does this variable mean. A priori, would one expect it to be related positively or negatively to the average English (or Mathematics) achievement test score? What is the basis for the weighting? Is a doctorate really one-third as effective (or whatever) as a master's degree? What is the basis for dividing by total number of full-time teachers? The authors do not provide us with answers to these questions. The partial correlations of this variable are lower for English than for Mathematics Achievement test scores. However, without a theory, one doesn't know what to make of this fact.

These studies, however, do bring up an issue which is yet to be directly confronted in any vocational education evaluation study -- namely that "... very little of the influence of the schools can be separated from the social background of their students and very little of the influence of social background can be separated from the influence of schools."[28] Thus, given the

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26/ Mayeske, George W., Frederic D. Weinfeld and Gordon D. Adams, Correlational and Regression Analysis of School Achievement for Schools of Varying Racial Composition, Analytical Note Number 51, Division of Operations Analysis, National Center for Educational Statistics, September 18, 1967.

27/ Ibid., p. 4.

28/ Mayeske, et al., op. cit., p. 327. See also Howard P. Tuckman, "High School Inputs and Their Contribution to School Performance," The Journal of Human Resources, Vol. VI, Number 4, Fall 1971, p. 499.

recognized socio-economic status and value--behavior distinctions between vocational and nonvocational students, the attempt to attribute any net effect to a program treatment is extremely difficult.

The observed effect of the vocational curriculum may be due simply to unmeasured student characteristics, in which case, the whole conceptual basis for the evaluation and analysis disappears. Self-selectivity into the curriculum wipes out the conceptual basis for the analysis.

Specification and Measurement of Educational Outputs. The general difficulties involved in constructing a properly specified index of output have already been discussed. However, additional practical problems exist.

A benefit can be defined as any result of the vocational education process that increases individual or social well-being or welfare. This increase in welfare can be either economic or noneconomic. With respect to economic welfare, benefits occur either directly by increasing productivity or indirectly by freeing resources for alternative uses. With respect to noneconomic welfare, the educational process results in an increased level of satisfaction or utility for those participating in the educational process.

The problem of selecting and weighting relevant output indices becomes even more complex when programs with varied mixes of "general" and "vocational" components are compared. Typically the output indices chosen are appropriate to vocational objectives but slight the intended outputs of the general education component; this raises serious questions about the validity of the resultant program comparison. In a more generalized sense, it epitomizes the type of bias that can result from judging any program on the basis of a narrowly conceived set of outputs, without regard for the program's concomitant effect (positive or negative) upon other desirable outputs.

Conceptual difficulties also arise when the amount of education is considered as a relevant variable. When holding power or amount of further education, for example, is utilized as a dependent variable, education is being treated as an end in itself. In other instances, the education variable (like holding power) might be considered an independent variable, and its ultimate and actual effect upon other outputs measured. The choice of treating the amount of education as a dependent or independent variable changes with the evaluation context and rationale, but making the choice cannot be ignored.

Finally, greater attention must be paid to the specification and measurement of developmental outputs. The effect of educational processes upon career patterns, as one illustration, should be determined. Longitudinal data are therefore required. Thus far, only the National Longitudinal Surveys are providing such data. None of the other studies do so except retrospectively.

Benefit-Cost Analysis and the Investment Criterion

Given that costs and benefits have been successfully estimated, there are two additional elements to benefit-cost analysis: time and the interest rate used to discount costs and benefits to their present value. Both the costs and benefits of investment in vocational and other forms of education occur through time. Different investment alternatives are likely to have different time profiles. The purpose of discounting is to attach relative weights to these cost and benefit time profiles in order to account for the productivity of investment and social or private time preference.

Discounting is theoretically justified for a number of reasons. The first is that the interest rate used in discounting represents the opportunity cost of investment funds; that is, invested wealth usually earns a positive rate of return. Thus, "Y" dollars invested today will yield "Y + X" dollars at some time in the future due to the productivity of the investment. Therefore, reversing the process, to relate this future income to its present value, one must discount the future income stream to the present time when the investment decision is being contemplated. Second, future income is valued less than present income. People have a positive time preference, that is, they dislike postponing consumption.

Table 3 displays the interest rates used in discounting costs and benefits in the various studies. All the rates except that of Kraft fall within a reasonable range. Of all the studies, those of Hu, et al. and Carroll and Ihnen discuss the problem of the choice of discount rate most completely.[29/]

29/ Hu, et al., op. cit., p. 59 ff and Carroll and Ihnen, op. cit., p. 869 ff.

Table 3

Discount Rates Used in
Major Cost-Benefit Studies
of Vocational Education

Study	Rate in %
Carroll and Ihnen	5 and 10
Kaufman and Lewis	6
Kraft	Unstated; Implicitly zero
Persons, et al.	7
Hu, et al.	6 and 10
Somers, et al.	6
Shriver and Bowlby	4
Corazzini	5 and 10

Source: See bibliography at end of chapter.

Investment Criteria. Several investment criteria are available to the education decision maker. At the simplest level of analysis benefit differentials and cost differentials can be estimated. The pay-back period can also be estimated. The net expected present value, the benefit-cost ratio, and the expected internal rate of return can be calculated. Under certain conditions, these last three measures are equivalent and provide the same guidance to decision making. The conditions are noted below and exceptions to these conditions comprise the bulk of this discussion.

The Correct Criterion. There is considerable confusion over what constitutes a "correct" investment criterion. This is due to the fact that there is confusion between specification of the appropriate investment rule as distinct from the criterion to achieve the goal of the rule. The appropriate investment rule in benefit-cost analysis is to maximize the net present value of benefits. Depending on the nature of constraints, any of the last three criteria above may achieve this rule. However, there are both practical and theoretical conditions which either commonly exist or can be devised which demonstrate that no single investment decision criterion is theoretically correct for all investment situations. This discussion concentrates on only three of the above criteria: the expected internal rate of return, the expected net present value, and the benefit-cost ratio.

Cost and Benefit Differentials. Cost and benefit differentials represent a necessary but incomplete stage of analysis. These differentials show the configuration of the data and provide the inputs to the proper (for a given set of constraints) investment criterion. Alone they are not a useful guide to decision making, yet, one commonly perceives misunderstanding of this fact. For instance, a given education program A, costing X dollars more than an alternative education program B, is averred (by its advocates) to be of "higher quality" or (by its detractors) to be "too costly." But "higher quality" or "too costly" in what sense? Both these statements, taken by themselves, are nonsense in terms of the efficiency and effectiveness of the program. Costs and benefits must always be related to each other.

The Pay-Back Period. The pay-back period is a simple ratio of total costs, C, to constant marginal benefit, b, with the constant benefit measured over a given time unit such as a month or year. Thus, b/C equals the pay-back period. This simple index relates costs and benefits to each other and different programs can be crudely judged as to their relative effectiveness. The criterion is to select the investment with the shortest pay-back period.

The pay-back criterion suffers from a variety of conceptual flaws. First, it ignores the fact that costs and benefits of competing investments are distributed through time and have different time profiles. Education yields its benefits over an entire lifetime. Discounting is necessary to make the different benefit-cost profiles commensurable. Second, the absolute

size of net benefits between alternatives may differ but the use of the ratio will obscure this. Third, as with the internal rate of return, the pay-back criterion breaks down completely in those cases where investment alternatives are mutually exclusive. Thus, the pay-back period criterion has serious conceptual limitations as a decision-making tool, and is not highly recommended.

A Consideration of Three Criteria. The net expected present value criterion can be stated as follows: Given the appropriate interest rate by which to discount, one should adopt any program for which the present value of the discounted stream of net benefits is greater than zero. Or if more than one program has net discounted benefits greater than zero at the given rate of interest, adopt the program with the highest present value of net benefits.

The benefit-cost ratio tells the decision maker to invest in those programs for which the ratio of the present value of benefits to the present value of costs is unity or greater.

The result of calculating a rate of return is a simple percentage which can be compared against that interest rate which represents an acceptable rate of social or private investment return. Briefly defined, the internal rate of return is that interest rate which makes the discounted value of costs equal to the discounted value of benefits.

A Critique of the Three Criteria. Much controversy exists over what constitutes the proper investment criterion. The discussion in the literature centers around a critique of the present value and the internal rate of return criteria. The benefit-cost ratio is not widely considered. This

latter fact is especially significant in light of federal government practice to employ the benefit-cost ratio as an investment criterion.

Many writers argue that the present value rule is most correct since it automatically assues that the present value of benefits is at a maximum. As noted previously, this position is taken because of a confusion between what identifies the correct maximand as against the appropriate criterion to achieve that maximand. However, to repeat, both the present value and internal rate of return criterion will result in the proper and identical investment decision given that: capital markets are perfectly competitive, investment alternatives are not interdependent, all relevant investment choices are completely divisible so that marginal adjustments can be made, and all net returns are reinvested at the original rate of return or higher up to the end of the project with the longest benefit stream. 30/

In this context both are correct and neither is to be preferred over the other. However, it is unlikely that these conditions will ever be met simultaneously. The real world imposes constraints such that each of these rules can, at times, give advice which will result in the decision maker's not maximizing the present value of net benefits.

The use of these three investment criteria is generally well understood in the studies which use them. However, the Kraft study devises a cost-utility function as a criterion. There are several problems with it. First, while the author speaks of utility, he, like everyone else, has no way to measure it and relies on money benefits in his analysis without, apparently recognizing the inconsistency. So, the criterion is something of a misnomer. Next, with costs in the denominator, his rule must be invest

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30/ Blaug, Mark. "The Rate of Return on Investment in Education in Great Britain," The Manchester School, 33:205-61 Vol 3; September, 1965, p. 168.

as long as C/U< 1, since clearly one always wishes the denominator to be larger than the numerator.[31] However this gets him into difficulties on page 92 and elsewhere, since his estimated rates of return are generally well over 20% while his cost/utility ratios are all greater than unity when they should be less than unity to be consistent with the earlier statement of his rule. In short, the rule is not too useful as it stands except as a pay-back period rule. It has little to say about utility per se. Incidentally, there is another problem with the Kraft study in that the author argues that the intent of the decision maker should be to chose the program that allows the maximum benefit for the least cost...[32] Of course, it is not possible to simultaneously maximize two relatives. The appropriate statement of the rule is to maximize benefits for a given cost or minimize cost for a given benefit.

Shriver and Bowlby also suggest a decision making "rule" which can lead to some confusion. They argue that

> ...If vocational education leaves earnings unchanged (or lowers them) one should conclude that it is consumption rather than investment. If training raises earnings and the increase in earnings is less than the costs of training, one should conclude that vocational training is an investment, albeit a poor one. If the increased earnings are greater than the increased costs, one can conclude that vocational training is a good investment, and the greater the positive difference, the more desirable it becomes in comparison with other possible investments.[33]

The problem with the above statement is that an incomplete accounting of benefits is implied. If all benefits--wages, value of immediate

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31/Kraft, op. cit., p. 45

32/Ibid., p. 45

33/Shriver and Bowlby, op. cit., p. 101

consumption, and so forth are accounted for, and costs proved to be greater than these, then, vocational education would simply be a bad investment. It would not be consumption. It would result in less real satisfaction after appropriate discounting. In short, it would be counterproductive. Only the last of the three statements, assuming a complete accounting of costs and benefits, is technically unambiguous.

Of course, when benefits are not in money terms, it is perfectly legitimate to estimate cost-effectiveness ratios. Examples are such things as average or marginal cost per placement or per training relisted job placement. The study by Donvito makes extensive use of cost-effectiveness ratios.[34/] This study is marred by the poor quality of cost data, since the data are based only on federal expenditures reported in the Annual Vocational Education Reports. In spite of the well-known shortcomings of these cost data, the author reports cost-effectiveness ratios by state for job related placement which range from $364 to $54,311.[35/] While we are aware that there is mismatching between training and jobs in the labor market, differences in performances among states by a factor of over 160 times suggest that the educational system is completely haywire. What is much more likely, however, is that (1) the cost measure is incomplete and inadequate across states and (2) the particular definition of job related placement is too restrictive for instance, dropouts apparently gain no benefits; persons who enter the army right out of school gain no benefits; people of unknown status gain no benefits). Thus, much of the analysis at best is of only limited use and at worse, completely misleading as to the benefits of federally supported vocational educational programs.

34/ Pasqual A. Donvito, A Statistical Evaluation of Vocational Education Programs, prepared for Deputy Assistant Secretary, Evaluation and monitoring, U.S. Department of Health, Education, and Welfare, no date.

35/ Ibid., p. 63.

Definition of Cost and Benefit

Costs are defined in their most general sense as opportunity costs. That is, the cost of doing anything is the value of the next best opportunity or alternative which has to be foregone because of the particular course of action one has taken. Thus, in the most general terms, the cost for an individual to invest in vocational or technical education is the cost of (1) not being able to work simultaneously in the labor market or (2) the cost of foregone leisure or (3) the inability to engage in production at home.

There is often a confusion in the literature since costs are sometimes treated as being conceptually different when, in fact, what differs are the problems involved in measuring them. Thus, some writers will categorize educational costs into direct outlays, indirect outlays, opportunity costs--meaning wages foregone--and capital costs. Yet, it has to be remembered that all costs are opportunity costs and one should not consider cost elements as conceptually different simply because they may occur at different points in time, accrue to different individuals or groups, or take different institutional forms such as wages or tuition.

Benefits are just the reverse of costs. They are opportunities gained as a result of engaging in some activity. Thus, they can represent (1) increases in the value of labor market production or activity or (2) increases in the value of consumption or leisure or (3) increases in the value of non-market or home production. In short, they represent increases in the productivity of market and non-market production and consumption.

To avoid errors in underestimating or overestimating costs and benefits, they should ideally be measured in terms of utility lost and gained. Then,

there would be no confusion that the complex multiproduct nature of educational investmentswere being crassly subsumed under money returns and costs alone. Measurement of utility, however, is a counsel of perfection. It cannot be done, given the state of the art. And, in an imperfect world, it is improper to consider money costs and benefits as measures of utility or even as good indices or proxies for it. In this regard the study by Kraft discusses cost-utility analysis at some length.[36] However, in all his estimations of utility, Kraft considers only money benefits. In order to maintain the logic of this empirical approach, he would have to argue that only economic money benefits matter in one's utility function. Clearly, this is an oversimplification, though often a useful one. However, to avoid confusion, this assumption should be clearly stated. The remaining studies, such as Hu, et al., often make short statements as to the desirability of getting a more complete measure of benefit, but none do so.

Given the complex nature of educational investment, both in terms of its costs or benefits, it is best to simply indicate the components of costs or benefits being measured and not claim wider validity for them as proxies of utility. This discussion brings us to a general consideration of the methodological issues in the measurement of costs and benefits. In short, the measurement of costs is just as difficult as the measurement of benefits, and previous statements by some investigators concerning the greater ease of cost estimation are based on a simplistic concept of cost.[37]

36/ Kraft, op. cit., Chapter IV.

37/ See, for instance, Richard W. Judy, "Costs: Theoretical and Methodological Issues," in Gerald G. Somers and W. Donald Wood, editors, Cost Benefit Analysis of Manpower Policies, Proceedings of a North American Conference, May 14-15, 1969, Kingston, Ontario: Industrial Relations Centre, Queen's University, 1969.

General Considerations

A foray into the methodological issues surrounding the distinction of costs and benefits of investment in social programs designed to improve human welfare brings a variety of basic conceptual problems to the fore. The best summary discussion of these problems to date has been performed by Lester Thurow in his book Investment in Human Capital.[38] The basic issues he discusses can be outlined as follows:

1. Earnings maximization versus utility maximization;
2. Complementarity in production and consumption;
3. Joint costs of production, consumption and investment;
4. Non-market production and consumption;
5. Change in preferences due to the act of education or training;
6. Risk due to lumpiness of investments; and
7. Complementarity, substitutability, and inseparability of human skills and abilities.

Thurow lists several other points, but these above are of most interest with respect to investment in vocational and technical education or other training programs since they impinge directly on the measurement of costs and benefits.

In addition to these points, one should consider:

8. Externality;
9. Income redistribution effects as they influence the determination of costs and benefits;

38/ Thurow, Lester. Investment in Human Capital., Belmont, California: Wadsworth Publishing Company, Inc., 1970, especially Chapter 8.

10. The influence of unemployment on the determination of costs and benefits; and
11. The problem of the control group.

Each point will be considered below with specific reference to vocational and technical education. And, where applicable, each point will be considered with respect to social, individual or governmental estimation of costs and benefits.

Earnings versus utility maximization. Even though vocational and technical education as well as manpower training have a more immediate labor market orientation than do other forms of education, such as a liberal arts college education or the pursuit of a general curriculum in high school, it is dangerous to evaluate the former types of education only in terms of earnings maximization. Earnings are only one of the elements which comprise one's utility. (See above comments on the Kraft Study.) One of the elements of utility one gains besides earnings are direct consumption benefits during the educational process itself as well as improved possibility for the enhancement of consumption after education. If persons are rational in their pursuit of utility and attempt to maximize their welfare, they will gravitate to those kinds of education and occupations which give them direct consumption benefits along with increased earnings. This is the crux of the matter when educators, economists and others seek to evaluate the degree of "job satisfaction" involved in career choice.

Of course, if all persons are rational, including those who pursue the college preparatory or general curriculum in high school, there is no necessary reason after the fact to assume a priori that vocational or

technical students will have greater job satisfaction than other types of students. Presumably, each group gravitates to that type of training which will maximize its expected future job satisfaction. Thus, job satisfaction and other characteristics of a person's post-training situation which are measures of psychic well-being and the degree of consumption benefits being received on the job must be directly measured. However, if different kinds of persons gravitate to different programs, there remains the difficult task of establishing unambiguous scales to measure these direct consumption and psychic benefits. Different elements may comprise the consumption and receipt of psychic benefits by different groups. Thus, even if you ask the same kind of question of these different groups, seemingly uniform and consistent responses may have entirely different meanings and be incommensurable.

Prima facie support of this conclusion comes from the Kaufman and Lewis study wherein they report that similar patterns (of job satisfaction) were found for the graduates of other curricula (general and academic as well as vocational) and there were no significant differences among them.[39/] The Eninger Study also reports no significant difference in job satisfaction between academic and vocational course graduates.[40/]

Taking a different point of attack, the Carroll and Ihnen study attempt to estimate a more complete measure of money economic benefit by monetizing the value of extra leisure gained due to postsecondary vocational education. On the assumption that one's wage rate measures the value of his time at the margin -- the point where he is indifferent between working one more hour or

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39/ Kaufman and Lewis, op. cit., p. 98-99.

40/ Eninger, Vol. I, The Product, op. cit., Chapter 9.

consuming leisure one more hour, the money value of extra leisure is equal to the wage rate one earns times the extra hours of leisure. However, for this assumption to hold, the labor market must fulfill all the assumptions of a perfect market and individuals must be rational maximizers of utility. Also, recent theoretical analysis by Gary Becker suggests that the value of one's time is a function of the type of activity during that time. Thus, the value of leisure time spent in pursuits using large amounts of capital may be greater than the value of leisure time spent sleeping. Thus, imputing the wage rate as a measure of the unit value of leisure may over or underestimate the time value. However, Caroll and Ihnen are on the right track, for valuing the extra leisure at zero would create the greatest bias of all.[41/]

In contrast, the Persons, et al., study values the cost of leisure at one-half the hourly wage rate. However, this is an arbitrary shadow price. (See the discussion on shadow-pricing below.) No rationale is given except that it is assumed leisure time is worth less than working time.[42/] Rather than making such an arbitrary judgement it would be better, in our judgment to rely on the methodology of Carroll and Ihnen.

Complementarity in Production and Consumption. Since one's human capital is inseparable from oneself, in the act of producing one also consumes. This occurs simultaneously and failure to account for this phenomenon can lead to an incorrect measure of benefit. Other things equal, if a person dislikes his job, one may tend to overestimate the benefit to the individual person. However, if he likes his job a great

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41/ Becker, op. cit.

42/ Persons, et al., p. 116.

deal, other things equal, one may tend to underestimate the total benefit received. There is no reason, however, to assume that one type of curriculum automatically has a greater over (or under) estimate of measured benefits due to this phenomenon. None of the extant cost-benefit studies takes this problem into consideration.

Joint Costs of Production, Consumption, and Investment

Thus, production and consumption on the job are joint due to the fact that any economic activity based on human capital can't be separated from the human agent. Likewise, the investment itself is joint, producing both production and consumption capabilities. This fact complicates the estimation of costs considerably. An excellent example of this is the Job Corps. Here, participants engage in training at residence centers. They simultaneously produce, consume and invest in themselves. Their maintenance costs support all three of these activities simultaneously since the activities are joint. Even though society or the participant's families don't have to maintain these participants, the participants would in many cases be maintained at lower levels were they not presently in the Job Corps. Thus, the question becomes, why isn't any measured increase in consumption treated as a social benefit of the program? Or, should it be treated as a transfer--a benefit received for which no reciprocal service or benefit is rendered--and hence not counted as a social gain?

But even if one agrees from the consumption standpoint to treat the increased level of maintenance as a transfer, the higher level of nutrition, medical services, clothing, etc., should contribute simultaneously to increased production in the Job Corps Center as well as improve learning

while in the Center. How can one sort out the immediate consumption component from the investment component of the higher level of maintenance? Assuredly, the higher level of maintenance is not all transfer payment. But, since the three activities are a joint output of maintenance, they cannot be separated out.

Similar kinds of problems exist with cooperative vocational education. The work component of a co-op program is jointly production, consumption and investment. Is the wage rate the student receives a measure of the student's productivity net of his on-the-job training or investment? Economic theory would argue that it is not likely to be completely net of the on-the-job training costs--that is, the student will not pay for all of his on-the-job training costs via a reduction in his wage rate. To the extent that a co-op student will have a job with components that are peculiar to the firm's own operations, we could expect the firm to pay this cost to cover this firm's specific component of the job. However, to cut down turnover and loss of his investment in the student, the employer is likely to share both the costs and the returns to the firm-specific training component of this job with the co-op student. Conceptually, these cost and benefit components should be separated out, but this is often difficult to do. No one, to date, has attempted an empirical resolution of this issue. The jointness of these activities renders a separation most difficult from an empirical standpoint. (Problems of prorating joint costs will be discussed further below.)

Non-Market Production and Consumption. Non-market production and consumption is a major consideration in any complete evaluation of the effectiveness of vocational and technical education or manpower training.

Obviously, persons trained in vocational and technical skills, such as electricians, auto mechanics, engineers and the like, are in the position to provide considerable non-market production for themselves since the skills themselves are in the high areas of demand: craftsmen and semi-technical and professional. This production should be imputed as a return to the education, but as yet, no effort to do so has been made in benefit-cost or cost-effectiveness studies. Likewise, women who have learned vocational skills may be in a position to provide higher valued services as housewives than those with no such training. With respect to the ghetto-ized, poor, and other disadvantaged groups, courses in home economics and consumer education may yield very high non-market returns if the assertions are true concerning the effect of family instability and lack of parental guidance on the provision homemaking know-how and economic consumer skills among poor families.

Change in Preferences. It is difficult enough to evaluate consumption benefits when one assumes that a person's tastes and preferences stay the same, thus assuring that the relative weights one attaches to a benefit or cost do not change. However, the purpose of education, including vocational and technical education, is to change a person's preferences, tastes and attitudes. Several points are of concern here.[43/]

First, since it can be assumed that education changes tastes and preferences, the value and weights--that is, relative prices one will put on consumption, home production and leisure activities before one undergoes

43/Wiseman, Jack. "Cost-Benefit Analysis in Education," The Southern Economic Journal. 32 (2, part 2). Supplement: 1-12, July, 1965.

an education program is likely to be different from the valuation one assigns to these economic activities after one has completed his education. Which set of valuations or prices is the correct one? Should we add or deduct any differences in valuation between the two periods? Should only the valuation and prices after the educational process be considered even though the valuation and prices were created by the education process itself?

Next, this change in tastes and preferences may alter one's taste for leisure, work, and investment in education. Persons with higher levels of education generally work longer hours so the marginal value of leisure-time may be higher for this type of person. In any case, if work-leisure-investment preferences change, this will change the measurement of opportunity costs as well as benefits. None of the cost-benefit studies have dealt with this difficult issue.

Risk and Lumpy Investments. Human life is finite. Investments in human capital often extend over longer periods of time than investments in physical capital. And, persons cannot ordinarily train for more than one occupation or occupational set at a time. If a mistake is made--that is, one takes training in a skill which proves incompatible with one's needs or which has its demand eliminated by changing technology or tastes or competition, then, there may be very little time left to recoup one's losses or to retrain in a new occupational area. The only meaningful alternative, as with many older displaced Appalachian coal miners, for instance, may be to drop out of the labor force altogether.

Two observations on vocational and technical education and manpower training are pertinent at this point.

First, while it is conceptually reasonable to train for the "job of tomorrow," our manpower forecasting techniques are not accurate enough to

permit this type of educational strategy.[44/] Hence, the focus on quick job placement and training-relatedness is a proper one in vocational education even though to date, indices to measure training relatedness are still too crude to be of much assistance in guiding investment decisions in the area of occupational training. Second, given the flexibility of manpower training and the general short duration of such training, the gestation period of this investment strategy is relatively short and hence the opportunity costs, especially due to the risk of making a mistake in occupational choice, are relatively low so that manpower training has the flexibility to overcome the general lumpiness of human capital investment. Next, this lumpiness of human capital argues for a shortening of the gestation period whenever possible. There is no ironclad reason, after all, why high school must last four calendar years or why summer vacations must occur. Thus, the relative cost position of vocational and technical education can improve vis-a-vis its close competing substitutes, such as the general or college preparatory program, if efforts are made to shorten the training periods. In this regard, also, co-operative vocational education may have a relative cost advantage over other types of education including straight vocational; since the students work and attend school almost all year round, opportunity costs of foregone wages are less, and job placement may be more quickly achieved.

In short, while secondary vocational and technical education generally cost more than the general or college preparatory curriculums, this cost differential can be narrowed significantly by appropriate educational planning. Since foregone wages are a major cost of education even at the high school level, co-op programs and programs designed to shorten the calendar time in school may represent appropriate educational strategies.

44/ See Alice M. Rivlin, Critical Issues in the Development of Vocational Education, Reprint 112, Washington, D.C.: The Brookings Institution, 1966, pp. 157-158.

Complementarity, Substitutability, and Inseparability of Skills. This phenomenon arises from the fact mentioned earlier that it is impossible to separate one's human capital from his person. As a corollary, it is difficult to estimate the separate net effects of different kinds of human capital simultaneously embodied in the human agent and thereby determine the contribution of each to one's earnings or welfare. This problem is especially significant in the area of vocational and technical education due to the presence of on-the-job training. It is important to measure the contribution of one's (1) general education courses; (2) his vocational courses and, (3) since we are usually discussing a follow-up period of employment, his on=the-job training in order to make appropriate judgments as to the optimum relative mix of each kind of training. The problem is further compounded by the fact that much on-the-job training is informal rather than formal. It is possible to sort out these separate effects statistically, but the average effects of the investment elements are difficult to estimate with any precision where they interact jointly. Jacob Mincer did estimate the amount of on-the-job training costs by essentially working backwards from estimated rate of return differentials between groups with different amounts of education. 45/ His methodology is useful where direct measurement of on-the-job training is not possible. However, studies using interview data can collect the necessary information on wage differentials among skill levels within the same occupation to arrive at cost estimates and time spent in on-the-job training. Such cost and time estimates can then be entered appropriately in a regression model to control for the effects of on-the-job training.

Finally, co-operative training carries with it the same measurement problem. Namely, how much of the measured benefit is due each to the

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45/ Mincer, Jacob. "On the Job Training: Costs, Returns and Some Implications," Journal of Political Economy. Supplement. 70:50-79. October, 1962.

general, vocational and work experience components of the ecuational program? These separate costs and effects should be identified in order to make decisions as to the optimal mix among them in the training strategy.

Externality. An externality is an economic effect caused by an economic agent which bestows economic costs or benefits on secondary parties. The secondary party has no control over the receipt of these costs or benefits, but they influence his own economic behavior in positive or negative ways. On the other hand, the individual creating the externality is indifferent with respect to whom or where the cost or benefit finally resides. By its very nature, the externality cannot be priced and hence, rationed among possible recipients. As a result, the creator of the externality is indifferent to its existence, and the fact that he may be creating costs or benefits elsewhere in the economy does not enter into his own economic decision. The standard example of an externality is air pollution. In the area of vocational or technical education, an example would be the existence of complementarity between a given skilled technician and the remaining members of a research team such that the technician's productivity raised or reduced the productivity of the remaining members of the team. To the extent that the other members' productivity rose (fell), their wage rates would rise (fall), but there would be no way that the technician could request (or be charged) a portion of the other parties' gain (or loss) in wages due to his role as a team member. To some extent, the entrepreneur who brought the research team together would capture these external benefits. His role is to internalize these benefits within the company and capture them as profits. But he captures the benefit and not the worker, whose activity results in the external benefit.

With respect to a given skill, such externalities should be accounted for in any complete accounting of costs and benefits, but this is difficult to do for several reasons. First, because there is no market mechanism (though one could often be established) to price and ration these benefits, the quantities consumed and recipients are indeterminant. As a corollary, the very pervasiveness of externalities makes many of them take on the characteristic of a pure public good, so that in the case of a benefit, the consumption of this externality by one individual does not deny the use of any part of that benefit by other individuals. Since the externality is not rationed and since different persons weigh the value of it to them differently, in the absence of prices, one simply cannot estimate the total quantity of benefit bestowed on individuals or society.

In addition, it is difficult to identify externalities and a real possibility for double counting and, hence, overestimating costs or benefits exists. For instance, Burton Weisbrod lists socially desirable attitudes and behavior as an external non-monetary benefit of education.[46] Is this really an externality or just a direct non-economic benefit of socialization? It is, in part, both. My socially appropriate behavior will yield direct economic and psychic returns to me. To the extent that my behavior is appropriate and predictable, other individuals benefit from a more stable, predictable environment. Due to my behavior, their level of security and happiness will rise as well as their wage rate or earnings, yet they will not compensate me for this improvement in their well being. For society, part of the externality, then, is directly measured by the second parties' increased earnings, but how much? Of course, the rise in happiness eludes measurement at this state of the art.

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[46] Weisbrod, Burton A. External Benefits of Public Education, An Economic Analysis. Princeton, N. J.: Princeton University, Industrial Relations Section, 1964.

In the recent past, education has had a good press partly due to presumed large external benefits. The extent of these benefits of course is unknown, since they are, by their nature, unmeasurable in most cases given existing economic institutions and market structures. Recently, however, the presumed large external benefits to education, especially postsecondary education, are being vigorously challenged in the literature.[47]

The current cost benefit studies as a group fail to account for external benefits in quantitative terms. The study by Carroll explicitly ignores them and deals only with monetary costs and benefits.[48] Carroll and Ihnen mention the issue of externalities but don't attempt any measurements. They do attempt to measure the impact of income taxes and subsidies on private rates of return but in the context of their study, these factors are not externalities since their effects are known with certainty by the economic actor when he contemplates some action and the effects then enter directly into the decision making calculus.[49]

Taussig briefly mentions the possibility of external effects due to vocational education. He lists the alleviation of problems associated with unemployed out-of-school youth such as vandalism and juvenile delinquency as possible external benefits to vocational education.[50]

47/ Hansen, W. Lee and Weisbrod, Burton A., Benefits, Cost and Finance of Higher Education, Chicago: Markham Publishing Co., 1969.

48/ Carroll, op. cit., pp. 11-12.

49/ Carroll and Ihnen, op. cit., pp. 870-872.

50/ Taussig, Michael K., "An Economic Analysis of Vocational Education in the New York City High Schools," Journal of Human Resources, 3:59-87, Supplement, 1968.

Of course, the magnitude of these external benefits stemming from the alleged holding power of the vocational curriculum over certain types of dropout prove youth depends upon the actual reduction in the dropout rate. As we saw in Chapter VI, the net high school graduation rate for vocational curriculum students is about 20 percent less than that for academic curriculum students. Possible reasons for this were discussed in Chapter VI. In any case, Taussig's more impressionistic conclusion of the same effect is borne out by the analysis of the National Longitudinal Survey data. In the absence of the ability to demonstrate that vocational students would have an even higher dropout rate if forced into an academic curriculum, we must conclude that the suggested external benefits to this factor may not be large, especially when we recognize that not all dropouts are vandals or juvenile delinquents -- many must quit due to a desire to earn legal income.

In short, the discussion of external effects, much less a quantification of their amounts, is in a primitive state in the current cost-benefit literature. It is, in addition, an area where much caution needs to be exercised, due to the danger of cataloging long lists of external "benefits" which, if one quantified them, would quickly reveal the possibility of significant double counting.[51] Nevertheless, Taussig's conclusion that there are likely to be no net large external benefits is not substantiated by the sparse analysis he presents. We simply do not know at this time what the nature and magnitude of these benefits are.[52]

51/ The Hu, et al., study warns of this possibility but does not go futher to estimate such external benefits. Hu, et al., op. cit., p. 93.

52/ Corazzini, using benefit data estimated by Weisbrod, estimates that the money value of dropout reduction due to the alleged hold power of vocational education in the Worcester, Massachusetts school system considerably is less than its costs. However, he does not discuss this analysis in terms of externalities. See Corazzini, op. cit., and Burton A. Wesibrod, "Prevention of Highschool Dropouts," in Robert Dorfman, editor, Measuring Benefits of Government Investments, Washington, D.C.; The Brookings Institution, 1965.

Income Redistribution. Income distribution changes present a major problem in the estimation of the benefits and costs to an educational program. The issue is as follows: A given benefit-cost analysis must take as given or constant the distribution of income before a given educational program is implemented since the distribution of income is a major determinant of prices, wages, interest rates and rents. However, the very purpose of educational programs, including vocational and manpower training programs, is to alter the distribution of income in favor of some target population, such as youth, the disadvantaged, blacks, or Appalachian coal miners. Thus, relative prices will change if the affected group is large and if the program has any noticeable impact at all on their welfare. The problem becomes one of choosing which set of prices to use in evaluating the investment value of the program. The before and after states are noncomparable, especially if the program is a large one, such as a nationwide expansion of cooperative vocational education, area vocational-technical schools, or two-year community or post-secondary technical schools. Thus, the logical basis on which to make the investment judgment is lost.

A less serious problem is to estimate the direct income redistribution effects which can occur as a result of a given educational program. Thus, an area vocational-technical school may flood a labor market with welders to the extent that the increase in supply reduces the wage rate of the existing journeymen welders in the market even though it may be that disadvantaged youths who learn welding, for instance, may be better off. This represents a capital loss to the existing journeymem welders who undertook the expenses

of their training under the assumption of receiving the higher wage rate necessary to yield them a profitable rate of return on their investment. This loss must be offset against the gain of the hypothesized disadvantaged youth. Thus, an awareness of the impact of vocational programs on the supply of skills results in the fact that craft unions do take kindly to the attempts of public education officials to expand their apprenticeship programs or otherwise train deserving groups, such as blacks, in their skill areas.

Concern with the effects of earnings on blacks, youth and other disadvantaged groups reflects concern over the income distribution or equity goal of vocational education. Several studies show the differential impact of vocational education on blacks but only the Taussig study explicitly discusses the issue of equity. However, no attempts at quantification are made.[53]

A major problem exists in measuring equity benefits in that those whose absolute and relative income position improves (blacks, the disadvantaged, etc.) may attach different weights to their increased incomes than do those whose relative income deteriorates (taxpayers, whites, the middle class, etc.). Economists consistently argue that it is not scientifically possible to make inter-personal comparisons of utilities gained or lost among persons or groups. However, some such comparisons must be made in the real world and even a decision not to apply specific weights implies a weight of equality in terms of values or utilities lost or gained as the income distribution changes due to educational policy.

53/ Taussig, op. cit.

The Problem of Unemployment. Concern with the impact of income redistribution exists even when there is full employment in the economy. When cyclical or deficient demand employment exists, the problem is compounded mainly because the implications of income redistribution become so much more direct. In situations of less than full employment due to deficient aggregate demand, there is always the very strong possibility that a retrained worker from a manpower program or a formally trained vocational-technical graduate will simply displace an equally deserving worker who is not formally trained. Here, the concern is not only one of income redistribution, but one of the realization that there may be no net increase in national product while valuable resources have been expended, thus resulting in a net loss for society and a gain for one group of individuals that may not even totally offset the losses in welfare of the displaced group. In addition, as we noted above, even under full employment if there is income redistribution due to a program, one can, strictly speaking, make no judgment as to whether social welfare has improved because of the change in the structure of relative prices and the theoretical inability to make interpersonal comparisons among people concerning their relative losses or gains of utility due to the change. Where, then, does this leave us? Possible income redistribution effects should be taken account of and measured. To date, no benefit-cost study does more than provide lip service to this issue.

The existence of less than full employment compounds the measurement problems of benefit-cost analysis in other ways. For instance, as the level of unemployment as well as its distribution among occupational classes changes, the value of the embodied human capital represented by these acquired skills among occupational groups changes, since one's stream of expected

earnings changes. Thus, no unique capital value for a given skill exists. The expected capital value fluctuates for reasons independent of any fundamental underlying demand for the skill.

The significance of this problem is borne out by the fact that the analyses of earnings data based on the National Longitudinal Surveys show a strong cyclical response to different levels of aggregate unemployment. As was discussed in Chapter VI, the net earnings differential between the vocational and academic curriculum in 1966 was not statistically significant from zero. The estimated differential was $4.29 a week in favor of the academic curriculum but the large standard error ($3.88) resulted in a lack of significance. However, by 1968, with a much more favorable market, the vocational curriculum now showed a net benefit of $7.05 per week relative to the academic curriculum. Ignoring for the moment the problem of statistical significance, this represents a swing of $11.34 per week or about $590 per year. Which estimate, 1966 or 1968, is correct?

The question is, should one allow his measures of the value of human capital created by an educational program reflect the phenomenon of cyclical unemployment? From a private standpoint, earnings benefits as well as foregone earnings should reflect unemployment experience. However, it is not certain that this type of adjustment should be made for an estimation of social benefits or social opportunity costs. For the social case, one wishes to know what alternatives were foregone in a real sense--what society could have produced. A moment's reflection will indicate the arbitrariness of making an adjustment for unemployment for society when you try to estimate social opportunity costs of education in, say, 1932, as opposed to 1944.[54/] Fiscal and monetary techniques exist for the use of government to control the level of employment. A given educational

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54/ Bowman, M.J. "The Costing of Human Resource Development," in E.A.G. Robinson and J.E. Vaizey, (eds.), The Economics of Education, New York: St. Martin's Press, 1966, p.431.

investment should not be made to reflect the vagaries of a price level or income and employment policy whose social and political impetus may have nothing to do with the educational policy.

On the other hand, there is some reason to question the effectiveness an educational or manpower program which imparts a structure of skills which are relatively more sensitive to cyclical fluctuations in aggregate demand than say, the average of all skills in the economy. Therefore, it is of major interest to determine if secondary vocational programs do exhibit this characteristic. As noted, the preliminary analysis of the National Longitudinal Survey data suggests the possibility.

An additional issue is linked with the unemployment problem. With the existence of unemployment, the question arises as to which is a better measure of productivity--wage rate per hour or earnings (wage rate per hour times hours worked)? It is contended that wage rates are less likely to reflect the vagaries of unemployment and, hence, do not penalize educational programs due to the effects of fiscal and monetary policies which are irrelevant to the purposes of education. In short, wage rates are a more stable measure of the productivity of educational investment than are earnings in an environment of cyclical unemployment. Yet, to the extent that wages are flexible downward (and this is only slightly), they, too, will reflect the impact of unemployment. To the extent that they are not flexible downward, the validity of wages as measures of productivity is brought into question. Thus, the use of earnings becomes more meaningful as a measure of relative productivity in labor markets characterized by sticky wages and structural unemployment. In such markets a person may undergo continuing cycles of employment and unemployment because his productivity is less than the wage rate at which he is hired. Once it becomes apparent to the employer that a man's productivity is less than his wage rate, he is laid off.

Manpower retraining can serve to increase a person's productivity up to the point where it equals the going wage rate. When this retrained person is compared against a comparable person in a control group, no difference in wage rates may be discerned, but the trainee will experience more stable employment and higher earnings. It would be incorrect to argue in such a case, as do Earl D. Main and David Sewell that there are no necessary benefits to the training program since wage rates have not risen.55/

In line with this general problem of unemployment is the problem of estimating the costs of foregone wages in a labor market where structural unemployment exists. This problem is of a different nature for post-secondary than it is for secondary vocational education due to the different age structure and labor force committment of the two groups.

If unemployment is completely structural, there are no opportunity costs during the education or training process. The available workers cannot perform the existing jobs at all without the training. Likewise, once he is trained, the structural assumption implies that the person's entire earnings be ascribed to the benefits of the training program. However, as an empirical matter, it is difficult to accept these assumptions which ascribe no opportunity costs during training and treats the total amount of earnings after training as a benefit. In the first case, the argument is that the student or trainee had no economic alternatives before him. In the extreme, this implies that his marginal revenue product (productivity of a marginal unit of labor times the price of the marginal unit of labor's output) is zero. Next, by counting the

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55/ Main, Earl D. "A Nationwide Evaluation of MDTA Institutional Job Training," Journal of Human Resources. 3:159-170. Spring, 1968; and

Sewell, David O. Training the Poor: a Benefit-Cost Analysis of Manpower Programs in the U.S. Antipoverty Program. Kingston, Ontario: Queen's University, Industrial Relations Center, 1971. Research Series 12.

entire wage bill as a benefit, one is assuming that the trainee's marginal revenue product was zero at the time he entered training and the probability of untrained workers filling that job slot was zero.

However, the evidence in all the manpower retaining studies is that trainees did forego earnings since members of a control group had earnings during the training period. Members of the control group got jobs in the same areas as trainees. Thus a zero probability of employment in these jobs by both the trainee and the control group does not exist.[56] Therefore, it is incorrect to treat the entire post-training wage as a benefit, or opportunity costs during retraining as zero. The reason is that no market is ever completely dominated by structural unemployment.

In short, a person's expected earnings are almost never zero even at high levels of cyclical unemployment. Also, it is almost never the case that pure structural unemployment exists. Unemployment will usually be a mixture of the two types--a mixture which cannot be theoretically or empirically untangled.

But what if there are high levels of cyclical unemployment? If a worker begins training, he is eliminated for a time from the labor market. The probability that remaining unemployed workers may now become employed is at least the same and may now be higher, since the supply of labor in the market is reduced. If the probability that remaining workers in the labor force will be

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56/ See Ralph E. Smith, "The Opportunity of Participating in a Training Program," The Journal of Human Resources, Volume VI, Number 4, Fall, 1971.

employed increases such that the zero likelihood of employment by the worker being retrained is exactly compensated for, then no social opportunity costs exist in terms of foregone earnings. There has simply been an income redistribution. However, private opportunity costs do exist for the worker being retrained since a positive expectation of employment now becomes zero during the training process.57/

Practical Issues and Suggestions in the Measurement of Costs and Benefits

Identification of Costs under Conditions of Matching Grants. The Vocational Education Act of 1963 and its Amendments as well as such manpower acts as the Economic Opportunity Act set up conditions whereby the receipt of federal funds is contingent on the establishment of matching shares or partial cost sharing by the grant recipient.

Two broad problems exist when one attempts to measure the social costs of the vocational education, the Neighborhood Youth Corps or similar social programs involving federal-local cost sharing provisions. The first deals with the problem of measuring the social value of the sponsor share when the social program may be only partially funded by federal monies. The second problem deals with federal reimbursement of the sponsor for the use of certain sponsor facilities. These are common issues in any matching grant case. They are not recognized or dealt with in the current cost-benefit literature on vocational education.

The Sponsor Share. The federal expenditure represents an actual outlay for the federal government and is a cost to the federal government. However,

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57/ Michael Borus was one of the first to draw attention to these problems. See Borus, Michael E. "A Benefit-Cost Analysis of the Economics of Retrain-in the Unemployed," Yale Economic Essays. 4:371-429

from the standpoint of social economic cost, there is some question as to the validity and accuracy of the cost measure of the sponsor share. There are three problems involved here.

1. First, if the sponsor, often a school district, has excess physical capacity, the use of which is restricted to the school district, the cost to the sponsor in the short run for using this excess capacity is zero up to the limit of the designed capacity.

2. Second, if this restricted sponsor input, such as a comprehensive high school building, is used to simultaneously produce both federally supported and nonfederally supported educational output, the marginal cost of using that input for the federally supported is zero up to the limit of the designed capacity.

3. Finally, even when there are no joint inputs or excess capacity, many of the local sponsor matching inputs to the federally supported program do not have market prices so that the prices of these inputs must be estimated or "shadow priced."

The combined result of these three factors is likely to be an overstatement of true total costs to the combined government units (sponsor plus federal) as well as an overestimated statement of total social costs. Shadow pricing or price estimation and the joint cost problem are discussed below.

Federal Reimbursement for Sponsor Inputs. An issue separate from the sponsor share concerns the federal reimbursement of the sponsor for use of certain sponsor inputs, such as building space. Again, the three issues of possible excess capacity, joint outputs, and shadow pricing arise.

The problem is made more complex because cost to the federal government is not necessarily the same as cost to the sponsor. A rental payment to a sponsor can be an overestimate of the true cost to the sponsor even though it might cost the federal government more to rent the same facilities on the open market. For instance, if a school system has excess classroom capacity, the marginal or extra cost of using that excess capacity is zero up to the limit of designed capacity, as indicated above. If the federal government does not have access to that excess capacity, it must pay a rent in the market for comparable space. Thus, the alternative cost to the federal government justifies the payment of a rent to the school system, even though the true marginal cost to the school system may be less than that rent. As long as the federal government pays the school system less or no more than it would have to pay in the market, then this payment is rational from the standpoint of the federal government. To the extent that the school system has short run excess capacity, it receives a windfall gain. In fact, since the federal government has not rented in the market but has rented from the school district, then, if excess capacity exists in the school district, some or part of the rental payment is a transfer payment and not a social cost.[58/] Thus, it is reasonable to assume that total federal costs may also overstate this portion of the social cost of the program. The same result

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58/ A transfer payment is defined as a payment for which no compensating service has been rendered. Its effect is to redistribute income.

would arise if the federal government reimbursed a sponsor for the use of a joint input which was being employed to produce a sponsor output not associated with the educational program in question as well as to produce the program output itself.

Shadow Pricing. Even though the sponsor may be required by law to contribute a certain percent of the total cost of the program, the sponsor's share can often be in the form of goods in kind whose market prices are then estimated or "shadow-priced" in negotiations between the local sponsor and federal government officials. The federal regulations are not very explicit about procedures for this shadow pricing.[59] Thus, considerable arbitrariness can creep into the estimate of the sponsor's share. And, it is not at all inconceivable that different shadow prices could be attached to the same set of real resources being used in different projects across the nation even though the opportunity cost in each location could, conceivably, be the same.

Table 4 indicates the range of price estimates on classroom space which occurred in the establishment of the resource value of the sponsor's share of Neighborhood Youth Corps (NYC) project operation in the greater Los Angeles area. The estimates range from $1.60 per day per classroom to $40 per day per classroom. The General Accounting Office felt that a figure of $5.25 per day per classroom would be most reasonable, based on a 20-day month.[60] The true market value of this space is indeterminate under current institutional arrangements, however, and estimates of it are essentially arbitrary.

59/ Federal Procurement Regulations (2nd ed., FPR Amendment 42, April, 1968), Part 1-15, Contract Cost Principles and Procedures and Subpart 1-14. 2 Principles and Procedures for Use in Cost-Reimbursement Type Supply and Research Contracts with Commercial Organizations, pp. 1501-1520.

60/ Comptroller General's Report to the Congress, Review of the Community Action Program in the Los Angeles Area Under the Economic Opportunity Act, Office of Economic Opportunity, B-162865, March 11, 1968, p. 40.

Because of these differences in estimates of shadow prices, the resulting differences in estimates of total attributed costs can be large. For instance, for two NYC projects in the Los Angeles area, the Government Accounting Office's estimate of total value of contributed classroom space was $318,309 while the estimate of the Los Angeles Unified School District was $1,048,500, a difference of $730,191.[61/]

It is not clear what the resolution of this inconsistency might be, since these school inputs have no comparable market inputs upon which to get a more valid economic measure of cost.

TABLE 4

DIFFERENTIAL SHADOW PRICE ESTIMATES OF THE VALUE OF CLASSROOM SPACE, GREATER LOS ANGELES AREA

Educational Organization	Rate Per Day Per Classroom
Los Angeles Unified School District	$10, $34, and $40
Los Angeles County School Districts:	
Willowbrook School Districts	$6 and $9
Compton City School Districts	$5
Compton Union High School District	$1.60
Archdiocese of Los Angeles	$3.60 and $6
U. S. General Accounting Office	$5.50

Source: Comptroller General's Report to the Congress, Review of the Community Action Program in the Los Angeles Area Under the Economic Opportunity Act, Office of Economic Opportunity, B-162865, March 11, 1968, p. 40.

Three possible treatments for valuing this capital exist. First, one can argue that once the capital stock exists, especially the physical plant and buildings, it becomes specific to the educational process and thus has

61/ Ibid., p. 64

no alternative use. In this case, social capital costs would be zero in the short run, since no opportunity cost is involved in their use for a cohort of students who use the capital after the decision was made to create the school. This is a tenuous assumption, though, for it is easy to discover alternative uses for such capital stock. Thus, the value of the educational physical plant is not zero in competing uses, but since it is not a perfect substitute for these competing uses, the market value of the competing uses does not exactly reflect the opportunity cost of using the non-renovated physical plant for educational purposes. If one went to the market to price the value of the non-renovated educational plant in terms of its potential value as a hospital simply by observing what the value of a hospital was, the value would be overstated. Thus, the value is not zero, but it is less than the apparent value of alternatives since, without renovation, it is not a perfect substitute. And, even with renovation, such factors as location, which cannot be changed, continue to exist and affect the degree of substitutability, thus forcing one to further adjust the implied opportunity costs.

Second, historical costs of building construction and site acquisition can be used, but these historical costs are essentially irrelevant since they have no necessary bearing on the present opportunity costs involved in using the capital stock in question. They do not reveal the current economic value of the capital resource. Current economic value could be less than, equal to, or greater than historical cost.

Third, the use of replacement costs is a possibility in the attempt to measure capital costs. However, it is obvious that in many cases it would cost more to exactly replace a building than the building is currently worth in economic terms. The use of replacement costs would over-value the

capital resource, given a rising price level and assuming no compensating technological changes in construction technique.

In short, it is not obvious what price resulting among these three choices should be attached to the capital inputs to get a measure of the opportunity costs. None of the above is correct in a pure theoretical sense.

Estimating Capital Use. Even if the true economic value of the capital resources in use has been measured, the problem still remains as to the measurement of the rate at which the given capital stock is used up over the course of the investment process when more than one cohort of students employs the capital stock. Two courses of action have been suggested for use. One is to attempt to measure an imputed rent and depreciation to the capital stock by making analogies with respect to what amount of rent (i.e., return on the capital investment) the capital item would yield if it were being employed in the private sector of the economy. Some estimate of depreciation is added to this. But such a technique is subject to a great deal of arbitrariness and uncertainty. Legal rules for depreciation allowances do not reflect economic realities.

In order to get a measure of the rental opportunity cost, it is necessary to go to the market place and attempt to identify capital resources which represent alternatives to the resources employed in the educational process. This will allow one to determine the value of foregone alternatives. But, again, any imputed rent based on market observations will most likely overstate the value of the capital resources which are already committed to education. Thus, a great deal of judgment is involved in adjusting the observed market prices so that they more closely reflect the true opportunity costs.

The Corazzini study chooses to impute the rental value of the buildings, capital charges and property tax loss.[62] He relies on replacement costs of buildings, and, of course has the problems attendant with this estimate as mentioned above. Corazzini chooses to use estimates by Theodore Schultz for the implicit rent on buildings, grounds and equipment. This rent is estimated at 8 percent of the book value of the physical property.[63] Essentially, arbitrary assumptions must be made as to the depreciation rate on physical property and equipment. Thus, one's estimates of the flow of capital in use will vary as a function of these types of judgments. Likewise, Corazzini applied weights to the value of capital attributed to buildings, and equipment which are fully explained in his analysis).

In the absence of any trustworthy data, Taussig assumed that the flow of capital costs was 22 percent of current costs. This assumption was also based on calculations done by Schultz.[64]

The Hu, et al. study used replacement costs along with the capital recovery factor to estimate the annual flow of capital in use. The study employed sensitivity analysis to show how the rate of capital flow responded to different interest rates and life of capital assumptions. Schriver and Bowlby also use the capital recovery factor.[65]

62/ Contrary to the author's statement, this is an estimate of cost to the school system rather than social costs since property tax loss, a transfer, is included in the calculation. See Corazzini, Vocational Education: A Study of Benefits and Costs, op. cit., p. 5.

63/ Corazzini, op. cit., p. 32 ff. See also, Schultz, Theodore, "Capital Formation by Education," Journal of Political Economy. Vol. LXVIII, December, 1960 and by the same author The Economic Value of Education, New York; Columbia University Press, 1963.

64/ Taussig, op. cit. See also Schultz, Theodore, W., "Education and Economic Growth," in Nelson R. Henry, editor, Social Forces Influencing American Education, Chicago: University of Chicago Press, p. 85.

65/ Hu, et al., op. cit., p. 65 and Schriver and Bowlby, op. cit., p. 117 ff.

The Somers, et al. study relies on the work of Peterson for its capital cost estimates but does not discuss any of the underyling assumptions of these data.[66]

Carroll and Ihnen appeared to get around some difficult problems in capital cost estimation by adding the annual per student public support of the school to the average tuition paid by students. However, it is still not clear if capital or just current facilities costs are involved in the measures.[67] However, a check of Carroll's earlier study reveals that these figures omit the opportunity costs of the physical plant and depreciation. The author argued that this was not a serious bias. The author appears to be arguing that budgeted repairs and maintenance costs were approximately equal to site appreciation and that the two costs cancel each other out.[68] The statement is unclear. But if he is interpreted correctly, this is clearly wrong, since both represent opportunity costs which should be added in to get total resource costs to society. In fact, the discussion here of appreciation of site and depreciation of building only obliquely deals with the basic problem of getting an estimate of the opportunity costs of the land and capital. In any case, expenditures made to keep the value of the capital intact are opportunity costs and appreciation in the value of the asset represents a net increase to the value of the capital asset.

66/ Somers, et al., op. cit., p. 186 ff. See also Peterson, Leroy J., "Cost-Benefit Theory in Vocational and Technical Education," Center for Studies in Vocational, Adult and Technical Education, Madison, Wisconsin: University of Wisconsin (unpublished manuscript, 1969).

67/ Carroll and Ihnen, op. cit., p. 866.

68/ Carroll, op. cit., p. 42-43 and footnote 4.

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Kraft also confuses financial depreciation with opportunity cost. Consider the following statement:

> ...a student in a new school is receiving perhaps fifty dollars a year more for his education than a student in a school that has depreciated to near zero value. 69/

This statement is subject to several interpretations. First, it could mean that various students experience various capital costs, depending upon the opportunity cost value of the capital in use. It may also mean that a financially depreciated building has no opportunity cost -- no alternative use -- which is highly unlikely. Or, it may mean that the quality of educational capital differs as economic obsolescence takes its toll. This latter phenomenon is not necessarily a straight line function of time, however. It is quite possible for an older building to have a higher opportunity cost for a given activity than does a younger building.

As indicated above, an alternative technique for estimating the rate of capital use lies in employing the "capital recovery factor" (CRF). The application of this technique automatically accounts for both rent (interest) and depreciation.

69/ Kraft, op. cit., p. 49.

The capital recovery factor is that factor which ". . . when multiplied by the present value of capital costs, is the level (average) end-of-year annual amount over the life of the project necessary to pay interest on and recover the capital costs in full."

The formula is as follows:

$$c = \frac{C_0 i(1 + i)^n}{(1 + i)^n - 1}$$

where c is the capital recovery factor (annual level capital cost); C_0 is the present value of capital in use; i is the social opportunity cost rate of capital or investment funds; and n is the number of years over which benefits (of the capital in question) are returned, that is, the project life. In some respects, this technique is no less artibrary than that which imputes rent and depreciation. Apart from the problem of establishing the present value of the capital in use, essentially arbitrary judgments must be made with respect to the values of n and i. In addition, the rate of capital use is projected as a constant annual amount, whereas the true rate of capital use is quite likely to vary over time. This, of course, can create a bias in one's estimate of present value or rate of return.

Joint Costs. In addition to the shadow pricing problem, it is clear that much of the sponsor input into an educational program is really of the nature of a joint cost or joint input. The school physical plant is a case in point. In such situations, the input is being used to produce simultaneously two or more separate outputs. For instance, space in a currently operating school may be contributed to house the staff of a newly established, federally supported program. The total cost of operating the physical

plant of the school is then prorated among the various outputs, including the new program; yet, it may cost no more to operate the physical plant after the presence of the new program than it did before.

Two types of overestimation of costs can enter the analysis. First, a positive price may be put on in-kind resources contributed by the sponsor as its share of project costs when, in fact, the marginal cost of this resource use may be zero. This results in an upward bias in the estimate of sponsor share cost. Second, when the federal government reimburses a sponsor for indirect costs, the resource input in question may be a joint input, thus resulting in an upward bias in the measure of economic costs of the program in question as distinct from accounting or financial costs of the federal government. This latter situation is not unlikely.

The problem of joint costs affects the benefit-cost analysis in two ways. First, as is discussed below, there is no non-arbitrary measure of total cost and average cost. Since we often will not know what judgments may have been made when the sponsors prorated joint costs, one has to accept whatever upward bias is present in the total costs reported for the sponsor share as well as in the federally reimbursed sponsor costs. This situation exists for the measures of marginal cost also; however, the conceptual problem of proration is handled differently.

Issues in Prorating Joint Costs. There are two points of view with respect to the problem of proration when marginal benefit-cost comparisons are being made. The first advises against prorating. The second argues that proration is possible. The first point of view is supported by such persons as Hitch and McKean and Enthoven.[70] They argue that the existence of joint costs does not affect the determination of marginal costs, and, since efficient investment

70/ Hitch, Charles J. and McKean, Roland N. The Economics of Defense in the Nuclear Age. New York: Atheneum, 1965, See also Enthoven, Alain G. "Appendix: The Simple Mathematics of Maximization", in Charles J. Hitch and Roland N. McKean, op. cit., pp. 380-385.

decisions among two or more alternative programs are made on the basis of marginal costs, the presence of joint costs presents no basic problems for benefit-cost analysis. Not only is joint cost allocation necessarily arbitrary in nature, it is not needed, given the emphasis on marginal costs. True marginal costs are zero. When joint costs occur and involve two or more programs or outputs, the total cost of the set of programs or outputs can be measured. Then, the combined total discounted benefits of the set of programs or outputs should equal or exceed their combined total discounted costs. But total average costs of each of the two programs simply cannot be measured in any non-arbitrary economic sense. This is no real loss, though, since to repeat, investment decisions among two or more competing programs are correctly made on the basis of marginal and not average cost and benefit comparisons.

Within very broad limits joint inputs are similar to what is known in economic analysis as a public good. Just as the benefits from a public good, such as national defense, are pervasive and need not be rationed or allocated on an individual basis among consumers (since one person's consumption does not diminish the consumption of that same good by other consumers), so, too, a joint input need not be allocated among the outputs stemming from it because each output can use the joint input without limiting the use of the input by all other outputs. The major problem here is that, except for such services as national defense, it is very difficult to identify a pure public good. A secondary problem is that the production process should be operating below capacity for the statement above to hold.

The argument for proration has been advanced recently by R. L. Weil.[71/]

71/ Weil, R. L., Jr. "Allocating Joint Costs," American Economic Review, pp. 1342-1345, December, 1968. See also
Judy, Richard W. "Costs: Theoretical and Methodological Issues," in G. G. Somers and W. D. Wood, (eds.), op. cit.

Given a joint input, X, such as the physical plant of a school district which, along with general outputs, produces the output of a federally supported program, the argument for proration goes as follows: Estimate the total demand and the marginal revenues for each of the outputs in question. The marginal revenues of each of the outputs in question are then used to allocate the joint costs. The sum of the marginal revenues for the outputs in question must equal the price of the joint input. Thus, the cost of the joint input is allocated to each output according to its relative share of marginal revenue. The allocation of costs in this example will depend to a large extent on the conditions of demand for each of the outputs of the school district in question. Thus, for an identical production technique occurring in two markets with different demands for the outputs in question, different allocations of joint costs could occur.

The major problem with implementing this technique is that it is extremely difficult to estimate demand curves for goods and services--especially quasi-public goods like education--and it is even more difficult to identify specific points on these curves. Thus, the operational practicality of the technique is questionable, given the current state of the art.

The controversy over allocating joint costs has not yet been resolved, but at present our judgment is that joint costs should not be prorated, even though a pure joint input, like a pure public good, is difficult to find in actual practice.

Finally, to the extent that previously existing physical facilities are being used, these can be treated as "sunk" costs from society's standpoint. As such, their cost in use for the new program is zero if they have no alternative use. In short, in terms of clarity of the cost concept, the

federal share is less ambiguous of the two major cost components--federal and sponsor. And, the federal share may be closer representation of true social economic costs than the measure based on federal and sponsor share combined.

While the Hu, et al. study discusses the joint cost problem and the Persons, et al. study applies the concept, in our judgment, correctly, the remaining cost-benefit studies either fail to mention the issue or utilize some implicit or explicit arbitrary proration.[72] For instance, Corazzinni prorates capital costs equally among the 9, 10, 11 and 12th grades.[73] The true rate of capital use might be quite different among the grade levels, as Corazzinni recognizes.

Imputing Opportunity Costs of High School Students. The problem of estimating the opportunity costs of high school students is as yet unresolved. It is clear that on a private basis one ought to count as an opportunity cost wages similar persons are earning in the labor market. But the problem is different from a social standpoint. Conceptually, a relatively large influx of young persons into the labor market should lower the earnings of this group relative to the average earnings currently reported in the Census. Thus, use of Census data to impute opportunity would result in an upward bias. Nor does it help to indicate that child labor laws prohibit the employment of much of this group, for such laws, having been passed, can be repealed. To be more explicit, in long run terms, laws can be changed, and hence, what constitutes social opportunity cost will change.

Thus far, the extant cost-benefit studies do not impute the cost of foregone wages of secondary students while attending high school. However,

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72/ Hu, et al., op. cit., p. 68-69; Persons, et al., op. cit., p. 124

73/ Corazzini, op. cit., p. 37.

the Kraft study does recognize the problem.[74]

The Extrapolation of benefits. A major problem in benefit-cost analysis is the determination of the length of time which benefits extend into the future as well as the shape of this benefit stream. Average benefit streams for various types of educational benefits simply are not known with any precision. Most benefit-cost studies of manpower programs have only a few months to one or two years as a follow-up period after training. The benefits to vocational and technical education have been variously estimated as continuing for six years before vanishing in the Hu, et al. study. The Eninger study indicates that for graduates with no college education (the same basis as in the Hu, et al. study) college preparatory graduates catch up with vocational graduates after about 11 years out of school. There is a problem with his estimation however, since he is comparing the wage differentials between vocational and academic graduates for three different cohorts -- 1953, 1958 and 1962 graduates. Since the three cohorts do not necessarily come from the same universe, it is not strictly correct to treat the earnings progression among the three graduations cohorts as three time series observations[75] on the same population.

The reasons for this convergence are unclear. One possibility is that general and college preparatory graduates acquire more on-the-job training after leaving high school than do vocational graduates, though this has not yet been verified. Another possibility is that the more general flexible nature of the general and college preparatory education allows the sampling of a group of jobs which, on the average, have a

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74/ Kraft, op cit., p. 51

75/ See Hu, et al. op. cit., Chapter VIII and Eninger, The Product..., op. cit., Chapter 9.

greater earnings growth progression. Vocational graduates may enter their jobs at wage rates closer to their peak lifetime earnings than do students in competing curriculums. Finally, the option value--the degree to which a given level of education allows access to additional formal or on-the-job training--may be higher for the general and college preparatory curriculums.

A fourth possiblity may lie in the characteristics of the students themselves and the credentialling and job placements activities of vocational education. With respect to the first point, vocational students, as mentioned previously, have a more immediate commitment to labor market participation. The very fact that they are training for a specific occupation at a much earlier stage of their life cycle attests to this fact. Thus, by entering the labor market earlier they can have an immediate edge in terms of experience in job search and actual on-the-job training which is not eroded for some time. But, is this an attribute of vocational education itself and hence should the effects of it be ascribed as a benefit? It is more clearly due to the original differences in the student body to begin with. The problem is even more acute with females than with males, given the more tenuous and less uniform attachment of females to the labor force. Vocational curriculum females are likely to have a much firmer labor force attachment than any comparison group from a different curriculum.

Likewise, the credentialling and job placement services inherent in the vocational student a temporary edge over the student from a different curriculum. Until the other student acquires equivalent (but not necessarily the same) credentials and learns the ropes of job search, wage bargaining and other similar skills, his wage rate and earnings are likely to be somewhat lower. This eventual acquisition of credentials and investment in labor market knowledge

is then reflected in terms of an increase in the wage rate and earnings equal to the vocational graduate. But again, one asks the question, are the benefits of vocational education directly attributable to acquired vocational skills or to some other phenomenon as yet not properly identified? All these possibilities above are possible answers, but the reasons for the converging earnings time profiles still have not been fully investigated.

In the absence of any precision concerning earnings profiles, the best course is to employ sensitivity analysis to estimate the range of effects under different assumptions concerning earnings profiles. Borus and Tash propose a useful sensitivity matrix which allows for variations in the growth of the earnings profile at negative, zero and positive rates as well as benefit streams which last for a short, medium and lifetime earning period.[76] This is the best solution to the problem at this point. But, it leaves one with a variety of estimates, no one of which is clearly a measure of the true value.

76/ Borus, Michael E. and Tash, William R. Measuring the Impact of Manpower Programs. A Primer. Policy Papers in Human Resources and Industrial Relations, 17. The University of Michigan--Wayne State University Institute of Labor and Industrial Relations, November, 1970.

TABLE 5

TYPES OF COST-EFFECTIVENESS
COMPARISONS AMONG EDUCATIONAL PROGRAMS

ROGRAM	COMPARISON GROUP
ıdary Vocational iculum Graduate	a. Grade School Graduate b. College Preparatory Curriculum Graduate c. General Curriculum Graduate d. Vocational-Comprehensive Curriculum Graduate e. Comprehensive High School Graduate
ıate of a Specific ndary Vocational l	Any other combination(s) of graduates from closely competing vocational curriculum skills (e.g., machinists vs. automobile mechanics).
uate of a Vocational iculum or Vocational l Trained Within the ext of a Given Educ- nal Production tion	Graduates from the vocational curriculum or from the same skill trained by means of different educational production functions.[1]
uates of a Vocational iculum or Vocational l Trained Within the ext of a Given Educ- nal Production Fun- n and a Given Mix of ational Inputs	Graduates of a vocational curriculum or vocational skill trained within the context of the same educational production function, but a different mix of educational inputs to that function.
uates from Post- ndary Vocational nical Program	a. College Preparatory Curriculum Graduate b. General Curriculum Graduate c. Secondary Vocational Curriculum Graduate d. Vocational-Comprehensive Curriculum Graduate e. Comprehensive High School Graduate f. Community College Graduate g. Junior College Graduate h. Analogous variations on items 2, 3, and 4 above.
Specific Socio- graphic Target p, Such as Blacks, e Females, or can-American Dis- ntaged	Programs, curriculums, or vocational skills conceived of as closely competing substitutes. For Instance: (a) Job Corps vs. Neighborhood Youth Council-II/Out-of-School. (b) College preparatory vs. general secondary curriculum. (c) Postsecondary vocational school vs. Junior College. (d) The same program with contrasting production educational functions. (e) The same program with the same production function but with different educational input combinations.

could legitimately argue that if two programs have different educational production
tions, then they cannot be considered the same program.

The Problem of the Control Group. The final issue in the measurement of costs and benefits deals with the use of control groups. The choice of a control group to use depends on the purpose of the analysis. Different control group comparisons tell different things about a program. For some purposes it is desirable to use only college preparatory or general students as a control for vocational students. For other comparisons, one may wish to use the student body of a comprehensive high school or grade school graduates. (See Table 5, p.85) Likewise, one will get different results for a manpower training program if he designates dropouts as the control group as distinct from a random sample of the unemployed or those eligible who did not enter the program.

It is not commonly understood that observations on variables for the control and experimental groups should be taken both before, during, and after the training process.

When estimating the effect or net change that a program has had on a target group one must know the level of performance prior to the inception of the program, not just the difference in the levels of effect after the program. Only in the former case can one get a proper estimate of the value added by the program.

It would be too harsh to suggest that the use of a control group is not fully appreciated, though departures from random selection are, of course, necessary if one wishes to pick a judgement sample for a very specific purpose. Under such conditions, however, the narrow purposes of such a methodology should clearly be recognized.

One particularly good study from the standpoint of its institutional analysis of several competing manpower programs is marred by the fact that

there is no control group in the study. The empirical analysis relies exclusively on before-after comparisons. (See the discussion on this point below.) Of course, it could have been greatly improved from an empirical standpoint if the authors had developed the methodological comparisons shown at item 6 of Table 3.[77] They would then have been able to use multiple regression analysis to better advantage, also.

Most studies of educational and manpower programs are retrospective in nature and hence must generate a control group after the fact. The study of the in-school Neighborhood Youth Corps in Cincinnati by Gerald Robin is an exception to this statement.[78]

The major improvement over the usual retrospective study is the Longitudinal Study of Four Manpower programs currently being conducted by Operations Research Incorporated, Silver Spring, Maryland. It is jointly financed by the U. S. Department of Labor and the U. S. Office of Economic Opportunity. OEO is bearing the major cost and responsibility. Likewise, the National Longitudinal Surveys

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77/ See Garth L. Mangum and R. Thayne Robson, editors, Metropoliten Impact of Manpower Programs: A Four City Comparison, unpublished manuscript. A longer version of this study by the same authors is Total Impact Evaluation of Manpower Programs in Four Cities, Volume II, Final Report, Washington, D.C: Olympus Research Corporation, August 1, 1971.

78/ Robin, Gerald D. An Assessment of the In-Public School Neighborhood Youth Corps Projects in Cincinnati and Detroit, with Special Reference to Summer-only and Year-round Enrollees. Final Report and Interview Schedule Supplement. Philadelphia, Pennsylvania: National Analysis, Inc., February, 1969.

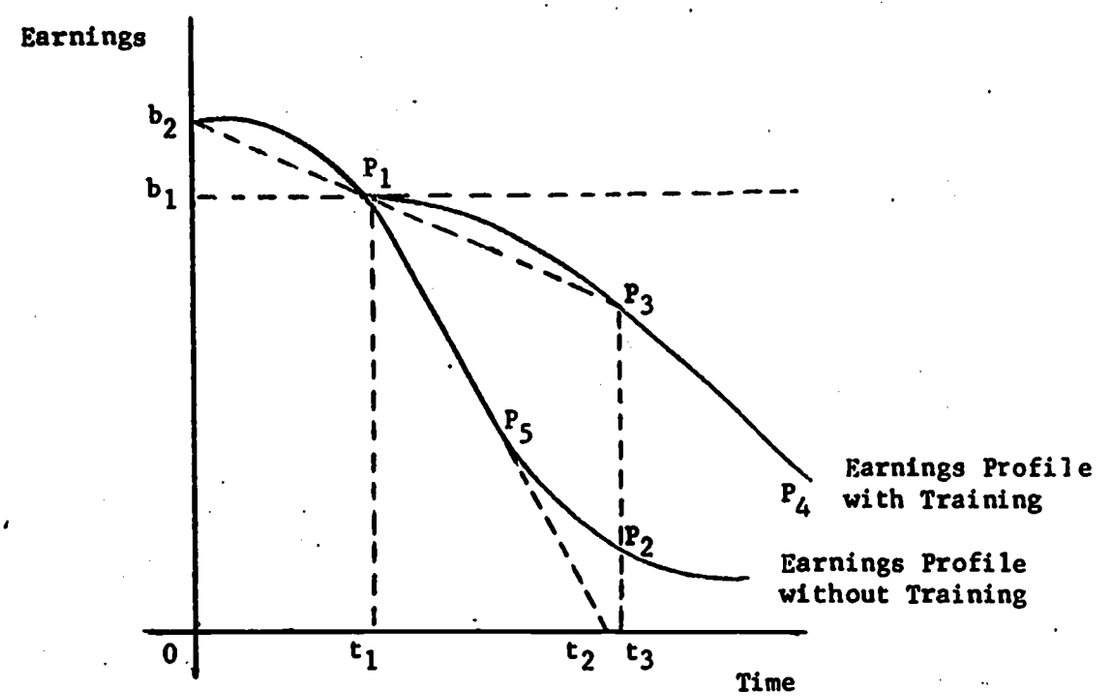
data from the Bureau of Census - Ohio State University has the same desirable characteristics as does the Project TALENT data.

Two general approaches have been used to evaluate programs. The first is simply to compare the experiences program participants had before the program with experiences they had after the program. The second method is to attempt to develop a comparable group of persons who have never had the treatment to serve as a basis for comparison.

With the before-after comparison, one is troubled by the fact that changes other than the treatment occur over time which can affect the measure of program outcomes. By their very nature, it is difficult to control for these factors. For instance, given that earnings and employment are a measure of outcome, one will get biased results if the pre-, during, and post-program measurement periods extend over a business cycle. On what basis do you adjust wages and employment up or down to reflect a full employment level of employment and earnings for the experimental group over the study period?

Before-after comparisons can distort one's measures of costs and benefits in other ways. Figure 6 shows the before-after earnings profile of a person who was structurally unemployed but who then took retraining. Ideally, what one wishes to measure as a benefit is the area under the curves bounded by P_1, P_3, P_2, P_5. This cannot be done, since, once the person takes training, the line segment P_1P_2 is no longer observable. Thus, a possible strategy to get a measure of earnings change is to compare earnings at the time of entrance to the program, t_1, with the profile of earnings after the program. As can be seen however, the result will be to measure negative benefits to the trainees. This is not an

Figure 4: Hypothetical Before-After Earnings Profile of Structurally Unemployed Manpower Trainee



unlikely result when you are dealing with workers in high wage industries, such as West Virginia coal miners who become technologically displaced and structurally unemployed rather abruptly. Another strategy would be to estimate the slope of the line b_2P_1, extrapolate it to P_3 and subtract this earnings projection from the line segment P_1P_3. This will result in positive benefits, but a considerable understatement. A third alternative would be to estimate the slope of the curve $B_2P_3B_4$. This will result in an overstatement of benefits, since the earnings profile has an inflection point (it changes direction of slope) at Point P_5. Thus, none of these alternatives is very satisfactory.

Hardin and Borus experimented with their Michigan retraining data and found the gains from retraining were $1,524 using a before-after method; when using a control group, the gains were only $216 in the 365-day period after training--a difference by a factor or more than seven.[79/] Thus, depending when one begins his before-after estimation on the time profile of income, serious under- or over-estimates of benefits can occur.

79/ Hardin, Einar and Borus, Michael E. Economic Benefits and Costs of Retraining Courses in Michigan. East Lansing, Michigan: Michigan State University, December, 1969.

The Pejovich, et al., study relies on a before-after comparison to estimate the rates of return to a variety of skills taught in a postsecondary vocational school in Texas. Estimates of average private rates of return range from 27 to 168 percent and average social rates of return from 15 to 94 percent. If one crudely reduces these by a factor of seven, it is obvious that the estimated rates of return would drop to modest and often very low levels, and they would be closer to the 16.5 percent return to postsecondary vocational education estimated by Carroll and Ihnen.[80/]

Likewise, in the study edited by Mangum and Robson, if the benefits are reducible by a factor of seven, wage rate differences ranging from 30 to 64 cents per hour for manpower programs in Boston would drop to a range of about 4 to 9 cents per hour or to annual benefits based on a 2,000 hour year ranging from 80 to 180 dollars per year instead of over 1,000 dollars.[81/]

80/ Pejovich, et al., op. cit., p. 53 and Carroll and Ihnen, "Costs and Returns...," op. cit., p. 869.

81/ Mangum and Robson, editors, op. cit., pp. 4-9, and elsewhere.

However, serious problems also exist in the absence of a true experimental study model where the experimental and control groups are selected before treatment from a similar population of subjects. Manpower training benefit-cost studies have variously used program dropouts, unemployed or underemployed registrants at employment security offices, and eligible persons who were accepted into the program but who did not participate. Although most socio-demographic characteristics can be controlled for, the persistent problem of self-selection into the program remains to bias results. No technique thus far has been too successful in controlling for such bias, though the estimation of a discriminant function is a help. A discriminant function permits an estimate of the probability of a person who is included in the control group being a member of the experimental group. One general statistical estimation technique for the discriminant function is known as probit analysis.[82/]

Vocational and technical education presents a particularly difficult problem when one seeks to develop a meaningful control group. Generally, participants in vocational or technical programs are compared against those in the general or college preparatory curriculums. However, there exists a fundamental problem in that all these groups do not come from the same population of students. It can be expected that each of these persons will place a different weight on earnings, job status, the value of additional college education, and other factors associated with the multiple outcomes of education. Generally, these relative weights are not known. Thus, for instance, if wage rates or earnings are used as a simple index of program benefits, a bias can result. If vocational graduates place less emphasis on job status and more emphasis on earnings

82/ See, for instance, Laumann, Lydia Fischer. "Effects of Project Headstart, Summer, 1965: A Second Look at the Equality of Educational Opportunity Study," Discussion Paper 47-69, Institute for Research on Poverty, University of Wisconsin, Madison, Wisconsin, August, 1969.

than from the standpoint of, say, college preparatory students whose emphasis may be the reverse, benefits to vocational education may be over-estimated. Due to the fact that the different types of students are attempting to maximize different sets of satisfactions (or utility functions), there is, as yet, an unresolved problem with the use of these types of curriculums as control or comparison groups with vocational or technical graduates.

Some work is now being performed to attempt to estimate the relative weights students of different curriculums place upon the job characteristics they seek. Of particular interest is the work being done by Impellitteri and Kapes with ninth grade vocational and non-vocational students. The authors have developed analyses whereby relative occupational rankings are estimated in terms of such factors as advancement, salary, prestige, security, personal goals, preparation and ability and interest and satisfaction.[83/]

Most of the cost benefit studies reported here use comparison groups which have been selected randomly or judgmentally on the basis of a desired characteristic or set of characteristics. However, both the Carroll and Ihnen and the Schriver and Bowlby studies use a matched pair selection basis. One drawback of this technique is that it quickly becomes difficult to match on more than a few distinct characteristics. In addition, as with the more typical random selection of an experimental and comparison or control group, one does not escape the fact that the two groups may still come from different samples. There is always self-selection bias to deal with as long as a true experimental sampling framework is not established.

83/ See Joseph T. Impellitteri and Jerome T. Kapes, The Measurement of Occupational Values, Vocational Development Study Series, No. 3, Department of Vocational Education, Pennsylvania State University, University Park, Pa., September 1971. See also Jerome T. Kapes, The Occupational Values of Ninth Graders Who Select a Vocational vs. a Non-vocational Highschool Curriculum, Department of Vocational Education, Pennsylvania State University, University Park, Pa., December 1969.

Finally, while it is not necessarily more expensive and while you can exactly control your sample on any specific list of characteristics, a large enough random sample would allow one to select the same subgroup from it, e.g., White males of average I.Q., while providing one with much larger sample sizes to perform analyses on other types of subgroups. And regression techniques will allow one to net out various interaction effects among critical independent variables if this is desired, a process which ought to be performed on matched pair samples, too, for unmatched socio-demographic characteristics.

Problems with Non-Response. Almost every sample chosen will have non-respondents, persons, who, for whatever reason, can't be located or refused to reply to the study. Exceptional expenditures of funds, often several hundred dollars per observation, can reduce the bias, but obviously it will seldom be the case that all respondents will be located and interviewed.

Also, there is no magic response rate less than 100 percent which will ensure that no bias exists in the end result, as long as nonresponse is not random. If nonresponse is truly random, a 10 percent response rate would be acceptable. If it is grossly nonrandom, a 90 percent rate will not suffice to ensure unbiased results. And, when one wishes to perform analysis on sample subsets, even very high response rates will not ensure non-bias. The finer the subset one performs analysis on, the greater is the likelihood of bias.

The question of nonresponse, then, is a practical one. What does one do about it?

One technique is to attempt to impute values for the missing observations or incomplete answers to questions from responding study members. This is the method employed in the Four Manpower Longitudinal Study being conducted by Operations Research, Inc., with funding from the Office of Economic Opportunity. Another method is to impute sample weights to adjust for non-response. Econometric proofs have shown that a variety of techniques designed to serve the latter of the two problems above always result in biased estimates of one's regression coefficients. And, of course, the problem is no different conceptually if one is using only cross classification techniques to study program effects.[84/]

84/ See Jan Kmenta, Elements of Econometrics, Chapter 9. Also A. A. Afifi and R. M. Elashoff, "Missing Observations in Multivariate Statistics I. Review of the Literature," American Statistical Association Journal, September, 1966; and by the same authors, "Missing Observations in Multivariate Statistics II. Point Estimation in Simple Linear Regression," American Statistical Association Journal, March, 1967.

Table 6

Non-Response Rates of Selected
Cost-Benefit Studies

Study	Type of Instrument	Non-Response Rate in %		
		No Answer	Dead Letter	Total
Hu, et al. [1]	Mail Questionnaire	33	33	66
Eninger [2]	Mail Questionnaire	--	--	68.3
Somers, et al. [2]	a) Mail Questionnaire	--	--	60.5 [3]
	b) Mail Questionnaire	--	--	55.9 [4]
	c) Mail Questionnaire	--	--	50.9 [5]
Schriver and Bowlby [6]	Mail Questionnaire	15.6	11.0	26.6

Notes:
1/ Approximate. Exact figures are not shown.
2/ Based on usable returns
3/ Secondary school sample
4/ Post-secondary school sample
5/ Junior college school sample
6/ A small payment was enclosed

Sources: See bibliography at end of chapter

However, one approach is to test the sample for the presence of non-response bias. Most of the cost-benefit studies discussed here do so by sampling a group of nonrespondents and applying a means test for significant differences between the response and nonresponse sample for each of a set of given critical characteristics. However, this procedure is not foolproof and obscures the fact that interactions within samples among variables whose means do not differ between samples can exist and bias the results. Each time a particular dependent variable is analyzed that particular model and set of variables should therefore be checked for nonresponse bias. The one-shot comparisons of gross means is not sufficient. Two alternatives exist to test for non-response bias. The first is the "test for equality of coefficients among two regression models." Such a test will allow each crucial evaluative model, say, an estimate of the effect of the vocational curriculum on earnings, to be tested for possible nonresponse bias. The Hu et al. study outlines the procedure. However, the error made in this study was that every regression model was not tested. The authors tested only the earnings model for the sample as a whole.[85/] To reaffirm, in our judgement, each crucial analytical model must be tested. If sample sizes are large enough one can test for non-response bias by means of adding dummy variables to the model to account for the behavior of the non-response group.

Thus, assume the following model:

$$Y_i = a_1 + a_2 \; x_{1i} + U_i$$

85/ Hu, et al., op. cit., Appendix IV.

Where X_{2i} = a dummy variable: 1 = respondent sample

0 = nonrespondent sample

and all other variables are as above. In this model, the variable X_{2i} tests for differences in the average level of earnings between the response and the nonresponse group. The interaction term, $X_{1i}X_{2i}$, tests for differences in the slope of the earnings function between the response and the nonresponse sample. If the regression coefficients, a_3 and a_4, are not statistically different from zero, then there is no nonresponse bias for this model of the study.[86/] However, since interaction terms can multiply quickly in a study with a large number of independent variables, large sample sizes may be needed to use this technique.

The quality of economic knowledge and understanding is high in this study as is the feeling for the institutional framework in which the educational process is occurring. The statistical estimation of benefits is generally sound and the estimation of costs properly executed. The matched pairs methodology allows for the establishment of an appropriate comparison group. Also, an effort has at least been made to catalog the value of fringe benefits. On the negative side, the study ignores capital costs though the rationale that short run average costs are only being considered is appropriate to justify the omission. Next, the earnings model contains two variables -- military service and size of high school -- whose interpretation is ambiguous as has been pointed out below. Even given this ambiguity, the authors leave the variables in the model in their present form.

86/ Damodar Gujarati, "Use of Dummy Variables in Testing for Equality between Sets of Coefficients in Two Linear Regressions: A Note," The American Statistician, February 1970 and "Use of Dummy Variables in Testing for Equality between Sets of Coefficients in Two Linear Regressions: A Generalization," The American Statistician, December, 1970.

The Taussig study contains numerous suggestions as to sound research methodology, but the empirical results can only be considered suggestive due to the poor quality of the data. Taussig recognizes the difficulties in establishing an appropriate control or comparison group. There is a careful cataloging of program outcomes and the nature of various types of benefits, but, with the limited data, little can be done to get estimates of these. There is an awareness of the difficulties involved in trying to impute marginal costs based on average cost estimates. There is also an awareness of the complications which unemployment adds to the estimation of benefits. However, on the negative side, the benefit period for follow-up is very short--a few months. Only wage rate differentials and not earnings are estimated. In a generally careful discussion of control groups, Taussig does not mention the main point that the objective functions (utilities the person wishes to maximize) differ among students in the various curriculums. To some extent the two curriculums--college preparatory and vocational--represent non-competing groups. Also, the treatment of capitol costs is inadequate as pointed out below. Also, Taussig was not able to adequately control for a variety of critical socio-demographic factors which would necessarily influence the estimate of net benefits. In short, the study provides prima facie evidence that vocational education does not perform well in New York City, but the conclusions are much too sweeping given the quality of the data.

Kraft reproduces much that is reported in Hu, et al., often verbatim, but the general impression one gets from reading this work is that the theoretical aspects of analysis still are not well synthesized by the author. In general, the Kraft study tends to be unwieldy. The study repeatedly confuses money benefits as a measure of total utility. The attempt to develop a new cost-utility decision rule resulted in inconsistencies the author was apparently unaware of. Other indices of program performance worked out by the author are of marginal value in a decision making context. The actual empirical basis of the study is limited since

it concerns measures of costs and benefits from only two vocational schools in Florida. The study does not have a control group but does rely on area wage surveys to calculate foregone earnings. Earnings progressions are based upon a cross-sectional data derived from observations on graduates in three successive years. We would argue that benefits are upward biased. The author is aware of the possible biases in his measurement technique. A simple pay-back period is used as a decision criterion. Overall, the results of this study must also be considered as suggestive.

The Eninger studies have a good data base but suffer from the fact that no clean cut model of analysis is implemented so that much of the richness of the data and the author's excellent mail questionnaire job history for the process and product study remain unexploited. These data, both the original "Process and Product" data and the more recent and less rich data from the METRO Study should be extensively reworked using properly specified benefit models;[87] with appropriate statistical technique to test for response bias in the various models, these two data bases could supply some very instructive analysis of relatively high reliability. As the analyses now stand, however, the results simply fail to make use of the relative richness of the data base. No model testing is attempted, the simplest cross-tabulations and correlation analysis is displayed. The studies are characterized by multitudinous cross-tabulations with little analyses or analytical core. Even the question of declining earnings benefits to vocational education is suspect in the product study because a proper model was not used to arrive at this result--the gross difference between college preparatory and Trades and Industry students is displayed among three different sample cohorts.

87/ Max U. Eninger, Project METRO--Evaluation Data on Vocational Educational Programs in Major Metropolitan Areas, Vols. I, II and III, Pittsburgh, Pa.: Educational Systems Research Institute, 1971.

The Person's, et al., study suffers heavily from an improper application and emphasis of statistical tools. As a result, the findings are unreliable in their present form. The data should be reworked, since the benefit functions as they now stand are inconsistent with economic reasoning.

Corazzini's study, as one of the first in the field, deserves attention. The main problem with the Corazzini study is the lack of an adequate post-training followup period. Entry wage rate differentials are used to estimate benefits. Thus, the results of this study remain suggestive also. The discussion on drop-outs in the various versions of his study are methodologically useful, but, of course, are marred by the poor data on wage rates.

The Vincent study, like the Eninger study, suffers from a lack of analytical richness and sophistication. Some of the author's conclusions are opposite of what his data show--he claims no economic returns when his tables on earnings show a gross differential in favor of vocational education. These Project TALENT data must also be reworked within the context of appropriate benefit models since the conclusions are not adequately supported by the analytical methodology used by Vincent. The current results, too, are only suggestive.

The Somers, et al. study is useful because of its focus on junior college and postsecondary vocational education. Careful attention was given to the development of the benefit models used in the study, but high non-response rates mar the usefulness of the analysis. The models should be re-estimated, as suggested above, to test for non-response bias. The cost-benefit chapter, especially the cost systhesis, is carefully done, but other cost-benefit comparisons could and should have been made. The Fernbach-Somers study is just an earlier version of the Somers, et al. study. The comments are the same for the two.

Sharp-Myint study is based on the same data base as the Somers,

88/ Laura M. Sharp and Thelma Myint, Graduates of Vocational-Technical Programs in Junior Colleges: Results of a Follow-up Study of the Class of 1966, Washington, D.C.: Bureau of Social Science Research, Inc.,1970.

Thus, the comments above apply to it also. While cross-tabulations are heavily relied on for data analysis, the analysis is of high quality and expresses a fundamental knowledge of the underlying economic reasoning--a factor largely absent from the work of Eninger.

The Schriver and Bowlby study is likewise of interest since it focuses on the area vocational technical school. While the level of economic sophistication is high and the underlying social science methodology is reliable, once the authors finish their final sample selection and matching, the sample is quite different from the original population which they surveyed to draw the initial sample frame. The authors begin with a 25 percent sample of the 19 area vocational technical schools in Tennessee. They have 1701 observations. Eventually they exclude persons currently in the armed forces; those with less than 300 hours of instruction; those with substantial physical disability or financial support from the state rehabilitation agency; those who left the school to attend college; and those with less than a full year of labor force experience in 1969. This cut the sample to 679. From this group were excluded students who did not graduate from a Tennessee high school; anyone born before January 1, 1943; anyone with college before his area vocational school training. This reduced the sample to 334. Further attempts to match resulted in the sample dropping to 249. The matching criteria concerned errors or falsifications in AVTS applications; those with grade point averages inconsistent with their IQ's; graduates of high schools merged out of existence; one black student from a predominantly white high school; and a few graduates from extremely small schools. Thus, almost 1500 observations were lost. In our judgment regression analysis would have been a more efficient way to control for all these educational and socio-demographic differences. Yet for the remaining sample the data are relatively reliable. Social Security records were used so that much interviewee response error is eliminated. Of course, social security data has problems of its own. For instance, true wage rates, hours worked and employment and labor force participation rates are either not

known or can only be approximated. Also, the study uses the multiplier concept improperly and has an improper investment-consumption trichotomy. Yet, the results are generally reliable for the limited sample base.

The Pejovich study is only suggestive in its results due to the before-after study methodology. Since it is only a case study as is the Carroll and Ihnen study, one should appeal to the latter study if one wishes to get a handle on the rate of return to postsecondary technical education.

The Hu, et al. study is generally sound. There is a proper estimation of marginal and average costs. However average benefits are not peoperly estimated, and marginal benefits are strictly speaking only the difference between two averages. The benefit models are generally sound although the behavior of the father's education variable suggests a misspecification in the functions. The study fails to adequately test for non-response bias but there is considerable awareness of all the major methodological issues. The study results may be somewhat upward biased for Cities A and C though this judgement is made only on the basis of the known high non-response rate. We would argue that, on net, for these cities, the figures are in the ball park.

The Kaufman-Lewis study and the Kaufman, et al. [89] study deal with separate components of the same data base--an original survey of nine cities of three different sizes. There is a problem with the definition of earnings. The questionnaire failed to specify whether before or after tax earnings were requested. There is also a problem with non-response bias which is not properly tested for. Both studies are largely institutional and as such are valuable additions to the literature. However, the data analysis in the Kaufman, et al. study is relatively simple. Much more sophisticated analysis could have been performed to get at the

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89/ Kaufman-Lewis, op cit.; Jacob J. Kaufman, et al., The Preparation of Youth for Effective Occupational Utilization, University Park, Pennsylvania: Institute for Research on Human Resources, The Pennsylvania State University, 1967.

underlying characteristics of the data and arrive at program effects more net of the influence of interviewing socio-demographic variables. Thus, with the Eninger data, the analysis is at a relatively gross level, and is limited in its applicability on that basis.

Unfortunately, for a variety of reasons, each of these studies is flawed. It is thus still unclear, except at the most gross level of analysis, just what are the private and social costs and returns to vocational education.

SUMMARY AND CONCLUSIONS: SOME OBSERVATIONS ON IDEAL METHODOLOGY

Depending upon the ultimate objectives of the researchers, each evaluation study has problems peculiar to itself. Thus, a study designed to determine the psychological impact of an educational program must concern itself with the development of indices to measure the intended psychological outcomes. A study designed to measure the impact of a poverty program on inner city Blacks has the problem of locating people with marginal adherence to "conventional society". A study which, due to economic constraints, is conducted by means of mail questionnaire has the problem of non-response bias. However, it is possible to provide some general guidelines which can indicate the desired elements of any evaluative research design intended to estimate the impact of a social or educational program.

To a great extent, the body of this appendix outlines the appropriate elements of an ideal research design, so much of what is presented here is by summary. The major elements are as follows:

1. Specification of Goals or Objectives. Regardless of whether one is conducting a cost-benefit study or any other study to evaluate program impact, the goals and objectives of the programs must be specified in operational form by the program administrators. Indices of performance of the program goals must be developed and agreed upon jointly by the investigators and program administrators.

2. Specification of Program Operation. The way in which the program works - that is, how it achieves its goals and objectives - must be specified. Again, this should ideally be done by the program administrators in conjunction

with the researchers. In economic analysis, this specification amounts to a description of a production function - a statement of how program inputs are interrelated and create the desired program outputs. In education, we would talk in terms of educational production function which would be ultimately based upon a theory of learning behavior. Without such a specification it is difficult to talk in terms of cause and effect. Without such a specification one does not know how to exercise choice among the vast array of variables and functional relationships which may exist among these variables. This choice is hard enough when one does have the guidance of a theoretical model. It is next to impossible to evaluate any empirical results in the absence of a theoretical model of behavior based on sound institutional underpinnings.

3. Specification of Control Groups and Behavioral Outcomes. If the study is intended to discover some "ideal" or "desired" or "optimum" way of performing some action, one must:

a. Specify the proper set of behavioral comparison to make including the choice of an appropriate control group (e.g., earning comparisons between Black. secondary, vocational and college preparatory curriculum graduates);

b. One must measure relative as well as absolute costs and benefits. This can be done in monetary or non-monetary terms. In the later case, one does not always price the value of inputs and outputs. Often, they can not be priced. In such a case, differences among any two of the three broad sets of characteristics, inputs, outputs or the comparison groups, must be standardized. Thus, for instance, one can discover the relative psychological or behavioral impact of a set of competing or substitute educational programs on White males, under age 35 with less than 12 years of education, for a given level of expenditure per person. With this standardization, the distinction of the programs which results in the greatest relative impact for a given index or set of measures is the desired program.

4. Identification of the Locus of Cost and Benefit. The cost of a program represents the value that its resources could produce in their next best alternative use. Benefits are the opposite of costs and are completely analagous. It is important to distinguish between activities which use up resources - costs - and those which just redistribute resources - therefore payments.

What is a cost (benefit) to one economic group may not be a cost (benefit) to a different economic group. Thus, costs as benefits to tax payers or the Federal government would not necessarily represent all or a portion of total resource costs. The same is true for benefits. In addition, one must be careful not to mix one's concept of cost and benefit so that, for instance, elements of private and social resources costs are included in the same measure. Finally, an attempt must be made to ascertain the nature and magnitude of any external effects of a program, whether they be benefits or costs. It is insufficient to simply assert that they exist.

5. Methodology of Analysis. Social science research of this type implies the use of fairly complex models, of economic, psychological, political or social behavior. This implies the potential use of a wide variety of variables and often complex interrelationships among them. Cross-tabulation is a necessary adjunct to such analysis but can not begin to handle the richness and complexity of such behavior and data. Regression analysis, analysis of variants, factor analysis and similar research methology represent the desired techniques for dealing with such data. Also, the use of such relatively sophisticated techniques reveals not only the richness of the data but also the underlying statistical problems in the data. Thus, we become aware of the

difficult problems of proper choice and definition of variables and proper specifications of functional interrelationships, impulation of cause and effect, auto-correlation, multi-collinearity, regression fallacy, heteroskedasticity, and other problems with data analysis which exist regardless of the research methodology used - cross-tabulation or otherwise. Awareness of these difficulties and undertaking the proper process to their solution will mean the difference between a valid and a non-valid analysis.

6. Non-response Bias. With inconsequential exceptions, every study will have non-response bias. The proper methodology to handle this exists but has been employed with rare exceptions. Eighty percent response rates do not insure against such bias. Comparison of sample growth means among variables for response and non-response groups do not constitute a complete test of the presence of bias.

7. Sample Selection. It is almost never necessary to study the entire universe of program participants. Random probability samples are the desired method of selection of program participants for study, if for no other reason that it is less expensive to check for errors in data in a sample than it is to check for such errors in a universe. Selection of judgemental samples should be avoided.Unless there is a clear cut reason for such judgemental selection on the basis of a particular program's anticipated good or bad performance it is not a proper basis for selection. Judgemental selection of exemplary programs is meaningful only if the characteristics of such programs can be replicated elsewhere. Otherwise, one simply has another case study from which it is difficult to generalize.

8. Self-selection Bias. Except for studies using a true experience model, desired program analysis will be affected by social bias. In more general terms, this means that the behavior of the experimental and control group differs in some fundamental fashion. Thus, it is necessary to statisii-cally control for such differences, usually through multi-variable analysis. With properly specified statistical functions, probit analysis can be arranged to adjust for such differences. Without such control, effects which one attributes to program differences may really be due to socio-demographic, psychological or motivational differences among the comparison groups.

In concluding, the specifications of a particular design for the "ultimate" evaluation study can not be done except in the broadest terms. Each study will have problems peculiar to itself which would require the modification of the design. In addition, a list of issues one could address oneself to is extremely long and complex as the above discussion has shown. Some part of analysis is an art just as in medical diagnosis. Some part of it is merely good business management- organizing a competent and compatible team of researchers, and part of it is relatively cut and dried - the coding of statistical data. Thus major points can simply be elucidated. Ideal approaches to specific issues can sometimes be specified by each research project, especially large and complex ones, are a special breed. Statistical and sampling totals, experience with working with data, knowledge of educational theory and institutions, economic knowledge and awareness of complex socio-economic behavior all must be combined in a single research operation in order for the effort to be a success. Yet, as we have seen, the above studies all fail to meet the ideal test in one or more ways. The Hu, et al., study, one of the better ones, effectively ignores

the problems of non-response. The various Eninger studies only crudely exploit the research data base available to the researchers. The Taussig study is excellent for methodological analysis. Indeed, it is the strength of the methodological analysis which lends what little credence there is to the data in this study. The study of manpower programs edited by Mangum and Robson is strong in institutional analysis but weak empirically. None of the extant studies succeeds in being an ideal model to follow in every respect and as much can be learned from the mistakes and shortcomings of each as can be learned from the sounder aspects of their methodology.

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Appendix B

Selected Statistics on the Cost-Benefits of Vocational Education at the Secondary, Post-Secondary and Junior College Levels from Various Sources

Appendix Table B-1

Socio-Demographic Characteristics of National Longitudinal Surveys Sample of Young Men, Aged 16-26, October-December, 1968

Sample Group 1/

Socio-Demographic Characteristic:	Total Out of School	18 & Under	19 & Over	White	Black	Non-White	Married	Never Married	Professional	Managerial	Sales	Clerical	Skilled	Operative	Laborer	General	College Preparatory	Vocational	Vocational Commercial
Number of Observations	1918	361	1557	1338	569	580	1017	842	215	90	59	167	321	636	322	970	373	221	253
Marital Status(percentage)																			
Single	43.9	84.9	35.4	39.7	54.2	53.8	---	---	28.2	20.0	45.6	54.9	34.6	44.0	58.6	42.3	45.8	48.0	48.8
Married	53.0	15.5	61.7	58.1	41.0	41.4	---	---	60.9	80.0	59.3	43.7	63.9	52.7	37.0	54.3	53.6	47.5	48.2
Widowed, Separated, Divorced	3.1	0.6	3.7	2.3	4.8	4.8	---	---	1.9	0.0	5.1	2.4	2.5	3.3	4.4	3.4	1.6	4.5	4.0
Age in Years	21.83 (2.97)	17.53 (0.62)	22.83 (2.34)	22.09 (2.93)	21.22 (2.96)	21.23 (2.95)	23.14 (2.40)	20.16 (2.78)	23.47 (2.15)	23.31 (2.04)	22.66 (2.58)	21.57 (2.98)	22.42 (2.88)	21.39 (2.99)	20.63 (2.92)	21.78 (2.92)	22.38 (2.87)	21.32 (3.00)	21.37 (3.04)
Ethnic Origin (percentage)																			
White	70.7	61.9	71.8	---	---	---	77.4	63.9	89.8	93.3	91.5	68.3	80.8	67.1	49.3	70.6	83.7	70.6	73.1
Black	29.7	38.8	27.6	---	---	---	22.9	36.7	10.7	6.7	8.4	31.7	19.9	32.6	48.8	29.8	15.8	29.4	26.9
Other	0.6	0.3	0.6	---	---	---	0.7	0.4	0.5	0.0	0.0	0.0	0.3	0.3	1.9	0.6	0.5	0.0	0.0
Highest Grade Completed	11.45 (2.59)	10.68 (2.07)	11.63 (2.67)	11.92 (2.40)	10.36 (2.66)	10.36 (2.68)	11.58 (2.60)	11.35 (2.60)	14.97 (2.11)	12.77 (2.38)	12.76 (1.76)	12.06 (2.05)	11.06 (1.99)	10.80 (1.99)	9.98 (2.67)	11.66 (1.66)	13.78 (2.14)	11.67 (1.08)	11.74 (1.11)
Age Left School in Years	18.06 (2.76)	16.64 (1.58)	18.40 (2.87)	18.37 (2.80)	17.34 (2.50)	17.36 (2.52)	18.31 (2.94)	17.81 (2.52)	21.62 (2.57)	19.66 (3.06)	19.47 (2.76)	18.66 (2.35)	17.52 (2.48)	17.42 (2.04)	16.65 (2.27)	18.09 (2.30)	20.16 (2.65)	17.83 (1.70)	17.39 (1.85)
Curriculum (percentage)																			
General	60.8	62.5	60.4	57.6	69.5	69.6	62.1	58.7	34.1	44.4	48.3	54.6	64.9	71.3	68.2	---	---	---	---
Commercial	2.0	2.4	1.9	2.5	0.7	0.7	2.0	2.2	0.5	3.7	3.5	4.6	1.9	1.7	1.4	---	---	---	---
College Preparatory	23.4	18.4	24.5	26.6	14.2	14.4	23.6	23.9	59.2	43.2	43.1	29.0	14.0	12.3	13.1	---	---	---	---
Vocational	13.9	16.7	13.2	13.3	15.6	15.3	12.4	15.2	6.2	8.6	5.2	11.8	19.2	14.8	17.3	---	---	---	---

Appendix Table B-1 (continued)

Socio-Demographic Characteristics of National Longitudinal Surveys Sample of Young Men, Aged 16-26, October-December, 1968

[1/]

Socio-Demographic Characteristic:	Sample Group: Total Out of School	18 & Under	19 & Over	White	Black	Non-White	Married	Never Married	Professional	Managerial	Sales	Clerical	Skilled	Operative	Laborer	General	College Preparatory	Vocational	Vocational Commercial
Type Post High School Training (percentage)																			
Business School	3.1	3.9	3.0	3.4	2.6	5.0	1.9	5.0	4.2	1.1	0.0	6.0	2.5	3.3	3.1	3.4	5.1	3.2	3.1
Company School	9.0	4.7	10.0	10.8	4.9	0.2	11.6	6.2	12.6	20.0	18.6	10.0	12.5	6.6	2.2	8.6	15.3	11.3	11.1
Correspondence School	2.0	1.1	2.2	2.8	0.2	1.4	2.8	1.1	2.8	6.7	5.1	3.6	1.6	1.6	0.3	1.8	3.2	1.8	1.6
High School	3.0	2.2	3.3	3.8	1.4	5.7	3.8	2.3	12.1	2.2	1.7	1.2	1.9	2.5	1.2	2.0	7.0	3.2	4.0
Other School	6.3	6.7	6.2	6.5	5.6	3.6	6.4	6.3	7.9	3.3	3.4	7.2	6.9	6.6	2.8	6.6	7.0	7.2	6.3
None	76.6	81.4	75.3	73.7	85.3	84.1	73.5	78.2	60.4	66.7	71.2	72.0	74.6	79.4	90.4	77.6	63.4	73.3	73.9
Labor Force Participation Rate*	.986	.975	.989	.985	.990	.990	.994	.976	.991	1.000	1.000	.970	.984	.992	.975	.990	.979	.996	.996
High School Graduation (percentage)	69.3	67.0	69.9	76.7	49.4	49.5	65.7	73.7	97.8	87.9	93.6	84.6	60.6	58.2	48.3	68.1	96.3	73.4	75.9
Average Weekly Earnings In Dollars*	115.05 (48.73)	87.61 (33.43)	121.41 (49.52)	125.39 (49.33)	90.83 (37.81)	91.18 (37.77)	130.68 (49.98)	95.87 (39.87)	140.72 (45.51)	158.37 (67.62)	137.34 (61.53)	108.66 (34.23)	126.32 (49.27)	113.13 (42.23)	85.03 (37.60)	115.83 (46.72)	133.05 (53.92)	117.14 (45.00)	118.94 (46.30)
Attend Some College (percentage)	34.2	27.6	36.0	40.9	16.3	16.5	29.0	40.7	86.4	56.1	59.1	46.6	16.9	14.4	14.6	34.7	78.1	18.7	22.0

Source: National Longitudinal Surveys, Survey of Work Experience of Young Men, 1968, U.S. Department of Commerce, Bureau of the Census and the Center for Human Resource Research, Ohio State University, Columbus, Ohio, 1968.

Notes:

1/ Sample sizes vary according to the variable. Sample sizes above do not apply to curriculum, % high school graduation or % attending some college. Numbers in parentheses are standard deviations of the sample means. The sample excludes all persons attending high school either part or full time. The variables starred (*) above also exclude in their calculation all persons attending college part or full time.

Appendix Table B-2

Effects of High School Curriculum on Average Weekly Earnings, Males, Age 14-24, Attending No Educational Institution, for Survey Week. October-December 1966, Separate Regressions for Total Sample and Ethnic Groups

Sample Group		College Preparatory b	College Preparatory (s)	General b	General (s)	Commercial b	Commercial (s)	Vocational b	Vocational (s)	Dependent Variable (weekly earnings) M	Dependent Variable (weekly earnings) (s)	N	$\bar{R}^2$ 2/
Total Out of 1/ School Sample	A	----	----	-5.21	(2.96)	3.96	(6.75)	-4.29	(3.88)	84.56	(43.19)	1272	.326
	B	4.34	(3.88)	- .90	(3.06)	8.27	(6.84)	----	----				
White	A	----	----	-5.21	(3.59)	6.78	(8.33)	-3.69	(4.85)	94.67	(44.59)	893	.266
	B	4.05	(4.86)	-1.20	(4.04)	10.79	(8.55)	----	----				
Negro	A	----	----	-8.04	(5.21)	- .42	(11.50)	-8.77	(6.21)	63.01	(30.70)	370	.231
	B	8.76	(6.21)	.72	(4.14)	8.35	(11.22)	----	----				
All Nonwhite	A	----	----	-8.31	(5.11)	- 4.55	(10.80)	-8.98	(6.13)	63.10	(30.48)	378	.226
	B	8.97	(6.13)	6.70	(4.11)	4.43	(10.54)	----	----				

Source: Unpublished data, National Longitudinal Surveys. Survey of Work Experience of Males, 14-24, 1966, U.S. Department of Commerce, Bureau of the Census and Center for Human Resource Research, Ohio State University, Columbus, Ohio.

Notes:

1/ In addition to the curriculum variable above, each regression model controls for marital status (married, never married, widowed, separated or divorced); race (white, black, and other); college or noncollege attendance; highest grade of school completed age at which respondent left school; post-high school training other than college (business school, company school, apprenticeship or none). For the three race subgroups, the race variable is omitted from the regression model. These models omit all persons in the sample who are attending high school or any post-secondary institution, either part-time or full-time.

The regression coefficients are interpreted as deviations from the average experience of the omitted regressor for each equation. Thus, for the total out-of-school sample, equation A, students in the general curriculum earned $5.21 per week less than did students in the academic curriculum. The difference is not statistically significant. For the same equation, there is no difference between the weekly earnings of the academic and vocational curriculums because the coefficient for vocational education is not statistically significant.

2/ The R^2 is the same for each pair of regressions (A and B) for a given sample subgroup.

b is the partial regression coefficient
(s) is the standard error
* = statistically significant at the .05 level
** = statistically significant at the .01 level
R^2 is the coefficient of determination
M is the mean of the dependent variable

Appendix Table B-3

High School Curriculum and Vocational Skill Area Effects on Average Weekly Earnings, Males, Age 14-24, Attending No Educational Institution, for Survey Week, October-December 1966, Separate Regressions for Total Sample and Ethnic Group

		College Preparatory		General		Commercial		Metal		Wood		Electric		Mechanical	
Sample Group		b	(s)	b	(s)	b	(s)	b	(s)	b	(s)	b	(s)	b	(s)
Total Out of School Sample	A	----	----	-5.18	(2.97)	- 3.98	(6.75)	- .94	(14.22)	- 3.87	(9.63)	-16.31	(9.58)	4.40	(6.08)
	B	5.21	(2.97)	----	----	9.17	(6.37)	4.25	(14.00)	1.31	(9.31)	-11.12	(9.28)	9.50	(5.59)
White	A	----	----	-5.20	(3.60)	6.80	(8.34)	- .25	(18.30)	- 3.03	(11.61)	-22.62	(12.49)	1.78	(8.50)
	B	5.25	(3.60)	----	----	12.01	(7.91)	4.96	(18.07)	2.17	(11.26)	-17.41	(12.20)	6.98	(8.05)
Negro	A	----	----	-8.26	(5.21)	- .60	(11.49)	-14.63	(20.37)	-12.61	(17.07)	- 6.39	(13.38)	1.81	(7.91)
	B	8.25	(5.21)	----	----	7.65	(10.67)	- 6.38	(19.75)	- 4.35	(16.40)	1.86	(12.64)	10.07	(6.49)
All Non-White	A	----	----	-8.53	(5.11)	- 4.66	(10.79)	-15.02	(20.25)	-13.15	(16.97)	- 6.76	(13.29)	1.79	(6.45)
	B	8.53	(5.11)	----	----	3.87	(9.95)	- 6.50	(19.65)	- 4.62	(16.38)	1.76	(12.57)	10.32	(6.45)

Appendix Table B-3 (Continued)

		Other Building Trades b	(s)	Other b	(s)	$\bar{R}^2$	F
Total Out of School Sample	A	- 7.54	(10.67)	- 6.74	(4.97)	.328	30.58
	B	- 2.36	(10.36)	- 1.56	(4.40)		
White	A	- 8.30	(15.64)	- 2.93	(6.17)	.269	17.88
	B	- 3.09	(15.38)	2.28	(5.58)		
Negro	A	-11.56	(12.52)	-18.57	(8.00)	.243	6.27
	B	- 3.30	(11.53)	-10.32	(6.52)		
All Non-White	A	-11.93	(12.43)	-18.81	(7.92)	.238	6.25
	B	- 3.41	(11.47)	-10.29	(6.48)		

Source: See Appendix Table B-2

Notes: See Appendix Table B-2

The sample sizes and means and standard deviations of the dependent variable are the same as in Appendix Table B-2.

Appendix B-4

Effects of High School Curriculum on Weekly Earnings, Males, Aged 16-26, Survey Week, October-December, 1968, by Separate Regressions

Samples Sub-Group [1]		College Preparatory b	College Preparatory (s)	General b	General (s)	Commercial b	Commercial (s)	Vocational b [2]	Vocational (s) [2]	M [3] (s)	N	R^2
Total Out-of-School	A	-7.05	(3.69)	-3.86	(3.02)	3.82	(7.65)	---	---	115.05 (48.73)	1596	.327
	B	--- [2]	--- [2]	3.18	(2.78)	10.86	(7.53)	7.05	(3.69)			
Age 18 and Under	A	-9.69	(6.13)	-1.07	(5.00)	-19.16	(12.68)	---	---	87.61 (33.43)	293	.215
	B	---	---	8.62	(5.04)	-9.47	(12.54)	9.69	(6.13)			
Age 19 and Over	A	-6.37	(4.38)	-4.07	(3.56)	11.15	(9.01)	---	---	121.41 (49.52)	1303	.293
	B	---	---	2.29	(3.23)	17.51*	(8.86)	6.37	(4.38)			
White	A	-6.28	(4.51)	-3.93	(3.80)	2.45	(8.57)	---	---	125.39 (49.33)	1172	.277
	B	---	---	2.35	(3.29)	8.72	(8.36)	6.28	(4.51)			
Black	A	-5.98	(6.44)	-4.98	(4.74)	34.37	(20.16)	---	---	90.83 (37.81)	416	.225
	B	---	---	1.01	(5.25)	40.35*	(20.21)	5.98	(6.44)			
Non-white	A	-6.63	(6.40)	-4.62	(4.73)	34.49	(20.16)	---	---	91.18 (37.77)	424	.223
	B	---	---	2.01	(5.19)	41.13*	(20.19)	6.63	(6.40)			
Married	A	-6.07	(5.93)	-1.97	(4.81)	12.02	(11.66)	---	---	130.68 (49.98)	849	.226
	B	---	---	4.10	(4.36)	18.10	(11.55)	6.07	(5.93)			
Single (Never Married)	A	-10.17*	(4.49)	-5.05	(3.73)	-4.92	(9.49)	---	---	95.87 (39.87)	698	.285
	B	---	---	5.12	(3.45)	5.25	(9.29)	10.17*	(4.49)			

Appendix Table B-4 (continued)

Effects of High School Curriculum on Weekly Earnings, Males, Aged 16-26, Survey Week, October-December, 1968, by Separate Regressions

Samples Sub-Group [1]		College Preparatory b	College Preparatory (s)	General b	General (s)	Commercial b	Commercial (s)	Vocational b	Vocational (s)	M [3] (s)	N	R^2
Professional and Kindred	A	3.95	(11.87)	2.03	(11.93)	36.33	(40.54)	---	---	140.72 (45.51)	211	.361
	B	---	---	-1.92	(5.92)	32.38	(38.57)	-3.95	(11.87)			
Clerical and Kindred	A	3.45	(8.83)	2.19	(7.88)	-5.59	(13.93)	---	---	108.66 (34.23)	152	.346
	B	---	---	-1.25	(5.92)	-9.04	(12.78)	-3.45	(8.83)			
Sales and Kindred	A	-21.40	(39.36)	-46.58	(40.03)	-4.17	(61.28)	---	---	137.34 (61.53)	58	.466
	B	---	---	-25.18	(17.93)	17.23	(47.41)	21.40	(39.36)			
Craftsmen and Kindred	A	-9.35	(9.93)	-9.23	(7.17)	-26.22	(20.77)	---	---	126.32 (49.27)	271	.252
	B	---	---	.13	(8.73)	-16.86	(21.27)	9.36	(9.93)			
Operatives and Kindred	A	-7.71	(6.30)	-3.07	(4.66)	31.33*	(13.28)	---	---	113.13 (42.23)	522	.263
	B	---	---	4.64	(5.13)	39.03**	(13.42)	7.71	(6.30)			
Laborers	A	-11.73	(8.60)	2.07	(6.28)	-6.02	(19.98)	---	---	85.03 (37.60)	214	.301
	B	---	---	13.81	(7.29)	5.72	(20.21)	11.73	(8.60)			
Managers and Kindred	A	-4.24	(30.33)	16.68	(28.29)	33.90	(46.44)	---	---	158.37 (67.62)	81	.255
	B	---	---	20.92	(20.24)	38.14	(44.22)	4.24	(30.33)			

Source: Unpublished data, National Longitudinal Surveys, Survey of Work Experience of Young Men, 1968, U.S. Department of Commerce, Bureau of the Census and Center for Human Resource Research, Ohio State University, Columbus, Ohio.

Appendix Table B-4 (continued)

Effects of High School Curriculum on Weekly Earnings, Males, Aged 16-26
Survey Week, Octover-Decemnter, 1968, by Separate Regressions

Notes:

1/ In addition to the curriculum variable above, each regression model controls for marital status (single, married, widowed, separated and divorced), age, ethnic origin (white Black, other) whether or not some college was attended, highest grade of schooling completed, age at which respondent left school and the square of this regressor, type of school attended for post high school education other than college (none, business school, company school, correspondence courses, high school and other). The sample omits all persons who are still attending high school or college, either full- or part-time.

2/ The regression coefficients are interpreted as deviations from the average experience of the omitted regressor for each equation. Thus, for the total Out-of-School Sample the students following the academic curriculum (equation A) carned $7.05 per week less, on the average than those following the vocational curriculum. However, this estimated difference is not significantly different from zero.

3/ The Sample mean (M), R^2, S.E.E., and F-ratio are the same for each pair of regressions (A and B) for a given sample sub-group.

B is the partial regression coefficient

(s) is the standard error

* = statistically significant at the .05 level

** = statistically significant at the .01 level

M is the mean of the dependent variable

R^2 is the coefficient of determination

rey Week October-December,,1968, Total Out-of-School Sample, for Weighted and Unweighted Regression Models

Independent Variable	Unweighted b	Unweighted (s)	Weighted b	Weighted (s)
Curriculum				
Vocational 1/	----	----	----	----
General	-3.86	(3.02)	-5.31***	(.06)
Commercial	3.82	(7.64)	1.16***	(.13)
College Preparatory	-7.05*	(3.69)	-7.77***	(.07)
Marital Status				
Single 1/	----	----	----	----
Married	20.27***	(2.40)	21.01***	(.04)
Widowed, Separated, Divorced	18.45***	(6.11)	17.77***	(.10)
Age in Years	3.13***	(.42)	4.14***	(.01)
Ethnic Origin				
White 1/	----	----	----	----
Black	-20.29***	(2.35)	-20.98***	(.05)
Other	-9.75	(13.39)	-3.25***	(.27)
Whether or Not Attended College	-1.13	(.80)	.87***	(.07)
Highest Grade of School Completed	5.29***	(.80)	5.12***	(.01)
Age When Left School	-1.98	(2.64)		
Square of Age When Left School	.07	(.07)	.008***	(.001)

Appendix Table B-5 (Continued)

Effects of High school Curriculum on Average Weekly Earnings, Males, aged 16-26 Survey Week October-December, 1968, Total Out-of-School Sample, for Weighted and Unweighted Regression Models.

Notes:

b is the partial regression coefficient

(s) is the standard error of the partial regression coefficient

* = significant at the .10 level

** = significant at the .05 level

*** = significant at the .01 level

1/ This regressor enters into the intercept term. For the particular variable in question, the coefficients of the other regressors are interpreted as deviations from the average experience of the omitted regressor. Thus, in the unweighted regression, students in the general curriculum earned $3.86 less per week during the survey week than did the students in the vocational curriculum. However, the difference is not statistically significant from zero.

Source: Unpublished data, National Longitudinal Surveys, Survey of the Work Experience of Young Men, 1968, U.S. Department of Commerce, Bureau of the Census and the Center for Human Resource Research, Ohio State University, Columbus, Ohio, 1968.

Effects of High School Curriculum on Average Weekly Earnings, Males, Aged 16-26
Survey Week October-December, 1968, Total Out-of-School Sample, for Weighted and Unweighted Regression Models

Independent Variable	Unweighted b	Unweighted (s)	Weighted b	Weighted (s)
Post-High School Training Other Than College				
Business School	-13.16**	(5.86)	-14.22**	(.10)
Company School	11.29	(3.63)	9.20***	(.06)
Correspondence School	2.01***	(7.13)	1.03***	(.11)
High School	-5.42	(6.13)	- 5.38***	(.10)
Other School	-7.17	(4.22)	- 7.63***	(.07)
None 1/	----	----	----	----
Constant	- .58		-36.14	
Coefficient of Determination	.327		.304	

APPENDIX TABLE B-6

COMPARATIVE ANALYSIS OF COST AND BENEFIT ESTIMATIONS OF SELECTED STUDIES OF SECONDARY VOCATIONAL-TECHNICAL EDUCATION

Name of Study	Time Period of Study[1]	Locus of Study	Experimental Group	Control Group	Cost/Year[5]		Benefit/Year[6]		Duration of Training in Years	Duration of Benefits in Years[4]	Rate of Return (percent)	Present Value in Dollars	
					Marginal	Average[8]	Marginal	Average[8]				5%	10%
1. Hu, Lee, and Stromsdorfer	1959-66	Baltimore, Philadelphia Detroit	Vocational-Technical[7]	Comprehensive[7]									
a.[2] 1.		Philadelphia			464		343		3	6	9.3	240	Neg
2.		Detroit			386		643		3	6	33.6	1776	1152
b.[2] 1.		Philadelphia			485		343		3	6	8.2	193	Neg
2.		Detroit			403		643		3	6	31.8	1772	1102
2. Fernbach and Somers	1964-69	Nationwide	Vocational-Technical	College Preparatory									
a.						592; 596 615[3]		667	3	10	25.9	2911	1593
b.						711; 715 738		667	3	10	21.4	2494	1283
3. Project TALENT (Males only)	1953-65	Nationwide	Vocational-Technical	College Preparatory									
a.						465; 483 483[3]		375	3	10	17.7	1200	642
b.						560; 574 595		375	3	10	13.8	943	307

APPENDIX TABLE B-6 (Cont.)

Name of Study	Time Period of Study[1]	Locus of Study	Experimental Group	Control Group	Cost/Year[5] Marginal	Cost/Year[5] Average[7]	Benefit/Year[6] Marginal	Benefit/Year[6] Average[8]	Duration of Training in Years	Duration of Benefits in Years[4]	Rate of Return (percent)	Present Value in Dollars 5%	Present Value in Dollars 10%
4. Corazzini (Males only)	1963-64	Worchester, Massachusetts	Vocational-Technical	Comprehensive									
a. 1.					512	964	312	312	2	10	23.1	1659	596
2.									2	10	7.4	219	Neg
b. 1.					618	1129	312	312	2	10	17.9	862	412
2.									2	10	4.1	Neg	Neg
5. Eninger (Males only)	1950-64	Nationwide	Vocational-Technical	College Preparatory									
1956-65:						435; 447; 465[3]	412	412	3	10	21.2	1624	783
a.						522; 547; 569	412	412	3	10	18.3	1358	631
b.													
1960-64						485; 491; 406[3]		577	3	10	27.4	2512	1443
a.						582; 589; 595		577	3	10	22.8	2245	1199
b.													

APPENDIX TABLE B-6 (Cont.)

Name of Study	Time Period of Study[1]	Locus of Study	Experimental Group	Control Group	Cost/Year[5] Marginal	Cost/Year[5] Average[8]	Benefit/Year[6] Marginal	Benefit/Year[6] Average[8]	Duration of Training in Years	Duration of Benefits in Years[4]	Rate of Return (percent)	Present Value in Dollars 5%	Present Value in Dollars 10%
6. Kaufman and Lewis	1959-65	Three cities in Pennsylvania	Vocational-Technical	Combined College Prep and General									
1960					549, 553, 562[3,9]		837		3	10	34.5	4278	2735
1962					562, 567, 576[3,9]		611		3	10	25.2	2655	1549
7. Taussig	1962-65	New York City	Vocational-Technical	Combined College Prep and General									
a.					389, 412		240[10]		3	10	6.8	255	Neg
					417[12]		0[11]		3	10	--	Neg	Neg
b.					484, 509, 519[12]		240[10]		3	10	4.6	Neg	Neg
							0[11]		3	10	--	Neg	Neg
8. National Longitudinal Surveys (Young Men, 16-26)	1962-68[13]	Nation-wide	Vocational	College Prepar-atory		693, 702, 711[3]		367[14]	3	4[15]	Neg	Neg	Neg
								404[14]	3	10[15]	9.4	538	Neg
									3	4	Neg	Neg	Neg
									3	10	11.3	784	121

APPENDIX TABLE B-6 (Cont.)

Notes:

1/ Time period of study includes the training period as well as the available time for follow-up at the time the data were gathered.

2/ (a) Signifies current operating costs; (b) signifies total resource costs to society including current operating costs, capital costs and opportunity costs where applicable. This is the case for all the following similar tables.

3/ Each cost figure applies to a different year in the relevant 3-year training period.

4/ The 6-year benefit for Hu, et al., is based on the estimated length of time benefits persisted in the three-city study. The 10-year benefit period is based on Eninger, Process and Product. . . .: The Product, op. cit.

5/ Costs per year are relatively low since opportunity costs (foregone wages) are assumed to be the same between secondary vocational students and comprehensive students. Also, to the extent that they exist, these opportunity costs to society are assumed to be quite low since the influx of all high school students into the labor market at once would depress considerably an already low level of earnings for this age group.

6/ All benefits are before-tax earnings and represent a social benefit, that is, an increase in value added to the gross national product.

7/ Neither of these two groups had any post-secondary or junior college or college education in the 6-year follow-up period.

8/ The costs are true average costs. The benefits are differences between averages of the two comparison groups. Thus, the estimated rates shown here understate the actual average rate of return.

9/ Exact components of these cost figures are not known. They include at least current operating costs. Note that they are generally consistent with the other figures on the table. These figures are deflated, assuming costs were $553/annum in 1959, the base year.

10/ For males only, in training related jobs, assuming a 12 cent per hour gain and a 2,000 hour working year. Unadjusted for any socio-demographic differences except sex.

APPENDIX TABLE B-6 (Cont.)

Notes, cont.

11/ Females only, in training related jobs, unadjusted for any socio-demographic differences except sex.

12/ Each cost figure is for a separate year, deflated from the 1964-65 base year. Costs are for males and females combined. Costs are differences between two averages.

13/ This starting date represents the average time period when the young men in the sample entered the vocational program, approximately seven years before 1968, since the follow-up period is almost four years (3.77) and the assumption is that the training period is three years.

14/ The 367 figure represents benefits estimated from an unweighted regression model. The 404 estimate is based on a weighted regression model.

15/ The four year benefit period represents the average length of the follow-up period in the labor market experience of the National Longitudinal Survey sample.

Primary
Sources:

1. Teh-wei Hu, et al., A Cost Effectiveness Study of Vocational Education: A Comparison of Vocational and Nonvocational Education in Secondary Schools, University Park, Pennsylvania, March 1969.

2. Benefit Data are from: Susan Fernbach and Gerald G. Somers, An Analysis of the Economic Benefits of Vocational Education at the Secondary, Post Secondary, and Junior College Levels, Preliminary Report, Madison, Wisconsin, May 1970. Cost data are from: American Institutes for Research, An Analysis of Cost and Performance Factors for the Operation and Administration of Vocational Schools for Secondary Programs, Pittsburgh, Pennsylvania, May 1967.

3. Benefit data are from: U. S. Office of Education, Office of Program Planning and Evaluation, unpublished Project TALENT data, 5-year follow-up information on high school graduates of 1960 cited in Howard Vincent, "An Analysis of Vocational Education in Our Secondary Schools," July 1969 (revised), mimeo. Cost data are from: American Institutes for Research, An Analysis of Cost . . ., op. cit., May 1967.

4. Arthur J. Corazzini, "The Decision to Invest in Vocational Education: An Analysis of Benefits," in The Journal of Human Resources, Supplement: Vocational Education, Vol. III, 1968.

5. Benefit data are from: Max U. Eninger, The Process and Product of T and I High School Level Vocational Education in the United States, The Product, American Institutes for Research, Pittsburgh, Pennsylvania, September 1965. Cost data are from: American Institutes for Research, An Analysis of Cost . . ., op. cit., May 1967.

6. Cost and benefit data are from Jacob J. Kaufman and Morgan V. Lewis, The Potential of Vocational Education: Observations and Conclusions, University Park, Pennsylvania, May 1968.

7. Cost and benefit data are from: Michael K. Taussig, "An Economic Analysis of Vocational Education in New York City," Journal of Human Resources, Supplement, Vocational Education, Vol. III, 1968.

8. Benefit data are from National Longitudinal Surveys, Survey of Work Experience of Young Men, 1968, U.S. Department of Commerce, Bureau of the Census and Center for Human Resource Research, Ohio State University, Columbus, Ohio, 1968. Cost data are from American Institutes for Research, An Analysis of Cost..., op. cit., May 1967.

APPENDIX TABLE B-6 (Cont.)

Secondary
Sources:

1. Report of the Analysis Group, HEW Vocational Education Review Task Force, Vol. I. Prepared for Dr. James Abert, Deputy Assistant Secretary, Evaluation and Monitoring, Department of Health, Education, and Welfare, Silver Spring, Maryland: Operations Research, Inc., 25 September, 1970.

2. Ernst W. Stromsdorfer, Review and Synthesis of Cost-Effectiveness Studies of Vocational and Technical Education, Columbus, Ohio: The Center for Vocational and Technical Education, Ohio State University, 1972.

Appendix Table B-7

EFFECTS OF RACIAL DISCRIMINATION ON EARNINGS AND EMPLOYMENT FOR GRADUATES FROM SELECTED SECONDARY CURRICULUMS THREE NORTHERN CITIES, 1959-60-1966[1]

Sample Groups	Average Monthly Before Tax Earnings			Percent of Time Employed		
	First[2]	Sixth	6-Year Average	First	Sixth	6-Year Average
Vocational-Academic and Vocational-Technical Secondary Graduates						
Total Sample	-124**	-6	81**	30.61**	-8.4*	12.0**
n = 1080	(13)	(19)	(14)	(3.91)	(3.5)	(2.6)
Males	144**	106**	145**	22.11**	2.0	9.7*
n = 322	(33)	(35)	(31)	(10.4)	(4.4)	(4.5)
Females	120**	-20	71**	32.9**	-7.6	15.8**
n = 758	(14)	(20)	(14)	(3.6)	(4.5)	(3.0)
Comprehensive Secondary Graduates						
Total Sample	100**	24	76**	23.6**	-6.0*	11.1**
n = 1687	(12)	(17)	(11)	(3.1)	(2.9)	(2.3)
Males	99**	145**	123**	17.1**	7.0	10.9*
n = 630	(27)	(32)	(26)	(6.0)	(3.9)	(4.3)
Females	93**	-11	59**	24.0**	-8.7*	11.1**
n = 1057	(11)	(18)	(11)	(3.6)	(3.7)	(2.7)

Source: Unpublished data from Teh-wei Hu , Maw Lin Lee and Ernst W. Stromsdorpher, A Cost-Effectiveness Analysis of Vocational Education, Institute for Research on Human Resources, The Pennsylvania State University, University Park, Pennsylvania, March 1969. See also Ernst W. Stromsdorpher, Review and Synthesis of Cost-Effectiveness Studies of Vocational and Technical Education, Columbus, Ohio; The Center for Vocational and Technical Education, Ohio State University, 1972.

1/ This analysis standardizes for the effects of month and year of high school graduation, labor market at the time of graduation, IQ, post-high school training other than 2-year or 4-year college education, marital status, sex and father's education. Thus, the differences between whites and Negroes in this analysis are a very close measure of current racial discrimination practices as they existed in three northern cities from 1959-60 through 1966.

These statistics are the partial regression coefficients and their standard errors in parentheses. The partial regression coefficient is interpreted as follows: It measures the difference between average earnings or employment

Appendix Table B-7 (continued)

of white graduates and Negro graduates. Thus, white vocational-technical graduates earned $124 more per month than Negro vocational graduates in the first year after they graduated.

2/ First = first year after graduation; Sixth = sixth year after graduation; 6-year average = average experience during the 6-year period after graduation.

** significant at the .01 level of significance, two-tailed test.
* significant at the .05 level of significance, two-tailed test.

Appendix Table B-8

NET EFFECTS ON EARNINGS (IN DOLLARS) AND EMPLOYMENT (IN PERCENTAGE POINTS), VOCATIONAL VERSUS COMPREHENSIVE GRADUATES FOR SEPARATE REGRESSIONS BY RACE AND SEX THREE NORTHERN CITIES, 1959-60 - 1966

Sample Groups	First Year After Graduation		Sixth Year After Graduation		Average in Six Years	
	E[2]	N[2]	E	N	E	N
White male						
Comprehensive[1]						
Vocational	43**[3]	9.0**	30	2.0	44**	5.7**
n=854	(14)	(3.0)	(16)	(1.8)	(14)	(2.1)
Nonwhite male						
Comprehensive[1]						
Vocational	21	9.0	61	7.1	49	9.7
n=98	(27)	(8.7)	(38)	(5.5)	(29)	(6.1)
White female						
Comprehensive[1]						
Vocational	65**	19.5**	9	4.4	46**	12.7**
n=1522	(7)	(2.1)	(11)	(2.4)	(7)	(1.6)
Nonwhite female						
Comprehensive[1]						
Vocational	42**	10.8*	32	5.4	43**	9.3*
n=293	(13)	(4.7)	(21)	(4.5)	(13)	(3.6)

Source: Teh-wei Hu, et al., "Economic Returns to Vocational and Comprehensive High School Graduates," Journal of Human Resources, VI (1), Winter, 1971.

[1] This regressor of the variable enters into the intercept term. The other regressors of the variable are interpreted as deviations from this regressor. The variables of labor market, IQ, marital status, and father's education are included in the separate equations, but the coefficients are deleted here.

[2] E denotes average before tax monthly earnings, and N denotes percent of time employed.

[3] These statistics are the partial regression coefficient and (in parentheses) the standard error of the coefficient. The statistic indicates that white male vocational graduates earned $43 more per month than did white male comprehensive graduates in the first year after graduation.

* significant at the .05 level of significance, two-tailed test
** significant at the .01 level of significance, two-tailed test

Labor Market and Educational Experiences of Negroes Compared with Whites as a Function of Curriculum for Selected Output Variables
Males Age 14-24 and 16-26, Survey Week, October-December 1966 and 1968 [1]

Dependent Variables [2]

Curriculum Sample		Earnings [3]		High School Graduation [4]		College Attendance [4]	
		b	(s)	b	(s)	b	(s)
General	I	-21.10**	2.46	- .165**	.036	- .116**	.030
	II	-20.98**	2.96	- .165**	.031	- .164**	.028
College Preparatory	I	-13.10	10.75	- .064	.041	- .179**	.093
	II	-16.50*	6.49	- .039	.022	- .149**	.049
Vocational	I	-20.82**	5.80	- .301**	.076	- .143**	.048
	II	-18.36**	6.01	- .218**	.067	- .065	.054
Vocational-Commercial	I	-23.11**	5.34	- .262**	.069	- .112**	.047
	II	-15.39*	6.00	- .211**	.061	- .068	.055

I = 1966
II = 1968

* = significant at the .05 level
** = significant at the .01 level
b is the partial regression coefficient
(s) is the standard error of the partial regression coefficient

Source: See Appendix Table B-1 and B-2

Notes: 1/ The 1966 equations for earnings contain the following variables: marital status (never married, married and widowed, separated or divorced); age; race(white, black, other); college attendance, highest grade of schooling completed; age at which the person left school; square of age at which the person left school; training after leaving high school (no training, business school, company school, and apprenticeship). In addition, the equations for the vocational and vocational-commercial contain variables for metal, wood, mechanical electrical, other building trades, and "other" vocational courses. The vocational-commercial sample includes the commercial skills in addition to the above listed occupational skills.

The 1966 equations for high school graduation and college attendance contain variables for marital status, age, race and training after leaving high school. As above, the vocational and vocational-commercial subsets also contain the breakdown of vocational skills.

The 1968 equations are the same as the 1966 equations except that the vocational curriculum is not broken down into occupational categories and training after leaving high school is broken down into the following categories: business school; company school, correspondence school; high school; and, other school.

2/ The samples for earnings and employment during the survey week exclude anyone attending high school or any college or formal postsecondary education. The samples for probability of graduation from high school exclude anyone attending high school but include anyone attending college.

3/ The earnings variable represents the difference in earnings between whites and blacks for each curriculum. Thus, blacks in the general curriculum earned $21 per week less than whites during the 1966 survey week. The difference is statistically significant at the .01 level of significance.

4/ The two variables are interpreted as probabilities or, if multiplied by 100, as percentages. Thus, the probability of being a high school graduate was 16.5 percentage points less for Negroes in the general curriculum than their white counterparts.

Appendix Table B-10

PERCENT OF TIME EMPLOYED FOR NON-COLLEGE SENIOR HIGH SCHOOL GRADUATES, CITIES A, B, AND C, IN PERCENTAGE POINTS

Variable	Average in Six Years		First Year After Graduation		Sixth Year After Graduation	
	b	(s)	b	(s)	b	(s)
Curriculum						
College Preparatory@						
Vocational-Academic	9.9*	(4.0)	10.6*	(4.2)	11.5	(6.3)
Vocational-Comprehensive	5.2*	(2.2)	12.6**	(2.6)	3.4	(3.5)
General	3.2	(2.7)	7.4*	(3.2)	1.3	(4.4)
Vocational-Technical	7.5**	(1.9)	14.2**	(2.3)	10.1**	(3.1)
Labor Market						
City A@						
City B	-1.5	(1.7)	1.0	(2.0)	1.2	(2.8)
City C	-4.6*	(1.8)	-10.5**	(2.3)	1.1	(2.9)
Male	19.7**	(1.6)	2.2	(1.9)	40.8**	(2.6)
IQ	0.14*	(0.06)	0.14	(0.07)	0.17	(0.09)
White	5.9**	(2.1)	21.3**	(2.5)	-10.9**	(3.4)
Marital Status						
Married@						
Single	15.5**	(1.6)	-3.05	(2.0)	34.8**	(2.6)
Separated, Widowed, Divorced	-2.8	(7.6)	-26.11**	(9.0)	10.7	(12.1)
Father's Education	-0.15	(0.23)	-0.51	(0.28)	-0.00	(0.37)
Number of Observations	1,255		1,255		1,255	
Coefficient of Determination#	0.18		0.11		0.28	
Intercept	47.2	(7.2)	44.6	(8.4)	33.9	(11.4)
Standard Error of Estimate	23.9		28.2		38.1	
Mean of Dependent Variable	77.9	(26.4)	80.3	(29.9)	67.0	(44.7)
F-Ratio:						
All Variables	23.61**		13.83**		40.25**	
Curriculum	4.81**		10.54**		3.82**	
Labor Market	3.23**		12.97**		0.12	
Marital Status	43.76**		5.29**		86.75**	

Notes:
- * Significant at the .05 level.
- ** Significant at the .01 level.
- b is the partial regression coefficient.
- (s) is the standard error of the partial regression coefficient.
- @ This regressor of the variable enters into the intercept term. The other regressors of the variable are interpreted as deviations from this regressor.
- # Adjusted for degrees of freedom.

Source: Teh-wei Hu, et al., A Cost-Effectiveness Study of Vocational Education, (University Park, Pa.: Institute for Research on Human Resources, The Pennsylvania State University, 1969), p. 144.

Appendix Table B-11

Employment Rates, by Socio-Demographic Characteristics
Out of School Young Men, Aged 16-26
Survey Week, October-December, 1968

Socio-Demographic Characteristic:	Sample Group: Total	High School Curriculum: General	College Preparatory	Vocational	Commercial	Race: White	Black	Number of Observations
All Respondents	88.2	87.8	87.6	88.9	90.6	89.9	84.2	1892
Number	1892	960	365	220	32	1318	563	
Marital Status								
Single	79.7	79.1	77.4	82.3	83.7	81.7	76.5	822
Married	94.8	94.2	95.9	94.7	96.6	95.4	92.9	1011
Age								
16 - 17	65.1	59.2	55.8	78.6	83.5	67.7	61.2	140
18 - 20	82.5	83.6	77.8	82.0	76.3	84.7	79.0	544
21 - 26	93.4	92.7	93.0	95.7	96.3	94.0	91.7	1208
Race								
White	89.9	90.4	88.3	90.5	90.2	---	---	1318
Black	84.2	81.6	85.0	85.2	93.6	---	---	563

Appendix Table B-11a

Percent of Time Employed as a Function of High School Curriculum, Year Previous to Survey Week, October-December 1968, for Young Males in the Labor Force During the Survey Week, by Separate Regressions for Sample Sub-Groups

Sample Sub-Groups[1]	College Preparatory b	College Preparatory (s)	General b	General (s)	Commercial b	Commercial (s)	Vocational b	Vocational (s)	M (s)	N	$\bar{R}^2$
Total Out-of-School	-.0218	(.0191)	-.0228	(.0155)	.0034	(.0021)	--	--	.8818	1,587	.170
	--	--	.0010	(.0145)	.0252	(.0386)	.0218	(.0191)	(.2261)		
Age 16 and Under	-.0723	(.0562)	-.0784	(.0460)	.0321	(.1163)	--	--	.7402	293	.216
	--	--	-.0061	(.0463)	.1044	(.1157)	.0723	(.0562)	(.3078)		
Age 19 and Over	-.0024	(.0188)	-.0088	(.0152)	.0185	(.0386)	--	--	.9145	1,294	.105
	--	--	-.0065	.0140	.0208	(.0377)	.0024	(.0188)	(.1881)		
White	-.0272	(.0205)	-.0119	(.0172)	.0005	(.0390)	--	--	.8891	1,163	.156
	--	--	.0153	(.0151)	.0276	(.0379)	.0272	(.0205)	(.2076)		
Black	.0036	(.0463)	-.0475	(.0333)	.0253	(.1415)	--	--	.8425	416	.186
	--	--	-.0511	(.0383)	.0217	(.1413)	-.0036	(.0463)	(.2585)		
Non-White	-.0040	(.0460)	-.0483	(.0332)	.0217	(.1417)	--	--	.8421	424	.189
	--	--	-.0443	(.0378)	.0256	(.1414)	.0040	(.0460)	(.2594)		
Married	.0243	(.0171)	-.0029	(.0139)	.0131	(.0339)	--	--	.9483	845	.048
	--	--	-.0272	(.0127)	-.0112	(.0333)	-.0243	(.0171)	(.1311)		
Single (Never Married)	-.0654	(.0362)	-.0401	(.0296)	.0117	(.0752)	--	--	.7975	693	.129
	--	--	.0253	(.0279)	.0771	(.0735)	.0654	(.0362)	(.2859)		
Professional and Kindred	-.0373	(.0631)	.0523	(.0634)	.1491	(.2148)	--	--	.8797	209	.221
	--	--	-.0250	(.0313)	.1864	(.2038)	.0373	(.0631)	(.2170)		
Managers and Kindred	-.0155	(.0641)	-.0288	(.0617)	.0007	(.1009)	--	--	.9630	81	.124
	--	--	-.0133	(.0416)	.0161	(.0906)	.0155	(.0641)	(.1360)		
Clerical and Kindred	-.0278	(.0636)	-.0075	(.0551)	.0578	(.0971)	--	--	.8971	150	.232
	--	--	.0203	(.0421)	.0855	(.0868)	.0278	(.0636)	(.2179)		

Appendix Table B-11a

(Continued)

Sample Sub-Groups[1/]	College Preparatory b	College Preparatory (s)	General b	General (s)	Commercial b	Commercial (s)	Vocational b	Vocational (s)	M (s)	N	$\overline{R^2}$
Sales	-.0435	(.1310)	-.0718	(.1316)	.5260*	(.2064)	--	--	.9048	58	.456
	--	--	-.0283	(.0634)	-.4825**	(.1602)	.0435	(.1310)	(.2060)		
Craftsmen	.0058	(.0438)	-.0159	(.0314)	.0058	(.0909)	--	--	.9084	268	.160
	--	--	-.0217	(.0383)	-.0000	(.0931)	-.0058	(.0438)	(.2032)		
Operatives and Kindred	.0356	(.0362)	.0179	(.0265)	-.0163	(.0755)	--	--	.8837	522	.170
	--	--	-.0177	(.0295)	-.0519	(.0766)	-.0356	(.0362)	(.2263)		
Laborers	-.1071	(.0669)	-.0470	(.0454)	-.0526	(.1463)	--	--	.8233	212	.237
			.0601	(.0574)	.0545	(.1464)	.1071	(.0669)	(.2601)		

Notes:

1/ There are insufficient observations for an analysis of the widowed, separated or divorced sub-group.

See Appendix Table B - 4 for all other notes.

Source: See Appendix Table B - 4.

Appendix Table B-12

Probability of College Attendance as a Function of High School Curriculum, Males Aged 16-26, Survey Week, October-December 1968, by Separate Regressions for Sample Subgroups, High School Graduates and Nongraduates

Sample Sub-Groups		College Preparatory b	(s)	General b	(s)	Commercial b	(s)	Vocational b	(s)	M (s)	N	R^2
Single (never married)	A	.5580**	(.0450)	.1340**	(.0429)	.2474*	(.1030)	----	----	.4072 (.4915)	989	.300
	B	----	----	-.4240**	(.0294)	-.3106**	(.0975)	-.5580**	(.0450)			
Professional and Kindred	A	.2292*	(.0883)	.0875	(.0915)	.2661	(.2005)	----	----	.8644 (.3430)	312	.209
	B	----	----	-.1417**	(.0394)	.0370	(.1817)	-.2292*	(.0883)			
Managers and Kindred	A	.3858*	(.1698)	.0285	(.1703)	.1150	(.2665)	----	----	.5607 (.4986)	98	.313
	B	----	----	-.3573**	(.1015)	-.2708	(.2361)	-.3858*	(.1699)			
Clerical and Kindred	A	.6598**	(.1139)	.2308*	(.1102)	.2679	(.1899)	----	----	.4658 (.4999)	216	.303
	B	----	----	-.4290**	(.0642)	-.3919*	(.1646)	-.6598**	(.1139)			
Sales	A	.5906*	(.2897)	.1932	(.2924)	.1369	(.4244)	----	----	.5914 (.4942)	92	.368
	B	----	----	-.3974**	(.0961)	-.4538	(.3071)	-.5906*	(.2897)			
Craftsmen and Kindred	A	.4302**	(.0689)	.0999	(.0556)	.1107	(.1626)	----	----	.1691 (.3754)	291	.191
	B	----	----	-.3303**	(.0579)	-.3195	(.1629)	-.4302**	(.0689)			
Operatives and Kindred	A	.2924**	(.0516)	.0250	(.0406)	.0217	(.1184)	----	----	.1443 (.3517)	569	.141
	B	----	----	-.2674**	(.0399)	-.2707*	(.1184)	-.2924**	(.0516)			
Laborers	A	.5002**	(.0649)	.0757	(.0540)	.2189	(.1743)	----	----	.1457 (.3533)	242	.369
	B	----	----	-.4244**	(.0513)	-.2813	(.1729)	-.5002**	(.0649)			

Source: See Table B-4

Notes: See Table B-10

Appendix Table B-12 (Continued)

Probability of College Attendance as a Function of High School Curriculum, Males Aged 16-26, Survey Week, October-December 1968, by Separate Regressions for Sample Subgroups, High School Graduates and Nongraduates

Sample Sub-Groups		College Preparatory b	College Preparatory (s)	General b	General (s)	Commercial b	Commercial (s)	Vocational b	Vocational (s)	M (s)	N	R^2
Total Out-of-School	A	.5478**	(.0307)	.0957**	(.0286)	.1469*	(.0703)	----	----	.3421 (.4745)	1977	.311
	B	----	----	-.4521**	(.0204)	-.4009**	(.0670)	-.5478**	(.0307)			
Age 18 and Under	A	.3506**	(.0641)	.0538	(.0587)	.0440	(.1365)	----	----	.2759 (.4474)	410	.258
	B	----	----	-.2968**	(.0454)	-.3066*	(.1308)	-.3506**	(.0641)			
Age 19 and Over	A	.5964**	(.0345)	.1101**	(.0323)	.1932*	(.0808)	----	----	.3596 (.4800)	1567	.346
	B	----	----	-.4863**	(.0225)	-.4032**	(.0771)	-.5964**	(.0345)			
White	A	.5851**	(.0374)	.1236**	(.0360)	.1643*	(.0788)	----	----	.4089 (.4918)	1504	.285
	B	----	----	-.4615**	(.0238)	-.4208**	(.0739)	-.5851**	(.0374)			
Black	A	.4438**	(.0542)	.0246	(.0445)	.2249	(.1924)	----	----	.1632 (.3698)	463	.246
	B	----	----	-.4192**	(.0403)	-.2190	(.1915)	-.4438**	(.0542)			
Non-white	A	.4426**	(.0541)	.0290	(.0446)	.2290	(.1934)	----	----	.1646 (.3711)	473	.243
	B	----	----	-.4136**	(.0400)	-.2136	(.1924)	-.4426**	(.0541)			
Married	A	.5461**	(.0436)	.0671	(.0400)	.0497	(.0965)	----	----	.2904 (.4541)	937	.316
	B	----	----	-.4791**	(.0290)	-.4964**	(.0922)	-.5461**	(.0436)			

Appendix Table B-13

Probability of College Attendance of High School Graduates Only as a Function of High School Curriculum, Males Aged 16-26, Survey Week, October-December, 1968, by Separate Regressions for Sample Subgroups

Sample Sub-Groups [1]	College Preparatory b	College Preparatory (s)	General b	General (s)	Commercial b	Commercial (s)	Vocational b	Vocational (s)	M	N	$\bar{R}^2$
Total Out-of-School	.5533**	(.0376)	.1590**	(.0366)	.1469	(.0810)	----	----	.4938	1,544	.268
	----	----	-.3944**	(.0240)	-.4064**	(.0240)	-.5533**	(.0376)	(.5001)		
Age 18 and Under	.3423**	(.0822)	.1067	(.0795)	-.0112	(.1585)	----	----	.4118	308	.247
	----	----	-.2356**	(.0556)	-.3535*	(.1474)	-.3423**	(.0822)	(.4929)		
Age 19 and Over	.6073**	(.0417)	.1761**	(.0407)	.2114*	(.0935)	----	----	.5145	1,236	.301
	----	----	-.4311**	(.0263)	-.3958**	(.0880)	-.6073**	(.0417)	(.5000)		
White	.5762**	(.0426)	.1855**	(.0422)	.1588	(.0865)	----	----	.5330	1,243	.256
	----	----	-.3907**	(.0266)	-.4174*	(.0802)	-.5762**	(.0426)	(.4991)		
Black	.4758**	(.0841)	.0690	(.0759)	.1893	(.2535)	----	----	.3301	294	.233
	----	----	-.4068**	(.0579)	-.2865	(.2486)	-.4758**	(.0841)	(.4710)		
Non-white	.4744**	(.0838)	.0761	(.0758)	.1962	(.2543)	----	----	.3323	301	.229
	----	----	-.3983**	(.0573)	-.2783	(.2493)	-.4744**	(.0838)	(.4718)		
Married	.5672**	(.0552)	.1297*	(.0532)	.0379	(.1168)	----	----	.4417	702	.278
	----	----	-.4375**	(.0358)	-.5292**	(.1100)	-.5672**	(.0552)	(.4969)		
Single (Never Married)	.5504**	(.0525)	.1992**	(.0520)	.2614*	(.1126)	----	----	.5523	812	.257
	----	----	-.3512**	(.0330)	-.2890**	(.1047)	-.5504**	(.0525)	(.4976)		
Professional and Kindred	.2080*	(.0889)	.0980	(.0889)	.2385	(.1902)	----	----	.8839	306	.199
	----	----	-.1101**	(.0378)	.0305	(.1712)	-.2080*	(.0861)	(.3209)		
Managers and Kindred	.5014**	(.1765)	.1319	(.1796)	.1487	(.2669)	----	----	.6383	90	.298
	----	----	-.3696**	(.1057)	-.3527	(.2352)	-.5014**	(.1765)	(.4831)		
Clerical and Kindred	.7037**	(.1266)	.3108*	(.1235)	.2619	(.1966)	----	----	.5505	188	.312
	----	----	-.3929**	(.0688)	-.4418**	(.1649)	-.7037**	(.1266)	(.4987)		
Sales	.6878*	(.2899)	.3454	(12963)	.2183	(.4221)	----	----	.6322	86	.354
	----	----	-.3424**	(.0993)	-.4695	(.3045)	-.6878*	(.2899)	(.4850)		

Appendix Table B-13
(continued)

Sample Sub-Groups 1/	College Preparatory b	(s)	General b	(s)	Commercial b	(s)	Vocational b	(s)	M (s)	N	$\bar{R}^2$
Craftsmen	.4506**	(.0957)	.1964*	(.0834)	.1477	(.2256)	----	----	.2788	200	.179
	----	----	-.2541**	(.0779)	-.3029	(.2214)	-.4506**	(.0957)	(.4495)		
Operative and Kindred	.3481**	(.0592)	.0620	(.0592)	(.0079)	(.1557)	----	----	.2481	384	.165
	----	----	-.2861**	(.0541)	-.3402*	(.1545)	-.3481**	(.0707)	(.4325)		
Laborers	.5782**	(.0990)	.1126	.0877	.2194	(.2383)	----	----	.3018	162	.347
	----	----	-.5657**	(.0756)	-.3588	(.2337)	-.5782**	(.0990)	(.4604)		

Notes:

1/ Insufficient observations to perform an analysis on the widowed, separated and divorced subgroup.

For additional explanatory notes see Appendix Table B-4.

Source:
See Appendix Table B-4.

Appendix Table B-14

Probability of High School Graduation as a Function of High School Curriculum, Males, Aged 16-26, Survey Week, October-December 1968, by Separate Regressions for Sample Subgroups

Sample Sub-Groups		College Preparatory b	(s)	General b	(s)	Commercial b	(s)	Vocational b	(s)	M (s)	N	R^2
Total Out-of-School	A	.2118**	(.0328)	-.0516	(.0306)	.1619*	(.0750)	----	----	.6924 (.4614)	1977	.168
	B	----	----	-.2634**	(.0217)	-.0499	(.0715)	-.2118**	(.0328)			
Age 18 and Under	A	.2527**	(.0676)	-.0371	(.0618)	.2852*	(.1438)	----	----	.6701 (.4707)	410	.256
	B	----	----	-.2898**	(.0479)	.0326	(.1378)	-.2527**	(.0676)			
Age 19 and Over	A	.1994**	(.0373)	-.0583	(.0349)	.1284	(.0874)	----	----	.6989 (.4583)	1570	.164
	B	----	----	-.2577**	(.0243)	-.0710	(.0834)	-.1994**	(.0373)			
White	A	.1841**	(.0357)	-.0670	(.0343)	.1320	(.0751)	----	----	.7673 (.4227)	1504	.120
	B	----	----	-.2510**	(.0227)	.0521	(.0705)	-.1841**	(.0357)			
Black	A	.3428**	(.0795)	-.0194	(.0653)	.4571	(.2821)	----	----	.4943 (.5003)	463	.115
	B	----	----	-.3621**	(.0591)	.1143	(.2808)	-.3428**	(.0795)			
Non-white	A	.3454**	(.0789)	-.0153	(.0650)	.4636	(.2818)	----	----	.4953 (.5004)	473	.116
	B	----	----	-.3607**	(.0584)	.1182	(.2804)	-.3454**	(.0789)			
Married	A	.2112**	(.0508)	-.0831	(.0467)	.1570	(.1125)	----	----	.6573 (.4748)	937	.149
	B	----	----	-.2944**	(.0338)	-.0542	(.1075	-.2112**	(.0508)			

Appendix Table B-14 (continued)

Probability of High School Graduation as a Function of High School Curriculum, Males, Aged 16-26, Survey Week, October-December 1968, by Separate Regressions for Sample Subgroups

Sample Sub-Groups		Academic b	Academic (s)	General b	General (s)	Commercial b	Commercial (s)	Vocational b	Vocational (s)	M (s)	N	R^2
Single (Never Married)	A	.2134**	(.0434)	-.0288	(.0414)	.1556	(.0993)	----	----	.7373 (.4403)	989	.190
	B	----	----	-.2422**	(.0284)	-.0578	(.0940)	-.2134**	(.0434)			
Professional and Kindred	A	.0624	(.0410)	.0180	(.0425)	.0682	(.0932)	----	----	.9779 (.1472)	312	.073
	B	----	----	-.0444*	(.0183)	.0058	(.0844)	-.0624	(.0410)			
Managers, Proprietors and Kindred	A	-.0453	(.1149)	-.1012	(.1152)	.0661	(.1803)	----	----	.8785 (.3282)	98	.275
	B	----	----	-.0559	(.0686)	.1114	(.1597)	.0453	(.1149)			
Clerical and Kindred	A	.1154	(.0939)	-.0212	(.0909)	.1947	(.1567)	----	----	.8462 (.3616)	216	.093
	B	----	----	-.1366*	(.0530)	.0793	(.1358)	-.1154	(.0939)			
Sales	A	-.0802	(.1484)	-.2028	(.1498)	-.1121	(.2175)	----	----	.9355 (.2470)	92	.336
	B	----	----	-.1225*	(.0492)	-.0318	(.1574)	.0802	(.1484)			
Craftsmen and Kindred	A	.3238**	(.0916)	-.0679	(.0739)	.1099	(.2162)	-----	----	.6064 (.4893)	291	.158
	B	----	----	-.3917**	(.0769)	-.2139	(.2165)	-.3238**	(.0916)			
Operatives	A	.1134	(.0737)	-.1002	(.0581)	.1938	(.1693)	----	----	.5816 (.4937)	569	.108
	B	----	----	-.2137**	(.0570)	.0804	(.1694)	-.1134	(.0737)			
Laborers	A	.2091*	(.1015)	-.0438	(.0845)	.2886	(.2726)	----	----	.4829 (.5004)	242	.230
	B	----	----	-.2529**	(.0802)	.0795	(.2704)	-.2091*	(.1015)			

Appendix Table B-14
(Continued)

Probability of High School Graduation as a Function of High School Curriculum, Males, Aged 16-18, Survey Week, October-December, 1968, by Separate Regressions for Sample Subgroups

Source: See Appendix Table B-4

Notes:

1/ In addition to the curriculum variable, each regression model controls for marital status (single, married, widowed, separated and divorced), age in years, ethnic origin (white, Black, other), and type of postsecondary education other than college (business school, comparing school, correspondence course, high school, other school and no school).

2/ The regression coefficients are interpreted as deviations from the average experience of the omitted regressor for each model. They can be read either as probabilities or, if multiplied by 100 as percents. Thus, for the total out-of-school sample, academic students (equation A) are.2118 (given a scale from 0.00 to 1.00) more likely to graduate from high school than are students in the vocational curriculum, or the graduation rate is 21.2 percentage points higher.

See Table 8-VIII for interpretation of table headings and symbols.

Appendix Table B-15

PRESENT VALUE OF EARNING STREAMS FOR MALES AGE 17, BY OCCUPATION, YEARS OF SCHOOL COMPLETED, AND ETHNIC CATEGORY, FOR THE UNITED STATES, 1960[1/]

	White	Nonwhite
1. Experienced Civilian Labor Force		
HS 4	$38,384	$26,329
HS 1-3	35,960	23,645
	2,424	2,684
2. Experienced Civilian Labor Force		
HS 4	39,018[2/]	------
HS 1-3	36,601[2/]	------
	2,417	
3. Professional, Technical and Kindred		
HS 4	44,428	33,037[3/]
HS 1-3	42,448	------
	1,980	
4. Designers and Draftsmen		
HS 4	46,980	------
HS 1-3	46,411	------
	569	
5. Farmers and Farm Managers		
HS 4	22,762	------
HS 1-3	21,507	------
	1,255	
6. Managers, Officials and Proprietors		
HS 4	45,941	------
HS 1-3	45,869	------
	72	
7. Buyers and Department Store Heads		
HS 4	46,049	------
HS 1-3	46,891	------
	-842	
8. Clerical and Kindred		
HS 4	37,066	31,713
HS 1-3	35,770	30,952
	1,296	761
9. Bookkeepers		
HS 4	35,902	------
HS 1-3	35,065	------
	837	

Appendix Table B-15 (continued)

	White	Nonwhite
10. Shipping and Receiving Clerks		
HS 4	$34,730	$31,988[2/]
HS 1-3	35,689	36,213
	-959	-4,225
11. All Other Clerical		
HS 4	36,525	28,767[3/]
HS 1-3	35,699	28,012
	1,826	755
12. Sales Workers		
HS 4	38,067	28,281[2/]
HS 1-3	32,178	23,464[2/]
	5,889	4,817
13. Insurance, Brokers and Underwriters		
HS 4	44,430	------
HS 1-3	45,464	------
	-1,034	
14. Craftsmen, Foremen and Kindred		
HS 4	42,548	30,956
HS 1-3	42,155	28,727
	393	2,229
15. Brickmasons, Stonemasons and Tile		
HS 4	45,081	------
HS 1-3	42,539	
	2,542	
16. Carpenters		
HS 4	38,449	------
HS 1-3	38,624	------
	-175	
17. Compositors and Typesetters		
HS 4	42,859	------
HS 1-3	44,979	------
	-2,120	
18. Electricians		
HS 4	46,103	------
HS 1-3	48,358	------
	-2,255	
19. Lineman and Service		
HS 4	46,889	------
HS 1-3	48,992	------
	-2,033	

Appendix Table B-15 (continued)

	White	Nonwhite
20. Machinists		
HS4	43,707	------
HS 1-3	44,187	------
	-480	
21. Mechanics and Repairmen		
HS 4	38,816	------
HS 1-3	38,769	------
	47	
22. Airplane Mechanics and Repair		
HS 4	45,049 3/	------
HS 1-3	45,149	------
	-100	
23. Auto Mechanics and Repair		
HS 4	35,962	------
HS 1-3	36,428	------
	-466	
24. Painters, Construction and Maintenance		
HS 4	35,511	------
HS 1-3	32,925	------
	2,586	
25. Plumbers and Pipefitters		
HS 4	46,446	------
HS 1-3	45,427	------
	1,109	
26. Toolmakers and Diemakers, Setters		
HS 4	52,847	------
HS 1-3	53,211	------
	-384	
27. Operatives and Kindred		
HS 4	37,576	27,167
HS 1-3	36,821	26,519
	765	648
28. Truck and Tractors Drivers		
HS 4	37,502	------
HS 1-3	38,997	------
	-1,495	
29. Other Specified Operatives		
HS 4	37,089	25,907 3/
HS 1-3	35,256	25,729
	1,833	178

Appendix Table B-15 (continued)

	White	Nonwhite
30. Service Workers		
HS 4	30,860	21,249
HS 1-3	27,431	20,170
	3,429	1,079
31. Barbers		
HS 4	33,622	------
HS 1-3	35,645	------
	-2,023	
32. Protective Service Workers		
HS 4	41,895	------
HS 1-3	40,453	------
	1,442	
33. Other Service Including Households		
HS 4	24,659	20,330
HS 1-3	22,720	19,754
	1,939	576
34. Farm Laborers & Foremen		
HS 4	18,693	11,602 2/
HS 1-3	16,540	9,784 2/
	2,153	1,818

Notes:

1/ The data presented were calculated as follows:

$$\text{Return to 4 at age 17} = \frac{Y^4_{17}}{(1+r)^1} + \frac{Y^4_{18}}{(1+r)^2} + \ldots \frac{Y^4_{64}}{(1+r)^{48}}$$

$$\text{Return to 1-3 at age 17} = \frac{Y^{1-3}_{17}}{(1+r)^1} + \frac{Y^{1-3}_{18}}{(1+r)^2} + \frac{Y^{1-3}_{64}}{(1+r)^{48}}$$

where

Y^4 and Y^{1-3} = median earnings of those with 4 years of high school and 1-3 years, respectively, subscripts refer to age,

and

$Y^4_{17} = 0$ by assumption.

Also

$$Y_{18} = Y_{19} = \ldots = Y_{24}$$

$$Y_{25} = Y_{26} = \ldots = Y_{34}$$

$$\vdots$$

$$Y_{55} = Y_{56} = \ldots = Y_{64} \text{ for } Y^4 \text{ and } Y^{1-3},$$

again, by assumption,

and

r = 10 percent

2/ Age 18-24 and 25-64 cohorts used.

3/ Age 55-64 cohort earnings estimated.

Source:

Stuart O. Schweitzer, "Occupational Choice, High School Graduation, and Investment in Human Capital," Hearings of the Joint Economic Committee, Subcommittee on Economy in Government, National Priorities, 1-18 June 1970; also in The Journal of Human Resources, Volume VI, Number 3, 1971.

APPENDIX TABLE B-16

REGRESSION ANALYSIS OF WAGE RATE ON FIRST JOB, WAGE RATE ON LAST OR CURRENT JOB, AND AVERAGE MONTHLY EARNINGS, BY EDUCATION LEVEL, FOR SEPARATE REGRESSIONS BY PROGRAM AREA

Educational Level [1]	Office		Trade and Industry		Distributive		Health		Agriculture		Technical	
	b	(s)	b	(s)	b	(s)	b	(s)	b	(s)	b	(s)
Wage Rate, First Job [2]	n=495		n=300		n= 88		n=197		n= 82		n=362	
Post-Vocational High School	.01	.08	-.04	.13	.91*	.39	.22	.18	-.09	.39	.07	.12
Junior College	-.10	.13	.18	.21	.12	.51	.67**	.16	-.28	.36	.09	.14
Wage Rate, Last or Current Job	n=495		n=300		n= 88		n=197		n= 82		n=362	
Post-Vocational High School	.01	.12	.001	.19	.02	.45	.07	.29	-.24	.56	-.02	.16
Junior College	-.03	.20	.41	.30	.78	.61	.85**	.27	-.60	.52	.07	.19
Average Monthly Earnings	n=428		n=256		n= 73		n=175		n= 68		n=337	
Post-Vocational High School	+ [3]		+		-		+		+		+	
Junior College	+		+		+		191		+		+	

Notes:

* Significant at the .05 level of significance, two-tailed test.
** Significant at the .01 level of significance, two-tailed test.
b is the partial regression coefficient.
(s) is the standard error of the partial regression coefficient.

[1] The regression models for first, last or current wage rate control for region, relatedness of job to training, socio-economic status, father's education, sex, age, marital status, race, urban-rural setting and grade point average. The model is the same for average monthly earnings except that relatedness of job to training is expressed for both first and current or last job.

Primary
Sources:

1. Benefit data from: Susan Fernbach and Gerald G. Somers, An Analysis of the Economic Benefits of Vocational Education at the Secondary, Post-Secondary and Junior College Levels, Preliminary Report, Madison, Wisconsin, May, 1970.
   Cost data are from: Fernbach and Somers, Analysis . . ., op. cit., May 1970, and William C. Morsch, Study of Community Colleges and Vocational Training Centers: Cost Analysis, Washington, D. C., 1970.

2. Benefit data are from Gerald G. Somers, et al. The Effectiveness of Vocational and Technical Programs: A National Follow-up Survey, Madison, Wisconsin, 1970.
   Cost data are from Fernbach and Somers, Analysis . . ., op. cit., May 1970 and Morsch, Study, 1970.

3. Benefit data are from Somers, et al., Survey, . . ., op. cit., 1971.
   Cost data are from Fernbach and Somers, Analysis . . ., op. cit., May 1970 and Morsch, Study, 1970.

4. Adger B. Carroll and Loren A. Ihnen, "Costs and Returns for Two Years of Post Secondary Technical Schooling: A Pilot Study," Journal of Political Economy, Vol. 75, No. 6, December 1967.

5. Benefit and cost data are from Somers, et al., Survey . . ., op. cit., 1971.

Secondary
Sources:

1. Report of the Analysis Group, HEW Vocational Education Review Task Force, Vol. I. Prepared for Dr. James Abert, Deputy Assistant Secretary, Evaluation and Monitoring, Department of Health, Education, and Welfare, Silver Spring, Maryland: Operations Research, Inc., 25 September, 1970.

2. Ernst W. Stromsdorfer, Review and Synthesis of Cost-Effectiveness Studies of Vocational and Technical Education, Columbus, Ohio: The Center for Vocational and Technical Education, Ohio State University, 1972.

PPENDIX TABLE B-16 (Cont.)

2/ Secondary vocational graduates are the group against which these coefficients are to be compared. Thus, those office occupation graduates from post-secondary vocational school earned one cent an hour less on their first jobs than did office occupation graduates from secondary high school.

3/ + indicates that the partial regression coefficient is positive but not statistically significant; - indicates that the partial regression coefficient is negative but not statistically significant.

Source: Gerald G. Somers, et al., The Effectiveness of Vocational and Technical Programs: A National Follow-up Survey, Madison, Wisconsin, 1971. Table VI.13, Table VI.18, Appendix Table 23.

APPENDIX TABLE B-17

COMPARATIVE ANALYSIS OF COST AND BENEFIT ESTIMATES OF SELECTED STUDIES OF POST-SECONDARY VOCATIONAL-TECHNICAL EDUCATION AND JUNIOR COLLEGE EDUCATION

Name of Study	Time Period of Study[1]	Locus of Study	Experimental Group	Control Group	Cost/Year		Benefit/Year[6]		Duration of Training in Years	Duration of Benefits in Years[4]	Rate of Return (percent)	Present Value in Dollars	
					Marginal	Average	Marginal	Average				5%	10%
1. Fernbach and Somers	1964-69	Nationwide	Post-secondary vocational education	College Preparatory									
a.[2]					2494, 2519[7]		996		2	10	8.7	1198	Neg
b.					3084, 3132		996		2	10	6.8	642	Neg
2. Somers, et al.	1964-69	Nationwide	Post-secondary vocational education	Secondary vocational education									
a.					2814, 2839[7]		329		2	10	Neg	Neg	Neg
b.					3504, 3552		329		2	10	Neg	Neg	Neg
3. Somers, et al.	1964-69	Nationwide	Junior college	Post-secondary vocational education									
a.					2598, 2616[7]		1642		2	10	24.9	6986	4196
b.					3110, 3144		1642		2	10	20.0	5971	3204

APPENDIX TABLE B-17 (Cont.)

Name of Study	Time Period of Study[1]	Locus of Study	Experimental Group	Control Group	Cost/Year		Benefit/Year[6]		Duration of Training in Years	Duration of Benefits in Years[4]	Rate of Return (percent)	Present Value in Dollars	
					Marginal	Average	Marginal	Average				5%	10%
4. Carroll and Ihnen	1959-64	North Carolina	Post-secondary vocational education	College Preparatory	3551,[8] 3874		555[3]		2	43	16.5	15523	5157
5. Somers, et al.	1964-69	Nationwide	Junior college	Secondary vocational education									
b.					3474,[7] 3474		1656		2	10	17.6	5400	2617

Notes:

1/ Time period of study includes the training period as well as the available time for follow-up at the time the data were gathered.

2/ (a) includes current operating costs and opportunity costs; (b) includes current operating costs, capital costs and opportunity costs.

3/ Benefits are estimated to increase at a rate of $161 per year and reach $1,038 in the fourth year after graduation. In general, a 2 percent growth rate was applied to the earnings differential between the post-secondary technical graduates and their control group, comprehensive high school graduates.

4/ Except in the case of the Carroll and Ihnen study, benefit duration is based on the estimate of Max U. Eninger, The Process and Product of T and I High School Level Vocational Education in the United States: The Product, Pittsburgh, Pennsylvania, 1965.

5/ Opportunity costs are based on the earnings experiences of secondary vocational rather than college preparatory. This results in an upward bias in the cost estimate and a corresponding reduction in net benefits.

6/ All benefits are before-tax earnings and represent a social benefit, that is, an increase in value-added in the gross national product.

7/ Costs are expressed for each of the two successive years of training.

8/ Costs are total social costs, which include current operating costs, capital costs and opportunity costs.

Appendix C

Annotated Bibliography

Annotated Bibliography for

Ch. 2 The Socio-Economic Background of Students in Vocational Programs

INTRODUCTION

Despite the fact that vocational education has long been in existence in the school system, very little is known about the characteristics of the students who enroll in these courses. A study of the literature reveals there have been few national survey studies on the characteristics of vocational education. There are more state studies than national studies, but they are principally of students in specific occupational fields, or are so regional in content that they are not useful in a national survey context.

Study findings show that background is probably the most important influence on students' career choices, and most of the studies suggest that family background and the father's occupation have an enormous influence on the choice of study an individual will follow.

This chapter is divided into four sections: 1) National studies on the characteristics of vocational students, both at the secondary and postsecondary level; 2) State studies focusing on the high school enrollee; 3) State studies focusing on the postsecondary enrollee; 4) Several state studies focusing on information systems designed to collect data on vocational enrollments.

1. National Studies of Characteristics of Vocational Education Students

Somers, Gerald G. et al. The Effectiveness of Vocational and Technical Programs. A National Follow-up Survey. Final Report. University of Wisconsin, Madison Center for Studies in Vocational and Technical Education, Madison, Wisconsin, 1971.

Purpose: To provide some measurement of the effectiveness of vocational education. The study was primarily focused on the ability of vocational education to meet the educational, employment-oriented, and income needs of various population groups.

Procedure: A national sample of vocational students who graduated from high school, post-secondary schools, and junior college vocational programs in 1966 was surveyed three years later to determine the effectiveness of their vocational education. Schools were selected with vocational programs in the following areas: Trade and Industrial, Distributive, Health, Agriculture, Technical and Office Occupations. The sample was drawn on a random basis from each of these program areas. An academic "control" sample was used as a comparison group in analyses of employment and income experience of graduates in vocational programs.

Questionnaires were mailed to 7,327 graduates in the secondary school and 2,165 returns were used. In the post secondary schools 3,461 questionnaires were mailed and 1,526 returns were used. In the junior college group 2,591 questionnaires were mailed and 1,273 returns were used. There were 633 usable questionnaires returned from the academic sample group.

Findings - Socioeconomic Background

1. Respondents in the junior college and high school academic samples have fathers with a higher level of educational achievement than those in the high school or post-high school vocational sample. Approximately one-fifth of the respondents in the junior college and high school academic programs have fathers with more than a high school education. In the two vocational school samples, the corresponding percentages were 14.10 and 10.60.

2. Fathers' educational level by program area:

   Junior College -- One-third of the graduates from Technical programs had fathers who had achieved more than a high school education as compared with less than one-fourth of those from the Health and agricultural programs, and less than one-fifth from those in other programs.

   At all school levels the proportion of fathers with more than a high school education was lowest for graduates from the Trade and Industrial programs.

3. Jobs held by fathers in occupational programs

   Junior college - The proportion of professional, technical and managerial occupations was greater at the junior college level than at the post high school and high school level, especially for those graduating from technical programs where one-fourth of the fathers of the junior college graduates held professional or technical positions in contrast with only ten percent of the fathers of students in the post high school and high school programs.

Hughes, Lloyd Ray. The Effects of Selected Occupational Information Upon the Aspired Socioeconomic Status of Pupils in Agricultural Occupations Courses. Library, University of Illinois, Urbana, Illinois.

Purpose of Part I of the Study: To determine profile of pupils in certain agricultural occupation courses with regard to socioeconomic status, aspired socioeconomic status, father's occupation, and stated occupational goals of the pupils.

Method: Studied 142 pupils enrolled in agricultural occupation courses in grades nine, ten, and eleven in six high schools randomly selected from the population of seventeen high schools located in Eastern Central Illinois.

Findings:

1. The socioeconomic class of the pupils studied centered around the white mid-working class. The pupils aspired to middle class occupations. The data relative to aspired socioeconomic status seemed to indicated that one of the determiners of pupils' aspirations is their socioeconomic level.

2. The study indicates that more emphasis should be placed upon providing effective occupational information and guidance concerning non-farm occupations to pupils enrolled in agricultural occupation courses, especially in the 9th and 10th grades.

For most program areas in the junior college programs, the occupations of the fathers placed the students in a higher socioeconomic status than the fathers of post high school and high school vocational students.

Educational Level of mothers of vocational graduates

The mothers of the junior college and post high school vocational graduates had a higher level of education than those in the high school vocational programs. This was especially notable in the Technical and Agricultural programs where the educational level of the mothers was relatively high at the junior college and post high school levels but not markedly higher than in other programs at the high school level.

The socioeconomic index on occupations of employed mothers was considerably higher than those of employed fathers for graduates at the high school and post high school vocational levels.

Conclusion: Students entering and graduating from particular programs and particular levels of vocational technical education come from varying socioeconomic backgrounds.

Personal Characteristics of Dropouts

The differences between the socioeconomic index of father's occupation for dropouts and graduates is relatively small.

Reason for Selecting Vocational Courses

The students in the high school and post high school vocational programs selected vocational courses because of their work-oriented interests. They were generally motivated by the attractions of the type of work rather than by knowledge of specific pay or working conditions which might result.

Cross, Patricia K. Occupationally Oriented Students. American Association of Junior Colleges, Washington, D.C. November 1970. (Prepared for two-day conference jointly sponsored by the American Education Publication Institute and American Association of Junior Colleges on Occupationally-Oriented Programs in Two-Year Colleges, Miami, Florida, December 5, 1969.)

Short, excellent research review of junior college students enrolled in vocational and technical programs. The study is a combination of findings of recent studies about these students with a tentative discussion of their background and characteristics.

The author made the following conclusions about the characteristics of vocational students from her review of the recent literature:

1) Over half of the students come from homes of skilled, semi-skilled, or unskilled workers. Little over one-third of college parallel students in community colleges come from the homes of workers.

2) Average academic ability of two-year college students is lower than for four-year college students.

3) More women of moderate ability enter occupational curricula, whereas occupational men tend to be concentrated at lower-ability levels.

4) For many students, the choice of an occupational course of study is determined between the ages of fourteen and eighteen, if not earlier.

5) The interest of occupationally-oriented students is in concrete and tangible goals which is consistent with research findings that lower socio-economic groups are concerned with security and concrete rewards, i.e., money in a job; whereas higher socio-economic groups are more likely to seek goals of status, achievement, and respectability, i.e., learning for its own sake.

Garbin, A. P., Vaughn, Donald. Community-Junior College Students Enrolled in Occupational Programs: Selected Characteristics Experiences, and Perceptions, Final Report. Ohio State University, Center for Vocational and Technical Education, Columbus, Ohio, September 1971. (ED 057 196).

Purpose: A national survey concerned with furthering understanding of enrollees in junior college occupational programs. (First of four planned publications based on results of national survey).

Method: A questionnaire was distributed to 5,000 students in vocational technical programs at 50 selected public, community-junior colleges. The questionnaire contained questions on students' personal and background characteristics, experiences and perceptions. Where possible, findings were compared with those reported on other groups of students.

Student Characteristic Findings:

1) Socio-economic

A. Many vocational students have family origins of less than middle class, particularly among the black students, but it appears that respondents whose parental families belong to lower skill levels of white blue-collar groups are somewhat underrepresented in the sample.

B. The majority of students perceived positive attitudes from parents toward the value of studying hard.

C. There is a high mobility factor among vocational students, particularly in more rural areas. Therefore, many students are unsure as to their future community orientation

2) High School Grades

A. Vocational technical college students do not differ greatly in self-reported high school grades from junior college students in general, but females tend to be superior to males.

3) Demographic Variables

A. The ratio of males to females is about three to two. The female students are concentrated in service areas and the male students are concentrated in technical, trade-industrial and vocational agriculture.

B. One-half of the students are 19 years of age or younger, one out of seven is 24 years or older.

C. Vast majority of respondents are Protestants.

Kay, Evelyn R. Vocational Education: Characteristics of Teachers and Students, 1969. National Center for Educational Statistics. Published by U.S. Department of Health, Education and Welfare, Office of Education, Washington, D.C. 1971. (ED 050 297).

Purpose:

1) To gather information on backgrounds and teaching loads of vocational education teachers.

2) To gather information on personal characteristics and future plans of vocational education students.

3) To develop a technique for surveying teachers and students that could later be applied in greater depth at state and local levels.

Procedure: After determining the universe of vocational education teachers by program and level of instruction, a sample of teachers and vocational classes was selected to receive questionnaires. The returned questionnaires were checked for conformity with the sampling plan and were then coded, edited and tabulated.

Sample:

3.8 percent of the universe of teachers were tested. (4,472 name sample). Assuming each teacher taught an average of 20 students, the sample size of the students was expected to be approximately 90,000. 2,574 teachers and 43,111 students, or about 58% of the teachers on the original mailing list and 76% of the students in the sampled classes returned the questionnaires.

Marital and Family Status Findings:

1) Six percent of the females, two percent of the males were married or had been married.

2) One of five vocational students was the head of his or her own household (including students living by themselves).

3) Two-thirds of the students lived with parents or guardians.

4) One out of ten students who lived with his family reported a female-headed household.

5) Two out of five students lived with a single parent -- fifteen percent reported a three-person family.

Income:

1) Students living by themselves had incomes under $6,000 a year.

2) The majority of other student household heads had incomes about $6,000 a year level.

3) Three-fourths of the students who lived with families reported family income over $6,000 a year. Seven percent reported family incomes under $3,000.

4) Family income for the majority of the students exceeded $6,000 regardless of whether they were urban, suburban or rural areas.

5) The higher the educational level of the head of the student's family, the higher the family income. Median family income for all secondary and postsecondary students was around $8,500, but for those where the head of the household had less than an 8th grade education, the median family income was only $5,800.

6) Of those students who had jobs, nearly three out of five at all income levels worked between 15 and 34 hours per week. The males were employed more often than females.

7) Over half of all the employed secondary and postsecondary students had jobs related to programs they were pursuing.

Plans of the Students

About half of all the secondary-postsecondary vocational students planned to seek employment after completion of their schooling, about eight of nine of those expected to do so in their field of training.

Program Choice by Parental Education and Occupation

1) Findings provide only a rough indication of the distribution of parents by education and occupation and relationship to student program choices. It does appear that about half of the parents of secondary students had completed high school. One out of five had some college, one out of four had not studied beyond the eighth grade.

2) Relative educational attainment appears to be highest among parents of students in distributive and technical educational programs, lowest among those in agriculture, trades and industry.

3) Three out of five of the parents of secondary-level vocational students were blue-collar workers, half of the employed parents were "craftsmen and foremen."

4) Unusually higher numbers of white-collar workers among parents in distributive education, home economics and office occupations programs.

Kievit, Mary Bach. Expectations for Learning Environments and Personality Factors of Students Compared to Drop-Outs from Two-Year Institutions. Paper presented at 1971 Annual Meeting of the American Education Research Association, February 4-7, 1971, New York, New York. (ED 047 667).

Purpose: To examine college environments and behavior manifestations of personality needs.

Procedure: Measures used in study were developed by G. C. Stern for four year college students were applied to two year vocational education students. A survey was made of 1) all freshmen, at a selected community college and technical institution who were enrolled in four specific occupational curricula; 2) those students who continued in the curriculum into a fourth term; 3) those students who subsequently dropped out.

Findings:

1. Demographic Characteristics

   A. Over ninety percent were 25 years old or less.

   B. Slightly over one-half of the students were male.

   C. Over ninety percent were single.

   D. Approximately three-fourths were from families where the supporting parent was employed in lower status white collar, clerical, skilled and semi-skilled and unskilled occupations.

   E. About 70% reported that the highest level of parents' education was high school or less.

   F. The men were slightly higher among those dropping out -- the results suggest that students dropping out were from families of slightly higher socioeconomic status and had attained higher educational levels.

2. Scholastic aptitude was not significantly related to dropping out or continuing at either institution.

Operations Research, Inc. Report of the Analysis Group, HEW Vocational Education Review Task Force. Volume I. Silver Spring, Md. (D. HEW). September 25, 1970. 187 p. (050 291).

Purpose of Study: To quantitatively assess the present status of vocational education for use in identifying major issues and problems , and indicating implications for the future. The study, among other objectives, attempted to compare vocational education in the private sector with comparable schools in the public sector. It was pointed out that there is a shortage of data on the vocational education in the private sector.

Tentative Findings: Although evidence is by no means conclusive, it does suggest that average "quality" of the students enrolled in private vocational schools (in terms of socioeconomic background, quality and level of prior education and training, motivation and inherent ability) may be greater than that of his public vocational school counterpart. (For private vocational education study, see Belitsky, A. H., "Private Vocational Schools and Their Students."

Belitsky, A. Harvey. Private Vocational Schools and Their Students -- Limited Objectives, Unlimited Opportunities. Schenkman Publishing Company, Inc., Cambridge, Massachusetts, 1969.

Purpose: This was a national survey to determine how (or even whether) private vocational schools could be widely utilized in the training of "disadvantaged" persons. Attention in this study was also focused upon the workings of private vocational schools.

Procedure: A short questionnaire was mailed to 2,606 private schools in the following occupational training categories: Trade and Technical, Business, Cosmetology and Barbering. Approximately 12000 schools responded. In addition, a long, detailed questionnaire was mailed to the 156 members of the National Association of Trade and Technical Schools. One hundred and twenty-eight schools responded. The socioeconomic characteristics of the students mentioned below were based upon the questionnaires mailed to the NATTS schools.

Findings -- Socioeconomic Characteristics

1. The age of students enrolled in day sessions was approximately 20, and slightly more than ten percent of all students were at least 26 years of age and over. Nearly two-fifths of the evening students were 26 years of age and over. Therefore, it is unlikely that a sizeable portion of the day students had full-time employment experience, and it is highly likely that the evening students were or had once worked full-time.

2. There was a striking difference between the formal educational requirements for admission to a trade or technical school and the students' actual qualifications. Many students in two-thirds of the responding schools were "over-educated" -- their actual education exceeded the schools' requirements.

3. Enrollees in NATTS schools predominantly were men, nearly two-thirds of the schools had at least ninety percent male enrollments in both day and evening sessions.

4. Only a small minority of students attending trade and technical schools can rely upon their parents or their personal savings for all of the funds to pay for their schooling. Approximately two-thirds of NATTS schools indicated that some of their students received loans either from banks or directly from school funds.

5. The surveyed members of NATTS reported surprisingly low dropout rates for their schools. The median dropout rate for all day classes was 14% and the dropout rate for the evening classes was 20%. Financial problems were the major cause for dropouts. Personal or family problems were the next most commonly stated reason for dropping out.

Parnes, Herbert S., Miljus, Robert C., Spitz, Ruth S. and Associates. Career Thresholds: A Longitudinal Study of the Educational and Labor Market Experience of Male Youth 14-24 Years of Age. Volume One. Center for Human Resource Research, The Ohio State University, Columbus, Ohio, February, 1969.

Purpose: To examine relationship between selected demographic, attitudinal and educational characteristics of male youth in the United States and their labor market experience and occupational aspirations. The data are drawn from interviews conducted during October-December 1966 with a national sample of the noninstitutional civilian population of males 14 to 24 years of age. This report examines the labor force participation, unemployment experience, employment patterns, labor market knowledge, job attitudes, and educational and occupational aspirations of the age cohort at the time of the initial survey in 1966, and seeks explanations of variations in these factors on the basis of a large number of economic, social and psychological variables.

Procedure: Data were obtained through personal interviews with a national probability sample of the civilian noninstitutional population of males who were 14 to 24 years of age in April, 1966. The sample was drawn by the Bureau of the Census from households in the 235 areas that constituted the primary sampling units (PSU's) in the experimental Monthly Labor Survey (MLS) conducted by the Census Bureau for the Bureau of Labor Statistics between early 1964 and late 1966. The sample consisted of 5,225 individuals, of whom 3,734 were white.

Findings - Educational Characteristics

1. There is such a close relationship between age and grade in school, that for most purposes they can be used interchangeably.

2. The school enrollment ratio has been lower among blacks than among whites, which means that the educational attainment of those who are out of school is lower for blacks than for whites. About a third of the white youth not enrolled in school, as compared with almost three-fifths of the blacks, lack a high school diploma.

3. Black youth no longer in school are much less likely to have had vocational training outside the regular school system. Almost half of the whites, but only a fourth of the blacks have had such training.

4. In the case of blacks and whites, there is a strong association until the college level, between the level of school attainment and probability of having had vocational training.

5. In high school, 12% of the whites and 15% of blacks are enrolled in vocational or commercial curricula but white high school youth are about twice as likely to be enrolled in college preparatory curriculum.

Family Background Characteristics

1. On basis of residence at age 14, black youth are more likely than white peers to reside in large cities.

2. At age 14, vast majority of white youth were residing with both their natural parents (85%), whereas this was true of only 58% of black youth.

3. Occupation of father - white youth are four times as likely as black youth to be from homes headed by professional or technical workers or by managers, proprietors, and officials.

4. White youth are twice as likely as black youth to have had access to reading material at age 14.

Income and Assets

1. Three-tenths of black youth, in contrast with less than one-tenth of white, are in family units with annual incomes under $3,000.

2. For youths not in school, differences in income prevail in all age categories, but increase substantially as age increases.

School Enrollment Status and Selected Characteristics

1. Sons of white collar workers, ages 16 and 17, are more likely to be enrolled in school than sons of blue collar, service and farm workers.

2. Differences in enrollment rates between blacks and whites are, in large measure, explained by differences between two color groups in socioeconomic status of family of origin.

Type of Community

1. Among white youths between ages of 16 and 24, those with rural farm or non-farm backgrounds are considerably less likely to be enrolled in school than those from urban communities.

2. Pattern is same for black youth except that those from rural nonfarm areas are hardly less likely to be enrolled in school than those for urban areas.

High School Curriculum

1. It appears that youth in the general and vocational curriculum are less likely than those in college prep to continue their education beyond high school, but they are also more likely to drop out of high school before graduating.

2. Pattern for black youths is similar to that for whites.

Zeiler, Frederick A., and others. Career Thresholds: A Longitudinal Study of the Educational and Labor Experience of Male Youth. Volume 2. Ohio State University, Center for Human Resource Research.. Columbus, Ohio. Washington, D.C. October, 1970. 161 p.

Progress report that summarizes findings of a second round of interviews with a cohort of young men betweeen the ages of fourteen and twenty-four years of age. 1967 interview provided data on the magnitude and patterns of chages in education and employment status during the 12 months since the first round of interviews.

Findings: The data suggests that family income and other measures of socioeconomic status have a large effect on decision to remain in school or return after dropout, especially for the transition from high school to college.

Shea, John R., Roderick, Roger D., Zeller, Frederick A., Kohen, Andrew I. and Associates. Years for Decision: A Longitudinal Study of the Educational and Labor Market Experience of Young Women, Volume I, The Ohio State University, Center for Human Resource Research, Columbus, Ohio, February, 1971..

For purpose and procedure of study, see Parnes study cited earlier.

Findings:

Demographic

1. 18.1 million young women between the ages of 14 and 24 were in the civilian, noninstitutional population of the U.S. in February, 1968; 12% were black. Fifty-one percent of the whites, and 46% of the blacks were students at the time of the survey.

Educational Experience

1. Among nonmarried women in school, age and grade are closely related but a disproportionate large number of black young women are over-age in grade.

2. White high school girls 14 to 17 years of age are considerably more likely than black girls to be enrolled in college preparatory courses (40% white, 25% black). Blacks are more likely than whites to be in "general" curriculum (58% versus 44%). Identical percentages of each color group are enrolled in vocational and commercial programs.

Education and Training of Out-of-School Youth

1. White young women who are not enrolled in school have, on the average, completed more years of school than blacks. One-fourth of the white girls did not graduate from high school; this is true of almost one-half of the blacks. Whites are almost twice as likely as blacks to have attended college (19% vs. 11%).

2. Although black women who are out of school have less formal education than their white counterparts, roughly the same proportions of the two color groups have had occupation-related training outside regular school systems.

Family Background

1. There is a pronounced relationship between a father's educational attainment and how far his daughter has gone in school.

2. Whether a youngster had access to reading materials at age 14 seems to be a powerful influence on school achievement.

2. State Studies Focusing on the High School Enrollee in Vocational Education

Mallinson, George G. Characteristics of Non-College Vocationally-Oriented School Leavers and Graduates. Western Michigan University, Kalamazoo, Michigan. February, 1966. (ED 025 602).

Purpose: To survey a representative sample of non-college bound students who were dropouts or graduates of class of June, 1963 in 12 midwestern high schools. The study was designed specifically to investigate socioeconomic backgrounds, academic backgrounds and the reactions of these non-college bound students to self, family and school. It was further designed to determine occupational areas entered by subjects, what vocational training, if any, they had received, and their reaction to such training. The sample was selected from about 6,000 participants in a science motivation study conducted from 1957 to 1963.

Procedure:

1. Standardized test scores, obtained when subjects were in secondary school, were re-analyzed. The scores of these students were compared with those of a matched group of students who had entered college.

2. Interviews were conducted with the students in their home communities.

Findings:

1. Non-college students had neutral reactions to their high school training.

2. The occupational and educational levels of the parents of college-bound students were markedly higher than non-college graduates. In fact, the higher the educational level of the parents, the higher the reading and science achievement scores of the students.

3. The counselors in high school failed to provide adequate vocational guidance information to vocational students.

4. Forty-three percent of the subjects received some type of vocational training after high school. The most common type of training for males was apprenticeship in a business school course. The most common training for females was in nursing or beautician schools. The most common job held by males was factory work and by females was general office and nursing.

Bowles, Roy T., Slocum, W.A. Social Characteristics of High School Students Planning to Pursue Post High School Vocational Training. Final Report. Washington, State University, June 1966.

Purpose: To identify characteristics of students who plan to pursue vocational training after high school graduation. The study compares social characteristics of students planning vocational/business training with those students who plan to terminate their education with high school, and those who plan to attend or graduate from college. Comparisons were made of school experiences and attitudes toward school, family background, peer group relationships, and occupational expectations.

Procedure: The sample was selected fromvocational students enrolled in Washington State high schools in the 1965-66 school year. The students planning to take business and commercial training were separated from those planning to take courses in other vocational areas. The data were collected by questionnaire.

Findings:

1. Students planning to acquire additional business and vocational training had had different high school experiences and had different attitudes toward school than students planning to attend or graduate from college. The vocational students reported lower grades, less interest in school work and more dissatisfaction with school.

2. Socioeconomic findings: Vocational business students were less likely to have a mother or father who attended college than college-bound students.

In general, vocational or business students were not as likely to have family characteristics conducive to high levels of educational expectations or achievements.

A large majority of the men and women planning vocational or business training expected to enter occupations appropriate to the level of training they planned to receive.

Duncan, Otis Dudley, Featherman, David L., Duncan, Beverly. Socioeconomic Background and Occupational Achievement: Extensions of a Basic Model. Final Report. May, 1968. University of Michigan, Ann Arbor, Michigan. 312 p. (ED 023 879).

Purpose: To synthesize a body of knowledge about factors affecting occupational achievement in terms of a set of explicit models of the process of achievement.

Problem: What factors can be identified as influencing occupational achievement (if occupation is achieved status), and thus accounting for variation in occupational status. In particular, what, if anything, about socioeconomic backgrounds represent favorable or unfavorable conditions for achievement, and how do these conditions exercise their influence?

Some of the Socioeconomic Variables Studied

1. Head of family's educational and occupational attainment
2. Size of family
3. Ethnic and race category
4. Religion

Other Variables

1. Schooling -- dependent upon background antecedent to influence occupational achievement
2. Social influences
3. Career contingencies

Outcome Variables

1. Income/earnings
2. Occupational status
3. Job satisfaction
4. Security (economic status)

Ullery, Jesse Wm. A Comparative Analysis of Selected Student Characteristics and Vocational Cooperative Programs. University of Illinois at Urbana-Champaign, 1971. (Dissertation)

Objective of Study: To explore student selection and cooperative work-education (CWE) program operation; to devise a method to identify and study groups of students excluded (overtly or covertly) from vocational education programs (CWE); and to devise an analytical technique using selected characteristics to compare students admitted to CWE programs to those excluded. The students were in vocational education programs in high school in Illinois.

Findings: The characteristics of the students excluded from CWE suggest many students are denied admission to CWE on the basis of such factors as socioeconomic class, race, age, sex, dropout-proneness, low school achievement, absenteeism, etc. The conclusion is that non-CWE students fit the description of the population generally designated for priority assistance in terms of national goals and priorities. This is the population most in need of help provided by CWE.

Thompson, John F. Pilot Programs in Vocational Agriculture. Characteristics of Students Enrolled in Wisconsin Vocational Agriculture Pilot Programs, 1968-1969. Wisconsin University, Madison, Wisconsin, Department of Agricultural and Extension Education, 37 p. (ED 035 742).

Purpose: To study students enrolled in ten high school programs in vocational agriculture in Wisconsin. The study was performed by the Committee of Pilot Vocational Agriculture in Wisconsin appointed in October, 1967 by the Wisconsin Department of Public Instruction.

Procedure: The Committee gathered data along the lines of student characteristics, student plans and employment histories. One hundred and ninety-eight students were tested, predominantly upperclassmen.

Findings: The pilot program attracted very few girls. Sixty-six percent of the students had non-farm backgrounds. The majority of the pilot course enrollees were already familiar with vocational agriculture and the concentration of the students without prior agricultural experience was in the non-farm group. A higher percentage of the farm residents reported above average grades in agriculture than did non-farm residents.

Reisenger, Raymond Henry, Characteristics and Perceptions of Seniors Enrolled in New York State Area Vocational Centers, The Ohio State University, 1970. (Dissertation)

Problem: To study the characteristics of students who attend Area Vocational Centers in New York State. These are shared-time, half-day vocational education plans operated by the Boards of Cooperative Education Services.

Procedure: Significant items were identified from the pertinent data collected and used as the basis for developing a survey instrument. The programs in major cities in New York State were not studied.

Findings: The findings of the study indicate overwhelming satisfaction and support for enrolled senior high school students for area center shared-time vocational programs. The students' concern with their future careers and their need for occupational development indicates strongly that postponement of occupational development until post high school would be inappropriate. The students did not feel that traveling to an area center for a half day tended to isolate and segregate them.

Kaufman, Jacob J., Lewis, Morgan V. The Potential of Vocational Education: Observations and Conclusions Based on a Study of Three Selected Cities in Pennsylvania. Pennsylvania State University, University Park, Institute for Research on Human Resources, May, 1968, 171 p. (ED 023 902)

See citation in part 4 for purpose of study.

General Conclusions as to Characteristics of the Students in the Three Cities Enrolled in Vocational Education

1. Sixty-nine percent of the males and sixty percent of the females in the study were from blue collar homes. (In a broader study of the overall Pennsylvania data, 70% of vocational students were from such families). A larger percentage of the academic graduates had fathers in white collar occupations, especially the professional and technical managerial category.

2. These data support the findings of other social scientists that one's socioeconomic background exerts a major influence on occupational choices and experiences.

Mondart, C. T. Sr. and Others. Educational and Occupational Aspirations of Expectations of High School Youth. Louisiana State University, Department of Vocational Agricultural Education, Baton Rouge, Louisiana, 1971.

Purpose: To identify occupational and educational aspirations and expectations of Louisiana high school students and relate these aspirations to their background of experience.

Method: 13,607 students (7,021 girls and 6,586 boys) were interviewed in a group situation.

Major Findings:

1. Students' educational aspirations are influenced most by home and friends.

2. Students develop strong occupational interests early with the first tentative choices made at least before the 11th grade.

3. State Studies Focusing on the Postsecondary Student in Vocational Education

Brinkman, Fred John. Analysis of the Characteristics of Selected Vocational Students With Implications for Guidance and Counseling. Ph.D. Dissertation, 1970. Available from University Microfilms, Ann Arbor, Michigan. 282 p. (ED 046 388)

Purpose: To determine characteristics of student population enrolled in evening programs of the college and, through analysis, assess the relevant implications for guidance and counseling.

Procedure: Review of the literature, development of original survey instrument, and administration of instrument to 6,147 evening division students.

Findings:

1. Two-thirds of evening students had enrolled in educational programs because they anticipated direct benefit either to present or future employment.

2. Three-fourths of the students were pursuing educational programs related to career development.

3. Seventy percent of the students expected to obtain employment or job advancement as a result of completing their classes.

4. More than half of the students planned to graduate from the community college.

5. Approximately one-third of the students were uncertain of their plans.

6. The guidance staff needs both a background in and appreciation of the world of work and the role of guidance and counseling needs to be reassessed.

Stewart, Lawrence H. Characteristics of Junior College Students in Occupationally Oriented Curricula. University of California, Berkeley School of Education, March, 1966.

Purpose of Study: To determine whether students enrolled in diverse vocational programs in one institution can be differentiated in terms of non-cognitive variables, such as interest and personality traits. The subjects were enrolled in a junior college in the San Francisco Bay Area.

Procedure: Interest Assessment Scales and selected scales of the Omnibus Personality Inventory were administered to male and female junior college students enrolled in trade and industrial courses, along with a questionnaire designed to elicit background information and attitudes toward the school.

Findings:

1. There are meaningful psychological factors which are related to the choice of a vocational program in a junior college -- that is, vocational students are not simply an aggregate of individuals who have been dumped into vocational programs because they were unsuccessful in other courses.

2. There were significant sex differences in scores on the study variables, thus, the data was analyzed separately by sex.

3. There were significant variations in patterns of scores on the IAS and OPI among the students enrolled in various vocational curricula.

4. A number of scales on the OPI were related to academic performance.

Theoretical Significance of Study: Non-cognitive factors are important in the choice of a vocational curriculum.

Practical Significance of Study: A knowledge of the characteristics of students who typically enter certain fields should be of interest to an individual in making his own career choice.

Hakanson, J.W. Selected Characteristics, Socioeconomic Status, and Levels of Attainment of Students in Public Junior College Occupation-Centered Education. Unpublished doctoral dissertation, University of California at Berkeley, 1967. 49 p. (ED 013 644)

Purpose: To study 1,000 California students who entered six public junior colleges in the Fall of 1959 to identify the characteristics of these students (emphasizing socioeconomic characteristics) in terms of occupational programs.

Results:

1. Most students enrolled in vocational technical programs directly following high school graduation, rather than as a result of lack of success in transfer programs.

2. Most of the students, especially women, had taken vocation courses in high school.

3. Sixty percent did not complete the program.

4. Most of those who completed the courses were from the middle socioeconomic background.

5. Only 14% of those who failed to complete the transfer program changed to an occupational curriculum, almost one-third of the male terminal students with middle socioeconomic status had tried the transfer program before enrolling in occupational programs.

Saltys, Robert George. The Use of the "Pattern Search Technique" as a Tool for Identifying the Characteristics of Vocational Technical Students Attending a Two-Year Public Community College. University of California, Los Angeles, California, 1971.

Problem: To identify characteristics of students attending two year public community colleges in California, thereby developing institutional goals for vocational technical students.

Procedure: Sixty student characteristics were defined and categorized as indices of student talent, along with individual family and financial variables. A questionnaire listing these sixty "raw characteristics" was administered to 405 randomly selected students at Rio Hondo College, Whittier, California (approximately 20% of total student enrollment).

Conclusion: The study demonstrated the methodology which can be useful for generating and assessing information for school administrators, school boards, counselors, teachers, and others by separating inherent characteristics of community college students into patterns.

Becleer, William James. Technical Agriculture Programs in [illegible]io With Emphasis Upon Student and Program Characteristics. Ph.D. Dissertation, 1968. Library, The Ohio State University, Columbus, Ohio.

Purpose: To identify student characteristics in technical agriculture programs in Ohio, and to determine the association between selected student characteristics and success in the world of work.

Procedure: Studied 246 past and current students in technical agricultural programs, including 70 graduates and 33 individuals who had failed to complete the program. This sampling represented 86% of the individuals enrolled in technical agricultural programs since the 1963 inception of the program.

Findings: Typical enrollee is 20.1 years old, high school graduate, I.Q. of 103.2, 2.25 grade point average in high school, ranked in 46.6% of his high school class. Fifty percent of the students lived in a 50 mile radius of the Institute.

Oman, Ronald Nels. The Self Concept of Occupational Ability and Related Characteristics in Community College Occupational and Academic Students. Michigan State University, 1971.

Purpose:

1. To determine relationship among selected career development factors in community college students, including other's evaluation of occupational ability and other's expectations of occupational choice.

2. To investigate the relationship between these career development factors and socioeconomic background, previous occupational experience, and previous occupational training.

3. Compare students on career development factors. These comparisons include male versus female, academic versus occupational, previous versus no previous occupational education, high versus low socioeconomic status.

The subjects were 346 academic and 129 occupational freshmen students at Jackson Community College, Jackson, Michigan.

Major Findings:

1. One-third of the students named parents as the most significant other person influencing occupational choice. Friends, teachers, work supervisors, and employers also were mentioned frequently.

2. Differences between academic and occupational students indicated academic students evaluated their carerr potentials higher and expected higher levels of occupational choice than occupational students. Males considered their career potentials to be higher than did females. Higher socioeconomic males and females demonstrated greater variability than low socioeconomic males and females.

American College Testing Program, How Do Community College Transfer and Occupational Students Differ? Iowa City, Iowa. (ED 049 723).

Purpose: To examine the differences between and among commercial college students enrolled in transfer and occupational programs. The data was gathered from a sample of 924 full-time freshmen and sophomore students enrolled in transfer and occupational programs in three Iowa commercial colleges in Spring, 1968.

Findings:

Academic Achievement

1. Transfer men had higher academic and verbal ability than did occupational men. But the women students did not differ.

2. The educational aspirations of the transfer students were greater. On the scales measuring interpersonal competence characteristics, transfer men rated themselves higher than vocational education men, but women did not differ on any of the scales.

Socioeconomic Background

1. The fathers of male transfer students and occupational students were significantly different in occupational types. The fathers of transfer students were mainly in managerial and professional categories. The fathers of occupational students were mainly farm workers, laborers, etc. The fathers of occupational and transfer women did not differ in occupational categories.

2. Transfer and occupational male students differed on age of initial decision to enter college. Many of the transfer students made this decision as early as the sophomore year in high school; the majority of the male occupational students as late as high school seniors. The female transfer students did not differ in time of initial decision to enter college.

Williams, Robert T. An Analysis of Worker Supply and Demand Data for Program Planning in Occupational Education. North Carolina University, Center for Occupational Education, Raleigh, North Carolina, 1971. (ED 058 461)

Purpose: To develop a procedure for using occupational supply and demand data in the state-level planning of programs in occupational education.

Procedure: Demand data for 107 occupations in North Carolina were taken from the area skill survey, Employment Outlook for Selected Occupations in North Carolina, 1965-70. Supply data was collected from community colleges, technical institutions, and records of classes in secondary schools filed in state offices in North Carolina.

Enrollment Findings:

1. There were 13,015 full-time vocational students during the five-year period 1966-70, and 7,525 graduates. The enrollment figures show continued growth. A few curricula dominate the field -- auto mechanics, machinists, welding, radio and television servicing, air conditioning, and refrigerator mechanics, mechanical draftsmen, and electricians -- which represent 79.3% of the graduates. Auto mechanics is the leader which accounts for 28% of the graduates.

2. There were 7,530 full-time technical students and 2,992 graduates. Despite the slightly more than doubled enrollment during the five-year period, enrollment in these curricula shows irregular growth. Leading curricula are electronics, mechanical drafting and design, business data processing, and civil technology which graduated 74.7% of the graduates.

3. There were 6,871 part-time vocational students enrolled. The enrollment over the five-year period was stable but the fifth year enrollment was five percent less than the first year. Auto mechanics, mechanical drafting and machinist fields showed a deline but three other curricula -- building trades drafting, welding and masonry -- showed a strong increase. Upholstering, auto mechanics, and machinists account for 51% of the 942 part-time vocational students.

4. There were 1,052 persons enrolled part-time in the technical curricula. The enrollment was erratic. Of the 95 graduates, electronics and mechanical drafting and design account for 70%.

Wisconsin State Board of Vocational, Technical and Adult Education, Survey of Adult Education Participants: Vocational, Technical, and Adult Education Students, Madison, Wisconsin, 1969. 104 p. (ED 037 546).

A survey questionnaire was administered to 1500 persons in 70 part-time adult education classes in Wisconsin for information about the reasons for this participation in adult aducation, and to gain insight into the relationships of demographic and socioeconomic data with these reasons. It was intended that the findings would assist in future program planning.

Findings:

1. Approximately two-thirds participated for the primary reason of fulfilling a desire for general information and knowledge.

2. Important secondary reasons for participation in the classes: to improve ability on the job, and to spend time more enjoyably.

3. Enrollees in part-time industrial and general education courses had a lower level of educational attainment than overall education participants, while those in business, graphic arts and applied arts had highest levels of education attainment.

Von Strots, Gordon E. A Socioeconomic Study of Vocational-Technical Education Students. 1966, Available from University Microfilms, 351 p.

Purpose: To isolate certain socioeconomic and academic characteristics of postsecondary vocational and technical education graduates and dropouts.

Sample: 210 graduates of Oklahoma State Technical College were sent questionnaires before and after graduation. The student file of dropouts was also examined.

Findings:

1. The majority of the students were white males mainly from rural Oklahoma. The mean age at matriculation was 22-23. Fifty-one percent of the graduates found their jobs through the school. Other job finding methods were the state employment service, and friends and relatives.

2. The educational attainment of the parents appeared to have an effect on whether or not the children sought higher education.

Bailey, Larry Joe. An Investigation of the Vocational Behavior of Selected Women Vocational Education Students. ED.D Dissertation, University of Illinois, 1968, 135 p. (ED 055 183)

Problem: To explain the vocational behavior of selected young practical nursing students during the explorative vocational life stage.

Procedure: The data was drawn from instruments administered to 485 students enrolled in a previous study.

Conclusions: Women's vocational behavior differed significantly enough from that of men to warrant additional theoretical consideration.

4. Studies Focusing on Information Stystems to Record Data About Those Who Enroll in Vocational Courses

Schultz, Adrian. Montana Vocational Education Enrollment/Exit Follow Up Survey. Montana Occupational Research Coordinating Units. Helena, Montana. State Department of Public Instruction. November, 1969. 65 p. (ED 037 558)

This study is a description of an attempt to track vocational education enrollments, completers and dropouts through computerized efforts. This instructional manual is for the use of vocational educators in Montana, describing the continuing enrollment/exit/follow up computerized survey of vocational education and provides instructions for its implementation.

The system works as follows: upon enrollment in vocation-oriented course, the school records information on an entry card. It is then transmitted to Research Coordinating Unit where the data is encoded and transferred onto magnetic tape for subsequent use. The exit information is transmitted onto an exit card. Follow-up cards are transmitted to the students six months, two years and four years after their dates of exit, and on return are transmitted to the Research Coordinating Unit. An annual report summarizing all the general information is compiled and published after conclusion of each school year.

Items such as the following are included on the cntry card:

Social Security Number
Name
Address and Phone
Age
Sex
Marital Status
Number of Dependents
Current Employment, Yes/No
Monthly Salary
Highest Grade Completed
Handicapped -- sight, hearing, slow learner, chronic illness, emotionally disturbed, physically impaired, mentally retarded, others
Name and Address of School
Disadvantaged -- academic deficiency, geographic isolation, ethnic minority, socioeconomic, personality/character traits, others
Occupational Course Entered -- course code, funded by, data of entry, total course requirement, level of course (high school, postsecondary, adult)

Career Patterns. A Descriptive Analysis of Vocational-Technical Students and Teachers. Montgomery College, Rockville, Maryland, Office of Institutional Research. Maryland State Department of Education, August, 1970. 65 p. (VT 012 339).

Abstract: A newly designed student and teacher data system which was used to collect data required for state and federal reports, and to form basis for allocating funds under the Vocational Education Act of 1968. The system that utilizes machine processable forms yielded these data tables:

1. Personal characteristics of students by curriculum and by occupational orientation.

2. Age analysis by curriculum, class and sex.

3. Enrollment by sex and class.

4. Highest educational level by curriculum.

5. Employment status by curriculum, class and sex.

6. Educational and vocational expectations by curriculum, class and sex.

7. Employment profile by occupational orientation and class.

8. Job applicants in major occupational areas by sex and class.

9. Faculty data description and analysis.

Samples of data collection instruments are appended.

Annotated Bibliography for

Ch. 3 Changing Enrollment Patterns
in Vocational Education

1. Governmental Reports

Introduction

The literature in this section reveals a scarcity of analytic studies on the changing enrollment patterns in vocational education but several good government publications containing enrollment statistics and comparisons of these enrollment figures with previous years. This section is divided into two parts: 1) governmental publications, and 2) other studies discussing enrollment patterns.

Vocational Education in Major Cities; Analysis of Population, Vocational Education Enrollment, Teachers and Expenditures, Fiscal Year 1970. U.S. Department of Health, Education and Welfare, Washington, D.C., Division of Vocational and Technical Education, 1970. 20 p. (ED 056 195)

Findings Based on 1970 Census Report

1. In 25 major cities, a comparison of vocational education enrollment reveals that the percentage of enrollment in major cities falls behind the percentage of population.

2. A comparison of enrollment by target group with total enrollment reveals that 17 of 25 major cities have a higher percentage of disadvantaged than their percentage of the state's total enrollment, and 12 cities exceed in percentage of handicapped over the total vocational education enrollment of the state. Using the 1970 Census Report figures, the report gives statistics by state on:

1) Major city population proportion of the state

2) Major city vocational education enrollment (which lags population proportion of the state)

3) Major city federal expenditures on vocational education (which lags population percentage)

4) Major city state/local expenditures

5) Percentage of teachers in vocational education (compares favorably with population and enrollment)

6) Vocational education enrollment in major cities emphasizes adult and postsecondary programs. Major cities have a higher proportion of the state's secondary and adult enrollment than rural areas.

7) Major cities lag state population in enrollment of disadvantaged and handicapped.

U.S. Department of Health, Education, and Welfare. Office of Education. Bureau of Adult, Vocational, and Technical Education. Division of Vocational and Technical Education. Vocational Education Summary Data. Fiscal Year 1970. Washington, D.C.: Division of Vocational and Technical Education.

This report contains summary data from fiscal year 1970 annual reports submitted by the States in the administration of vocational education programs. The data presented include statistics relating to expenditures, enrollments, program completions, teachers, and teacher training. (This is provisional information and complete State-by-State tables will appear in the Annual Report of Vocational Education for fiscal year 1970.)

The following illustrate the kinds of information in the series of tables:

(1) A total of 8,793,960 persons were enrolled, which was an increase of 10.2 percent over the 7,979,366 enrolled in fiscal year 1969.

(2) A total of 805,384 disadvantaged persons were enrolled and received special services in order to succeed in vocational education.

(3) A total of 115,219 handicapped persons were served in vocational education programs.

(4) Elementary and secondary enrollment increased by more than a million students to 5,114,451 and post-secondary increased by 307,341 students to 1,013,426.

(5) A total of 190,364 individual teachers and 576 teacher aides were employed.

(6) A total of 52,783 persons were enrolled in preservice teacher training and 60,680 teachers received in-service training.

(7) Over $1.8 billion from Federal, State and local sources were expended for vocational education during the fiscal year.

(8) For each dollar of Federal funds expended, the States expended $5.14, with a range among the States of $22.96 to 1.14.

(9) About $65 million of the Federal allotments were carried forward for expenditure in fiscal year 1971.

(10) Of the total Federal expenditure of Part B funds, 23.1 percent was for postsecondary programs, 15.9 percent for programs for disadvantaged, and 8.1 percent for programs for handicapped persons.

U.S. Department of Health, Education, and Welfare. Office of Education. Bureau of Adult, Vocational and Technical Education. Division of Vocational and Technical Training. Enrollment in Vocational Education Occupational Programs. Vocational Information No. II. Washington, D.C.: Division of Vocational and Technical Training, April 1971.

This report summarizes data on Office of Education instruction programs from State annual reports on vocational education reporting systems. It provides tables with information on program enrollments over the five-year period 1966-1970 with percentage distribution in the broad occupational categories, and tables on the detailed breakdown of enrollment by level and program completions for fiscal year 1970. The information should prove useful to those interested in changing enrollment patterns and those who are concerned with relating training programs to employment needs and job opportunities.

The following are some highlights of the tables on program enrollments:

(1) General increase in enrollments reported as "other" is mainly due to cluster programs covering a broader scope than the programs listed, and includes new or unique programs not classified.

(2) Agricultural programs have been redirected from agricultural production to the off-farm agricultural occupations, particularly agricultural mechanics, ornamental horticultural agricultural resources, and forestry. Agricultural production enrollment decreased from 85.8 percent of the total in 1966 to 68.6 percent in 1970.

(3) A change was made in the list of instructional programs reported during fiscal year 1970 in distribution and marketing programs which made comparison with previous years difficult.

(4) There has been a general growth in all health occupations programs except dental assistant, dental laboratory technician and practical nursing which remained static. Practical nursing still enrolls the greatest proportion of the total enrollment but has declined from the 57.4% in 1966 to 29.0% in 1970. But an increasing proportion has been added each

year in newer medical occupation programs.

(5) Gainful home economics programs were first reported in 1965 and each of the programs showed a steady growth in line with the total enrollment.

(6) Office occupations showed the greatest growth over the five-year period in programs of business data processing, information communications, personnel, training, and related supervisory and administrative management, and typing and related.

(7) The greatest growth in technical education was in automotive and police science programs and the more general technical programs of engineering and other technological.

(8) In trade and industrial programs the largest enrollment increases were in programs of automotive services, blueprint reading, construction and maintenance, drafting occupations, electronics occupations, graphic arts, metal working, quantity food occupations, textile production and fabrication, and woodworking occupations.

Note: Due to the occupational clustering concept adopted by many states, enrollment shown in specific programs has declined in favor of broader classifications. For example, specific programs such as automotive specialization and radio/television has declined in favor of broader classifications of automotive services and electronic occupations.

2. Other Studies.

Kaufman, Jacob J., Lewis, Morgan V. The Potential of Vocational Education: Observations and Conclusions Based on a Study of Three Selected Cities in Pennsylvania. University Park, Pennsylvania: Institute for Research on Human Resources, Pennsylvania State University, May 1968. 171 pp. (ED 023 902)

Nature of Study: Three cities in Pennsylvania (one large, one medium-sized, and one small city) were selected to study potential of vocational education. For this study, vocational education was defined as including those programs reimbursed by the Department of Public Instruction and Office of Occupations Education.

General Conclusions:

1. In the three Pennsylvania cities, vocational education, with the exception of office occupations, had not significantly penetrated the school population in 1964-65, despite the fact that there was evidence of interest of the students in some occupation exploration, and despite the fact that a large majority of the students would be in the labor force, rather than in some form of higher education.

2. There were a number of imbalances between high school enrollments in vocational programs and occupational composition of local labor markets. The most pronounced discrepancy was found for distributive education. In each of the three cities clerks and salespeople comprised one of the largest proportion of the working force, yet distributive education enrolled only about two or three percent of the vocational students, which represented less than one percent of the total student enrollment.

3. Another discrepancy was the low percentage of trade and industrial students in comparison with the proportion of workers employed as craftsmen and foremen. But only about half of the trade and industrial graduates obtained jobs related to their training.

4. Office occupation enrollments were adequate to the demand for employment. The expansion of employment in service occupations was not reflected in school offerings which were still predominantly oriented toward manufacturing. The reason for this discrepancy may lie with the nature of the jobs, not the schools. For example, service occupations

are generally considered to be of low status.

5. In general, the vocational education offerings in the three cities in Pennsylvania were not broad enough to meet the needs of the students and the community.

Conclusion: Congruence between program enrollment and local employment patterns should not be the only criterion to judge whether vocational education has adopted its programs to current trends. Among other factors are unstable career plans of the young, changing nature of technology, the low status of some occupations, the high degree of geographic mobility of the young. It would be more feasible to provide broad training for the larger labor market.

Bennett, Lawton E. Change in Occupational Education Programs. A Study of Local Administrative and Community Factors Affecting Program Change in Public Secondary Schools. North Carolina State University, Raleigh Center for Occupational Education. 1970, 43 p. (ED 057 229)

This study, based on interviews with 23 public school superintendents in North Carolina, revealed that there is ample motivation to change and expand occupational education programs. The study also found that local support for occupational education programs is widespread, thus contributing to the climate necessary for change.

In discussing strategies for overcoming obstacles to change, the study recognizes two major limitations regarding program innovation: (1) limited power of a superintendent; and (2) boundaries of a superintendent's ambitions for the system.

Oregon State System of Higher Education. Teaching Research Division. Vocational Education -- General Education Situation Study. Monmouth, Eugene, Oregon: Teaching Research Division, February 13, 1968. 227 p. (ED 034 046)

Abstract: The purpose of this study is to prepare a statement of the qualitative (assessment) and quantitative (data) nature of vocational education as it is currently practiced in the United States and to prepare descriptions of vocational education from 1955-1975. A major portion of the study presents tables showing various types of enrollment and expenditure data.

Brenholtz, Gerald Severn. A Study to Determine Relationships Between Vocational Education Curricula Evolution and Some Aspects of Occupational Evolution. Dissertation, Texas University, January 1967. Available from University Microfilms, Ann Arbor, Michigan. (ED 056 211)

Purpose: To study occupational trends in relation to the growth of vocational education. The Study consists of analyses of occupational data and vocational enrollments between 1950-51 and 1959-60. Supplementary data were analyzed to delineate the decennial growth pattern and to detect long-term trends for the periods 1920-1921 to 1960-1961.

Specific Conclusions:

1. Vocational agriculture has a high enrollment despite a serious decrease in agricultural employment.

2. Distributive education should have additional emphasis on secondary and adult programs.

3. Vocational homemaking has little relation to vocational education.

4. Industrial education deals with a large segment of the occupational education program and should be augmented in size and scope.

"Position Paper on Occupational Training." School and Society, October 1971, p. 329-330.

In a position paper on Occupational Training, the New York State Board of Regents has called for new directions in occupational education as a program for all students, not only those who desire training in specific job skills. A number of forces have led to the demand for new directions in occupational education: demand for skills, specialization, and flexibility in a complex, rapidly changing technological society, increasing disadvantagement of the poorly educated and unskilled in the labor market, and widespread desire of students, parents, the community and the educators themselves for more relevant forms of education.

Annotated Bibliography for

Ch. 4 Career Opportunities, Manpower Projections, and Planning in Vocational Education

1. Overview. General Findings of Literature Search in this Area.

An examination of the literature dealing with the relationship of vocational education enrollments to anticipated career opportunities reveals a dearth of statistical reports correlating manpower demand with training needs, but a wealth of reports concerned with the utilization of manpower data for effective vocational education planning. Specifically, a significant number of studies focused on the currently available manpower forecasting techniques, their shortcomings, etc., and the potentialities of these techniques for effective planning at the state and local levels. Other studies examined the development of manpower information systems for effective program planning.

Especially noticeable throughout the literature search was the abundance of reports, particularly at the state level, that focused on projected manpower needs, with no corresponding attempt to relate these needs to existing training opportunities. The few state studies that did make an effort to correlate training needs with future occupational demand have been reviewed in this section.

2. Studies Concerned with Effective Vocational Education Planning

Kotz, Arnold, ed., Occupational Education: Planning and Programming, Vols. I and II. Menlo Park, Calif.: Stanford Research Institute, 1967. (ED017 733 - ED017 734)

Purpose: Examines current planning, programming, and budgeting procedures in operation at the state and local levels. Of particular relevance was an examination of the utilization of manpower supply and demand projections at the state and local levels.

Procedure: A reconnaissance survey was undertaken in six states and 11 communities. Then, based on information gathered in the survey, position papers were developed by experts from industry, government, non-profit organizations, state and local governments and presented at a conference conducted at Airlie House, Warrenton, Virginia.

Conclusions and Recommendations: 1) Quality of manpower projections for use in planning at the state and local levels should be improved. For this purpose, joint concepts, methodology, and funding arrangements are required among the relevant agencies at national, state, and local levels; 2) Manpower skill surveys, including total requirements as well as job vacancy data, should be developed for every major metropolitan area, on a statewide basis, and on a regional basis, and should project requirements for at least five years and should be kept current and adjusted on an annual basis; 3) The Department of Labor should issue guidance to state and local governments on how to conduct surveys of job demand, pursuant to the authorization of an interagency group established for this purpose; 4) A systematic inventory of supply should be conducted in every major metropolitan area, state and region, and 5) More resources in manpower and funds should be made available for the development of projection of demand and supply of manpower on a statewide, regional, and metropolitan basis.

Young, Robert C., Manpower Information for Vocational Education Planning. Final Report. Leadership Series No. 21, Columbus, Ohio: Center for Vocational and Technical Education, Ohio State University, November, 1969 (ED 035 716).

Purpose: Report of a Conference on Manpower Forecasting for State Vocational Education Planning held at the Center for Vocational and Technical Education, Ohio State University in June, 1969. The purpose of the Conference was "to examine existing manpower forecasting techniques, their shortcomings, potential improvements in their techniques, and the possibility of adapting these techniques to meaningful vocational education planning at the state level."

Procedure: Presentation of papers followed by discussant commentary. During the first conference session, Department of Labor representatives described currently available and anticipated employment forecasting techniques. Then, following a critique of these projection techniques, subsequent sessions discussed the education, training and mobility implications of anticipated employment. Finally, the concluding session examined alternative strategies that might be utilized in the process of preparation for employment and included a discussion of the value of manpower projections for vocational education planning. Noteworthy papers include Norman Medvin's "Occupational Job Requirements, A Short Cut Approach to Long Range Forecasting, Report on Test Results in Several Cities," Harold Goldstein's "Forecasting Occupational Employment for State Vocational Education Planning," and Irvin Wingard's "Forecasting Occupational Employment for State Vocational Education Planning."

Conclusions: Some findings of the various papers should be noted. First, Medvin contends that a new approach to long-range forecasting of occupational opportunities -- the openings-matrix technique -- appears successful in that surveys can be conducted quickly and inexpensively, and findings seem reasonable. Second, Wingard points out that the need for reliable manpower information by vocational educators "is placing heavy burdens on the available data base." He concludes that current manpower forecasting techniques for the most part, do not generate new data but instead merely massage the available data and make it more useable. He points to the need for a more substantial data base.

U.S. Department of Labor. Manpower Administration and Wisconsin State Employment Service. Project VISION (Vocational Information System Involving Occupational Needs). An Experiment with Occupational Needs Projection Techniques. Madison, Wisconsin: Wisconsin State Employment Service, June, 1970. (ED 045 822)

Purpose: This project compares five alternative methods of forecasting labor supply and demand in an urban labor market -- Employer Needs Survey, Leading Indicators Experiment Approach, Industry-Expert Approach, Unfulfilled Openings - Occupational Outlook Handbook Approach, and the BLS Occupation-by-Industry Matrix Technique, Method A -- in order to determine the optimal method for supplying labor market information to public vocational education programs. Further, the project attempted to determine the extent to which occupational information provided by the State Employment Service meets the goals of the Vocational Education Act of 1963.

Procedure: The Milwaukee, Wisconsin SMSA was chosen as the site for testing each of the forecasting methods. The field work was conducted in 1967 and 1968.

Conclusions: Study findings indicate that vocational education curriculum planning can be served most effectively by current employment estimates and short-run projections for specific occupations. None of the survey methods investigated was found to be fully satisfactory, although the report recommends the use of a modified area skill survey technique, possibly combined with certain aspects of other techniques for particular situations. Further, findings indicate that Employment Service reports were not geared to the needs of local vocational educators. Specifically, local employment service analysts did not understand how labor market changes affect training needs and, as a result, their "reports appeared to be a pointless collection of tables and poor narrative with no specific objective..." Appendices provide substantial data on supply and demand relating to 90 occupations -- current and anticipated to 1970.

Medvin, Norman. "Occupational Job Requirements: A Short Cut Approach to Long Range Forecasting," in Employment Service Review, January-February, 1967.

Purpose: Introduces a new technique for making long range forecasts of local occupational job requirements, entitled the "Unfulfilled Openings - Occupational Outlook Handbook" approach.

Description of Technique: In brief, the new technique begins with a listing of unfilled job openings over a period of a year or more in the local Employment Service Office. These openings are then shown by duration; the crux of the technique rests on the relation of the hard-to-fill jobs (unfulfilled for 30 days or more) to the total unfilled, rather than the level of such openings. It then links the current and past occupational shortages (unfulfilled job openings) to the Bureau of Labor Statistics' national outlook for the same occupations. In linking this data, local planners should find long range forecasting greatly facilitated.

Stoller, David S. Occupational Education Requirements Analysis, A Method of Projecting Vocational Education Requirements. Washington, D.C.: U.S. Office of Education, 1967.

A relevant study, but unable to obtain for review.

Morsch, W.C. and Griest, J. Occupational Education Requirement Analysis. Washington, D.C.: U.S. Office of Education, December, 1967.

A relevant study but unable to obtain for review.

McNamara, James T. A Labor Market Information System for State-Local Program Planning and Evaluation in Vocational Education. Paper presented at the 64th annual American Vocational Education Association Convention, New Orleans, Louisiana, December, 1970. (VT 012 347).

Purpose: Describes the development of a labor market supply and demand information system to aid local vocational education planners in Pennsylvania. This study is cited as an example of a current effort at the state level to enhance local vocational education planning.

Description of System: Provides comparisons of supply and demand statistics for 142 occupational categories in 16 major labor market areas in Pennsylvania. Also provides a measure of manpower needs over time in order to facilitate long range planning.

Lecht, Leonard, et al. Relating Manpower and Demographic Information to Planning Vocational Technical Education. Final Report. Washington, D.C.: Center for Priority Analysis, National Planning Association, September, 1970 (ED 044 528).

Purpose: Outlines a plan that uses current and projected manpower and demographic data to define vocational education programs, objectives, and priorities with a view to helping the program planner synthesize information about students, programs and the labor market.

Description of the Plan: 1) identify population served, 2) relate current enrollment to population, 3) establish enrollment objectives, 4) identify occupational patterns and determine job openings, 5) relate program completion to job openings, 6) set completion objectives, 7) translate completions to enrollments, 8) match enrollment objectives by type of program and by occupational area, and 9) estimate resources required to achieve each program objective.

Additional Comments: Provides guidelines for 1) establishing an information base in terms of demographic projections, 2) developing labor market information in order to determine completion objectives, and 3) adjusting the two sets of objectives so that projected occupational, special education, and cooperative programs are matched approximately to the needs of the anticipated student population. Also, provides guidelines for coordinating state and local vocational education plans.

Lewis, Wiley B. Review and Analysis of Curricula for Occupations by Health. Information Series #27. Columbus, Ohio: Center for Vocational and Technical Education, November, 1970. (ED 044 507).

Purpose: Reviews and analyzes the literature in order to identify major findings, promising developments, strategies, and methodological weaknesses and strengths present in curriculums designed to train dental assistants, dental laboratory technicians, hospital attendants, nurse's aides, LPN's, etc.

Conclusions: Findings reveal that 1) current training programs come closer to meeting intermediate needs in some health occupational areas than others and 2) a major shortcoming of present curriculum structure is the general lack of a core or cluster curriculum.

Recommendations: The study recommends the development of curriculums for new and emerging occupations in health and the evaluation of such curriculums through an educational planning system consisting of occupational analysis, program planning, program development and testing, and documentation and dissemination of results.

Additional Comments: Similar analyses of curriculum adequacy were undertaken for occupations in transportation, environmental control, food processing and distribution, and public service. They are cited to demonstrate the concern over curriculum adequacy in the face of changing manpower demands.

U.S. Department of Labor. Bureau of Labor Statistics. Tomorrow's Manpower Needs. Vol. 1-4. Bulletin No. 1606. Washington, D.C.: Bureau of Labor Statistics. February, 1969.

Purpose: This four-volume publication provides 1) current national manpower projections in specific occupations, and 2) a guide for their use in developing state and area manpower projections. Specifically, the four volumes focus on 1) developing area manpower projections, 2) National Trends and Outlook: Industry Employment and Occupational Structure, 3) National Trends and Outlook :Occupational Employment, and 4) The National Industry - Occupation Matrix and Other Manpower Data.

Commentary: Vol. IV should be noted since it presents an industry-occupation matrix for 1960 and 1975, consisting of the percentage distribution of employment by occupation in 155 industries and industry groups representing the entire economy. Statistical tables include 1) total national employment by industry, 1960 and projected 1975, 2) total national employment by occupation, 1960 and projected 1975, 3) percentage distribution of occupational employment by industry, 1960 and projected 1975.

U.S. Department of Labor. Bureau of Labor Statistics. Manpower Requirements for which Vocational Education Prepares Workers. Washington, D.C.: Bureau of Labor Statistics, July, 1969. (ED 054 297).

Provides average annual estimates of numbers of workers required through the mid-seventies to meet manpower demands in most of the occupations for which vocational education curriculums have been developed. Specifically, the report provides estimates of manpower requirements in the technical, health, trade and industry, office and distributive occupations. The report notes that average annual openings are based on 1) growth in each occupation, and 2) replacement of workers who die or withdraw from the labor force. The report notes that estimates may be used in several ways: 1) in evaluating, at the national level, the adequacy of present vocational programs in meeting total manpower needs in the occupations under review, and 2) in pointing out the gaps in occupational coverage of present research on national manpower requirements. Finally, the report points out possible problems in utilizing this data to determine vocational education training needs, but illustrates in tabular format, "how demand and supply data for a selected group of occupations can be evaluated in terms of what training programs need to be increased and the magnitude of the increase necessary to meet requirements."

3. Studies that Focus on the Responsiveness of Vocational Education to Labor Market Demand

Fluck, Bryan V. The Responsiveness of the Curricula of the Vocational-Technical Schools to Changes in the Labor Force. Ed.D Dissertation, LeHigh University, 1970.

Purpose: Noting that federal legislation assigned to vocational-technical education the responsibility of developing curricula that will enable a local area to meet its shifting and growing requirements for vocational and technical manpower, the author attempts to determine whether the curricula of a typical new vocational-technical school are responsive to the labor market data of the area it serves.

Procedure: Investigated four vocational-technical schools located in Montgomery County, Pennsylvania. These schools were chosen for investigation because all secondary and adult education in the schools was based on federal legislation and because Montgomery County's vocational education programs were designed during the recent rapid growth of vocational education.

Conclusion: Evidence indicates that vocational-technical curricula are, in several respects, notably inconsistent with labor market patterns. The author concludes that a major factor promoting this lack of responsiveness is the federal and state regulations that designate methods for designing and equipping expensive facilities without allowing sufficient flexibility or time for appropriate curriculum planning.

Somers, Gerald B. "The Response of Vocational Education to Labor Market Changes" in Vocational Education. Supplement to the Journal of Human Resources, Vol. 3, 1968.

Seems relevant, but unable to obtain the article in order to review.

Kaufman, Jacob J. and Lewis, Morgan V., The Potential of Vocational Education: Observations and Conclusions Based on a Study of Three Selected Cities in Pennsylvania. University Park, Penn.: Pensylvania State University, 1968.

Purpose: An in-depth study conducted in three Pennsylvania cities to determine recommendations for the improvement of vocational education. One segment of the study examined the extent to which vocational programs reflected the changing employment patterns of the three cities under study and the extent to which educators make adjustments to meet labor market needs.

Procedure: Examined vocational programs and labor market data in one large city (500,000+ population), one medium size city (100,000-500,000 population), and one small city (under 100,000 population).

Conclusions: Investigators concluded that vocational programs in the three cities were not sufficiently related to the changing employment requirements of the communities. Vocational education in the small city was more attuned to labor market needs than in the large city; this could be attributed to the fact that the small city's organizational and administrative machinery was less cumbersome, and thus, change could be effected more easily.

4. General Studies that Relate Future Occupational Demand to Training Priorities at the National Level

Teeple, John. Implications of Career Openings in Social Welfare for Priorities in Vocational-Technical Education. Working Paper. Washington, D.C.: Center for Priority Analysis, National Planning Association, December, 1968. (ED 036 611).

Purpose: Examines the implications of future career openings in social welfare for vocational training.

Conclusions and Recommendations: The administration of social welfare programs may create as many as 400,000 career openings in the 1970's; 175,000 of these will represent openings for junior college or high school graduates. A realistic goal for vocational education training in social work would be 500 to 1,000 graduates a year in each of the nation's major metropolitan areas. As a result, associate degree programs leading to employment in social work occupations must expand to meet this need. Advancement in research and planning in this area would also provide meaningful opportunities for the employment of many young persons in the left out groups of American society.

Kenadjian, Berdj and Larkin, Paul. Education for Technician Careers and the Nation's Priorities in the 1970's. Working Paper. Washington, D.C.: Center for Priority Analysis, National Planning Association, October, 1969. (ED 036 655).

Purpose: Examines future demand for technicians and notes the effect of this demand on technical education programs.

Conclusions and Recommendations: Contends that demand for technicians will experience a rapid rate of increase -- from 35,000 job openings per year in the early 1960's to 128,000 per year between mid-1960's and mid-1970's and states that a primary stimulus for this increase is the volume and scope of research and development activity directed toward the achievement of national goals and manpower needs. The authors emphasize that existing technical education programs are challenged to improve their public education programs, develop new programs, provide remedial science-related instruction to the educationally disadvantaged, and create a national awareness of the quantity and quality of technical career opportunities.

Teeple, John, et. al. Nonprofessional Occupations in Education: Their Implications for Priorities in Vocational-Technical Education. Working Paper. Washington, D.C.: Center for Priority Analysis, National Planning Association, January, 1969.

Purpose: Examines future nonprofessional career openings in education and notes the implcations of these openings for vocational education.

Conclusions: The authors emphasize the growing opportunities for aides, assistants, and technicians in education during the 1970's and note that, allowing for replacement needs, an annual average of approximately 110,000 career openings can be anticipated. They contend that research and planning to meet needs in the human service area constitute a significant priority for the vocational education system.

Teeple, John. Implications of Career Openings in Health Occupations for Priorities in Vocational Technical Education. Working Paper. Washington, D.C.: Center for Priority Analysis, National Planning Association, October, 1968. (ED 036 610).

Purpose: Discusses implications of the pursuit of health goals in the 1970's with a view toward determining priorities in vocational technical education.

Conclusions and Recommendations: Based on an examination of future demand for occupations in health, the author suggests the following agenda of priorities for planning and research in vocational and technical education: 1) program development for nonprofessional health occupations, 2) expansion of associate degree nursing and practical nurse programs, 3) increasing the representation of "left-out" groups in health occupations education. 4) closer coordination between vocational education and community health centers, 5) the offering of core curriculum in health at the 11th and 12th grade levels, and 6) cooperation between vocational educators and public and private agencies to assess local manpower situations.

5. Studies that Relate Future Occupational Demand to Training Priorities at the State Level

Maiden, Leonard F. Vocational Education and Occupational Opportunities in South Carolina: A Perspective. Ph'D Dissertation, University of South Carolina, 1971.

Purpose: Examines existing vocational education programs in South Carolina with a view toward determining whether training priorities reflect occupational demand.

Conclusions and Recommendations: Concludes that existing vocational education programs are characterized by a limited number of skill development areas with little emphasis upon the development of occupational competencies in jobs held by approximately 50% of the wage earners. The author contends that too much emphasis in vocational education is placed upon personal skill development; correspondingly, too little emphasis is placed upon the development of wage earning skills. He recommends that vocational programs be broadened to include occupations for which training opportunities do not now exist. In addition, he advises that contemporary data are available concerning occupational opportunities in South Carolina which could possibly be related to current vocational education training in a way that might suggest a course of action for decision-makers.

Finch, Harold L. Educational and Training Requirements to Meet Projected Labor Force Needs of the State of Kansas to 1985. Ed.D. Dissertation, University of Kansas, 1971.

Purpose: This study, conducted for the Kansas Master Planning Commission, had the following objectives: 1) to provide insights into manpower and work preparation trends -- past, present and future; 2) to forecast occupational growth and replacement needs to 1985 for the entire state of Kansas, and for regions within the state, and 3) translate labor force needs into educational and training preparation requirements.

Findings: Among the representative findings were: 1) the fastest growing occupational groups from 1940 to 1985 were projected to be Professional, Technical, and Kindred Workers, 2) the greatest number of job opportunities in the near future was for females with skill training, i.e. typists, and 3) the future demand, in general, for females is expected to be considerably greater than for males.

Judd, William Perry. The Status of Present and Projected Vocational Technical Training Programs in the State of Utah and Related Occupational Opportunities. Ed'd Dissertation, Brigham Young University, 1971.

Purpose: This study was conducted to determine the extent of Utah's present and projected vocational-technical education programs and to determine how closely these programs correlated with the current and projected industrial employment demand in Utah over the next five years.

Conclusions: Findings of the study indicated that 1) present and projected vocational-technical training programs produced far less graduates at all levels than the needs for personnel in related occupations, 2) expansion of vocational curricula and facilities, and area vocational schools.is needed, and 3) coordination between secondary and postsecondary training programs is needed.

Troutman, Frank, et. al. Evaluation of Arkansas Vocational Training Programs in Relation to Economic Development, Parts I, II and III, Publication No. L-6 Little Rock, Arkansas: Industrial Research and Extension Center, University of Arkansas, April, 1969.

Purpose: Part I of this study attempted to provide a comprehensive profile of the numbers and kinds of occupational skills needed in Arkansas in the next decade; Part II sought to obtain information about the state's existing vocational schools and training programs; and Part III evaluated existing vocational programs with a view toward determining their adequacy in meeting occupational demand.

Conclusions: Findings indicated that the manpower requirements of industry were being poorly met by the present vocational and technical education system. Existing programs were hampered by 1) inadequate facilities, 2) limited enrollment in trade and industrial occupations, and 3) an inadequate variety of programs to meet the varied requirements from industry, business, and the professions.

Arnold, Walter. Vocational, Technical, and Continuing Education in Pennsylvania. A Systems Approach to State-Local Planning, Harrisburg, Pennsylvania: Pennsylvania Research Coordinating Unit for Vocational Education, 1969. (ED 032 431)

Purpose: This study was planned primarily to provide a realistic overview and analysis of vocational, technical, and continuing education for the years 1964-1968 with a goal of determining its achievements, deficiencies, and direction in light of current and projected (1975) labor force needs in Pennsylvania.

Procedure: Study conclusions and recommendations were based upon 1) a five year analysis of enrollments and expenditures in vocational education, 2) an analysis of economic trends, 3) an examination of occupational training agencies and programs, and their output of graduates, 4) a description of a systems approach to vocational and technical education program planning, and 5) an indepth review of reporting procedures and financial aid policies, teacher education and certification and vocational guidance services. Special attention was given to the problems of vocational education in Philadelphia and Pittsburg.

Conclusions and Recommendations: Major conclusions and recommendations included 1) the need for more postsecondary vocational and technical education, 2) a need for increased funding and emphasis on adult education, 3) a special effort to overcome deficiencies in health occupations, technical education, and special needs programs for the socioeconomically disadvantaged, and 4) the development of an organized systematic planning procedure.

Annotated Bibliography for

Ch. 5 Finances and Priorities in Vocational Education

1. National Studies---General

Lindman, Erick L. Financing Vocational Education in the Public Schools. National Education Finance Project No. 4. Los Angeles: University of California, Graduate School of Education, 1970 (ED 052 517).

Purpose: This study, the result of the first year's work for one of the 11 satellite studies that comprise the National Education Finance Project, focused on projecting the enrollments and costs of vocational education in 1980 and describing present methods of federal funding allocation at the state level.

Procedure: In developing the study in general and a method of projecting costs in specific, the investigator observed vocational education programs in 15 states and used statistical information provided by the U.S. Office of Education.

Conclusions: The investigator projected that 1) the total vocational education enrollment (secondary, postsecondary, adult, and special needs) for all states in 1980 will be 14,162,300 and 2) at 1969 prices, the cost of vocational education in 1980 will "be between $1,824 million and $2,862 million above the costs of educating the same 14 million students in academic and vocational curricula."

Operations Research, Inc. Report of the Analysis Group. HEW Vocational Education Review Task Force. Vol. I and II. Silver Spring, Maryland: Operations Research, Inc., September, 1970. (ED 050 291 and ED 050 292).

Purpose: This report, developed over a 17 calendar day period, was prepared to quantitatively present the status of vocational education for use in identifying major issues and problems, and in indicating implications for the future. Of particular relevance are the chapters that provide 1) a cost-effectiveness analysis of both secondary and postsecondary vocational education, an analysis of two year junior college education, and a comparison, in economic investment terms, of these three types of education with federal manpower training programs, and 2) an examination of the role and impact of federal funding of vocational education.

Procedure: In developing their cost-effectiveness analysis of vocational education at the secondary and postsecondary levels and their comparisons among junior college, postsecondary technical education, secondary vocational education and federal manpower training programs, the HEW Task Force reviewed some of the major studies on the subject, i.e. the Fernbach and Somers study, etc. and synthesized these studies' conclusions. In determining the role and impact of federal funding on vocational education, the task force utilized statistical data from the U.S. Office of Education and examined several studies on the subject.

Conclusions: Based on a review of the literature, the task force concluded that the average costs of secondary vocational technical education are more than covered by the average benefits of the program, and that, although the populations of the two schools may differ, the junior college is a more economically efficient source of postsecondary education than the postsecondary technical institution. Further, the task force concluded that both income levels in a state and the extent of federal aid have had an impact on the overall level of state and local expenditures for vocational technical education. Tabular data on vocational education program costs, by state, are included in the Appendices (Vol. II).

2. Costs and Financing of Secondary Vocational Education

Dueker, Richard L. and Altman, James W. An Analysis of Cost and Performance Factors in the Operation and Administration of Vocational Programs in Secondary Schools. Pittsburgh, Penn: American Institutes for Research, October, 1967. (ED 019 516).

Purpose: Attempted to identify the kinds of cost and related data that could be obtained to aid in planning and evaluating vocational education. Specifically, the study examined the availability of data from which per pupil costs of vocational education could be determined. In addition, the study attempted 1) to gather and present data concerning cost, operational, situational, and performance factors which would serve as first approximations to data based on large scale samples, 2) compare cost allocations between vocational and non-vocational programs in the comprehensive high school, and 3) determine the relationship among the various kinds of available information.

Method: In order to collect study data, a sample of 32 undesignated schools was selected -- 16 vocational schools and 16 comprehensive high schools. Then, a questionnaire that requested information on expenditures, enrollments, and facilities was mailed each of the schools.

Conclusions: Findings indicate that available cost data do not readily lend themselves to coherent analysis and that cost data pertaining to vocational education are not maintained in a way that makes them accessible for rigorous analytic and evaluative purposes. Further, findings indicate that, in comparing costs for vocational and non-vocational education in comprehensive high schools over the years 1961-1962, 1963-1964, and 1965-1966, the academic and general curricula costs were higher in all cases.

Kaufman, Jacob J. and Lewis, Morgan V. The Potential of Vocational Education: Observations and Conclusions Based on a Study of Three Selected Cities in Pennsylvania. University Park, Pennsylvania: Pennsylvania State University, Institute for Research on Human Resources, May, 1968. (ED 023 902).

Purpose: A detailed study conducted in three Pennsylvania cities to determine recommendations for improvement of vocational education. The study explored a particularly relevant question -- do the extra costs of vocational education produce sufficient extra benefits to justify the continuation of the extra costs?

Procedures: Three undesignated cities were selected for purposes of field investigation -- a small (under 100,000 population),medium (100,000-500,000 population),and large (500,000+ population) city. Cost data for use in the analysis was obtained from a study entitled An Analysis of the Comparative Costs and Benefits of Vocational vs. Academic Education in Secondary Schools conducted by Ernst Stromsdorfer, et. al. This data was based on the graduating classes of 1959 and 1960 from one large city in Pennsylvania. Benefit data was obtained from reviewing the employment experiences of 65 members of the 1960 graduating class.

Conclusions: Data suggest that extra benefits in terms of earnings/month over a period of five years derived from the vocational education experience justify the extra cost outlays associated with the vocational education curricula. However, since cost/benefit data were based on 65 graduates in one large Pennsylvania city, this study's conclusion should be regarded as highly tentative.

3. Costs and Financing of Postsecondary Vocational Education

Anderson, E. F. Differential Costs of Curricula in Comprehensive Junior Colleges. Ph'D Dissertation, University of Illinois, 1966. (Abstract: Dissertation Abstracts 27:3648-49A; No. 11, 1967.)

Purpose: Examined direct costs associated with the vocational and academic curricula in eight junior colleges.

Procedures: (Unable to determine study methodology or location of the junior colleges surveyed because of inability to examine original document.)

Conclusions: Findings indicate that "a majority of the vocational technical curricula offered in comprehensive junior colleges included in this study cost more per student than liberal arts and transfer curricula in the same institutions." In addition, findings indicate that unit costs for curricula classified as industrial-technical occupations were 1.52 times more expensive than unit costs for liberal arts and transfer programs.

Morsch, William C. Study of Community Colleges and Vocational Training Centers: Cost Analysis. Washington, D.C.: Bureau of Social Science Research, 1970.

Purpose: To examine and compare the training costs of 20 community colleges and postsecondary technical schools.

Procedures: (Unable to ascertain study methodology because of failure to obtain original document.)

Conclusion: Findings reveal that 1) the average instructional cost in community colleges was $599.00 compared with $844.00 in postsecondary technical schools and 2) the total costs in community colleges were $1,184 compared with $1,664 in postsecondary technical schools.

Fowler, Harmon R. Selected Variables Related to Differential Costs of Programs in Community Colleges. Ed.D. Dissertation, University of Florida, 1970.

Purpose: This study attempted 1) to determine the differential costs of liberal arts and vocational programs in selected community colleges, 2) to determine the ratio of the unit cost/credit hour of each vocational program to the average cost of the transfer curriculum, and 3) to identify variables which appeared to be related to differential costs, i.e. average class enrollment, program level, etc.

Procedure: (Unable to determine study methodology or exact location of the eight year colleges surveyed because of inability to obtain original document. However, it was possible to determine that the comprehensive community junior colleges surveyed were among the 15 institutions included in the Community Junior College Finance Study, a satellite of the National Education Finance Project.)

Conclusions: Study findings evidence a wide variance in curriculum costs among and within the eight institutions. However, programs in business education, health-related occupational education, and technical and vocational education were consistently more expensive than liberal arts programs in the same institution.

Wattenbarger, James L. et. al. The Community Junior College: Target Population Program Costs and Cost Differentials. National Education Finance Project, Gainesville, Florida: University of Florida, Institute of Higher Education, June, 1970.

Purpose: This study attempted to 1)describe the target populations served by community colleges, and 2) identify the costs of postsecondary education at less than the baccalaureate degree level. A primary emphasis of the study was the determination of costs related to educating a student in a specified curriculum and the utilization of these cost data to demonstrate the relationship of the unit cost of several selected vocational technical curricula to the unit cost of a basic arts and science transfer curriculum.

Procedure: Fifteen comprehensive community colleges in seven states were selected to provide input data on target population, patterns of financial support, anticipated support needs, and program cost differentials. The junior colleges were selected because they exemplified the kinds of institutions that may be expected to develop more universally during the next ten years. Among the colleges surveyed were Miami-Dade Junior College (Florida), Black Hawk College (Illinois), Bristal Community College (Mass.), San Mateo Junior College District (California) and San Antonio Junior College (Texas).

Conclusions: An analysis of the cost differentials of the various programs seems to reveal that except for business-related courses, occupational programs are more costly to operate than general education programs. In certain instances, the differential exceeds 100% and can be even greater if equipment cost estimates are included.

Carroll, Adjer B. and Inhen, Loren A. Costs and Returns for Investments in Technical Schooling by a Group of North Carolina High School Graduates. Raleigh, N.C.: North Carolina State University, 1967 (ED 025 586).

Purpose: Estimated the incremental benefits and costs of two years of postsecondary technical schooling for 45 white male graduates.

Procedures: This study was based on data collected from 1) 45 male graduates of a two-year postsecondary technical education program conducted at Gaston Technical Institute, Gastonia, North Carolina and 2) a control group of 45 North Carolina high school graduates who had academic records similar to those of the Gaston Technical Institute graduates but who had no formal post high school education. Estimated costs included both direct and opportunity costs of foregone earnings. Benefits were computed by comparing income earned by the technical school graduates with income earned by the control group.

Conclusions : The study maintained that an estimated life-time public rate of return to the educational investment would vary between 16.7% and 20.1% and that an estimated life-time private rate of return would range from 23.9% to 25.9%.

Parry, Ernest B. An Investigation of Cost Differentials Between Trade, Technical and College Parallel Curriculums Offered in North Carolina's System of Comprehensive Junior Colleges. Ph.D. Dissertation, University of North Carolina, 1968.

Seems relevant but unable to obtain study for review.

Vander Linde, Albert. Emerging Models for Financing Area Vocational Technical Schools. Ph'D Dissertation, Colorado State University, 1971.

Purpose: Investigates and records methods utilized to finance post-secondary vocational and technical education in the United States. Also, identifies emerging models for financing area vocational-technical schools.

Procedures: Primary study data was obtained by a questionnaire mailed to the chief administrator for vocational and technical education in the 50 states (66.6% return rate). Secondary study data was obtained by personal interview with administrators of 16 area vocational technical schools located in 9 upper midwestern states.

Conclusions: Primary data revealed several methods of financing capital improvements and general operating expenditures but revealed no consistent financing pattern within the 50 states. Secondary data revealed various student tuition and fee structures and pointed out that student services, student activities, and laboratory or shop projects were conducted on a self-supporting financial basis when feasible.

Kraft, Richard H. P. Cost Effectiveness Analysis of Vocational Technical Education Programs. A Pilot Study. Final Report. Tallahassee, Florida: Florida State University, Department of Educational Administration. Educational Systems and Planning Center, 1969, (ED 034 055).

Purpose: This study purported to 1) examine public and private costs and utility aspects of selected vocational technical programs, 2) yield formulae which will result in the development of a simulation model that can be used by educational administrators for planning optimum allocation of staff, facilities, finances, and other resources, and 3) provide basic conceptual tools for future implementation of a planning, programming and budgeting system (PPBS).

Procedure: Study activities included 1)determining the occupational objectives of the vocational education programs offered at two undesignated area vocational technical schools in Florida, 2) determining the degree of attainment of occupational objectives by graduates of each program, 3) determining an economic cost effectiveness ratio for each program, and 4) exploring a simulation model with respect to optimization of interacting variables such as staff, and facility organization and utilization.

Conclusions: Some of the study conclusions noted that 1) based on the education-earning profiles of the 1965, 1966, 1967 and 1968 graduates of various vocational technical programs offered by the two area vocational technical centers, the private rate of return on "educational investment" is amazingly high and all public cost-utility ratios indicate a positive rate of return; 2) cost-effectiveness procedures could be valuable in comparing benefits that might result "from the more efficient utilization of vocational technical school facilities by use of the facilities after hours for adult education or other programs...", and 3) cost-effectiveness analysis can be utilized as a tool in manpower planning.

4. Costs and Financing of Federal Manpower Training Programs

Somers, Gerald G. and Stromsdorfer, Ernst W. A Cost-Effectiveness Study of the In-School and Summer NYC. Madison, Wisconsin: University of Wisconsin, July, 1970. (ED 053 302).

Purpose: A nationwide study conducted to determine the cost-effectiveness of the Neighborhood Youth Corps Program.

Procedure: In order to collect benefit data, the investigators sampled NYC participants from projects in operation during Fiscal Year 1965-1966 and 1966-1967. From a total of 1120 operating projects with 333,548 participants enrolled one day or longer, the investigators randomly selected 60 projects -- 20 from each of the three regions, North, South and West. Initially, they desired a sample of 1200 -- 10 NYC participants and 10 control respondents from each of the 60 projects. Finally, however, they based the study on a working sample of 780 for the estimation of educational benefits and 676 for the estimation of economic benefits. In determining program costs, the investigators measured social, governmental and private costs based on data received from the Department of Labor, Neighborhood Youth Corps, Division of Project Review and Analysis, On Going and Terminated Projects -- RY 66, For Week Ending Fiscal 1966, RPT 20073 and RPT 20119.

Conclusions: Some study conclusions were: 1) marginal social costs for the combined in-school and summer projects enrollments were $409 based on the federal share, 2) average social costs for the combined in-school and summer project enrollments were $313 based on the federal share, 3) private opportunity costs were estimated at $758 for the total sample, and $722 for in-school only enrollees, 4) NYC does yield substantial net-monetary benefits to its participants; however, this effect is selective among sex and ethnic groups, i.e. negroes benefit more than white, and 5) the maximum length of program participation whereby benefits will continue to accrue to a NYC participant is about 12 to 13 months.

Hardin, Einar and Borus, Michael E. Economic Benefits and Costs of Retraining Courses in Michigan. East Lansing, Michigan: Michigan State University, December, 1969. (ED 043 808).

Purpose: Evaluates institutional occupationally-oriented courses conducted under MDTA and the Agricultural Research Administration. In specific, the investigators examined both costs and gains of training in order to evaluate the impact of the federal training programs on national product, disposable income of trainees, and expenditures and receipts of the government.

Procedures and Conclusions: Unable to discuss procedures and conclusions because of inability to review original document. However, one study finding indicated that gains from training were smaller among those trainees with more years of schooling.

Sewell, David O. Training the Poor: A Benefit-Cost Analysis of Manpower Programs in the U.S. Antipoverty Program. Research Series No. 12, Kingston, Ontario: Queens University, Industrial Relations Center, 1971.

Seems relevant but unable to obtain the study for review.

Office of Economic Opportunity. Job Corps Benefit/Cost Study. A. & R Reports #11. Washington, D.C.: Office of Economic Opportunity, Evaluation and Research Branch, Plans and Evaluations Division, Plans and Programs Directorate, Job Corps.

Seems relevant but unable to obtain study for review.

Cain, Glen G. Benefit/Cost Estimates for Job Corps. Discussion Papers. Madison, Wisconsin: University of Wisconsin, Institute for Research on Poverty and the Department of Economics, 1967 (ED 037 495).

Purpose: Attempts to determine if the Job Corps program earns a rate of return at least equal to some average rate earned by other private and governmental investments.

Procedure: For study purposes, benefits were defined as change in the earnings of corpsmen. In order to measure earning improvement, two procedures were used. First, educational gains achieved in Job Corps were measured based on the relationship between education and lifetime earnings that have been estimated in the best statistical studies. Second, the wages earned by ex-corpsmen were directly compared with a control group who had no Job Corps experience. Costs included overhead expense, foregone earnings, and operating costs minus transfer payments. No indication was provided as to the number of sample corpsmen and control group members observed, or the length of the observation period.

Conclusions: The study found that the present value of improvement in lifetime earnings for sample corpsmen ranged from $3,600 to $5,900. The cost of a five month training program was estimated to be $3,500 per corpsman.

Cain, Glen G. and Stromsdorfer, Ernst W. "An Economic Evaluation of Government Retraining Programs in West Virginia" in Gerald Somers, ed., Retraining the Unemployed. Madison, Wisconsin: University of Wisconsin Press, 1966 (ED 021 198).

Seems relevant but unable to obtain study for review.

Mangum, Garth L. Contributions and Costs of Manpower Development and Training. Ann Arbor, Michigan: University of Michigan, Institute of Labor and Industrial Relations, December, 1967. (ED 021 949).

Purpose: This study appraises the training program authorized under the Manpower Development and Training Act, Title II. More specifically, it attempts to determine the overall costs of the program and the degree to which, if any, program contributions exceed costs.

Procedures: The study first examines the extent to which each program objective has been achieved, then estimates overall program costs, and finally reviews previous cost/benefit studies in order to compare conclusions.

Conclusions: Study findings indicate that, in general, every current component of an MDTA program may not be profitable, but overall program contributions have exceeded costs by a margin which not only merits support but justifies expansion.

Smith, Ralph E. F. "Foregone Earnings During Manpower Training," Working Paper 350-11. The Urban Institute, 28 January, 1970, published in Hearings, Joint Economic Committee, Subcommittee on Economy in Government, National Priorities, 1-10 June, 1970.

Seems relevant but unable to obtain for review. Does contain cost data.

Muir, Allan H., et. al. Cost/Effectiveness Analysis of On The Job and Institutional Courses. PRC D-1297. Washington, D.C.: Planning Research Corporation, 1967.

Seems relevant but unable to obtain for review.

Mangum, Garth. MDTA: Foundation of Federal Manpower Policy, Baltimore: The John Hopkins Press, 1968.

Seems relevant but unable to obtain for review. The study does contain cost data on MDTA programs, however.

System Development Corporation. Evaluation of the JOBS Program in Nine Cities. Falls Church, Virginia: System Development Corporation, 1969.

Relevant, but unable to obtain for review. Contains cost data on the JOBS program.

Leasco Systems and Research Corporation. Quantitative Analysis of CEP, Vol. I and II. Silver Spring, Maryland: Leasco Systems and Research Corporation, 1969.

Relevant, but unable to obtain for review. Contains cost data on CEP.

Besen, Stanley M. et. al. "Cost-Effectiveness Analysis for the 'War on Poverty'" in Thomas A. Goldman, ed., Cost-Effectiveness Analysis New Approaches in Decision Making. New York: Praeger, 1967. (ED 024 877).

Seems relevant but unable to obtain for review.

5. Other Relevant Studies

McNamara, James F. A Mathematical Programming Model for the Efficient Allocation of Vocational Technical Education Funds. Harrisburg, Pennsylvania: Pennsylvania State Department of Education, Bureau of Educational Research, 1970. (ED 047 115).

Purpose: Reports on a mathematical programming model developed to provide the Pennsylvania State Board of Education with complete information for evaluating decisions about the efficient allocation of vocational technical education funds to local school districts.

Conclusion: The model, based on a supply-demand criterion, was tested on a set of occupational training programs within a given labor market area of Pennsylvania, and proven to be a generalizable procedure that could be applied to all labor market areas in the state.

U. S. Office of Education. Division of Vocational and Technical Education. Vocational Education in the Major Cities: Analysis of Population, Vocational Education Enrollment, Teachers and Expenditures, Fiscal year 1970. Washington, D.C.: U.S. Office of Education, 1970. (ED 056 195)

Purpose: To provide some indication of the states' population served by vocational education in the major cities and to determine vocational education expenditures.

Procedure: Expenditures for vocational education are reported by federal and by state/local sources, by total amount of expenditures allocated to each level of education, and by the total amount allocated to the handicapped and disadvantaged. For states that have more than one major city, a total is compiled with a percentage for the total indicated. Information was collected from 1) the annual state vocational education reports, and 2) the 1970 Census Report on Population. Information on 40 major cities is provided; reports were not received for 15 of the 50 largest cities identified by the Census.

Conclusions: A comparison of federal expenditures with population reveals that 25 major cities expend a lesser percentage of the states federal vocational education funds than their percentage of the states' population.

Pratt, Arden L. An Appraisal of the Impact of Federal Funds Granted Under Section 4 (a) of the Vocational Education Act of 1963 on the Occupational Programs Offered by the Public Two Year Colleges in New York State. Ed.D. Dissertation, New York State University at Buffalo, 1968. (ED 057 204)

Purpose: Ascertain the effects of the 1963 Vocational Education Act on program development in public two-year colleges in New York State.

Procedure: Collected data from the 10-year colleges in New York state that had received the most funds under the Act through January, 1967.

Conclusions: Findings show that existing curriculums of occupational education in the public two-year junior colleges had been maintained and improved through projects funded under the Act. However, these curriculums were not extended, instead a few of them were narrowed by being pushed to a higher level. Additional findings evidenced that 1) many new programs were begun with partial support under the Act, and these new programs were well-attended, 2) research and development in relation to teaching materials and methods received virtually no support during the first two years of the Act, and 3) the entire area of occupational guidance and counseling was virtually ignored.

Corazzini, A.J. "The Decision to Invest in Vocational Education: Analysis of Costs and Benefits" in Journal of Human Resources Supplement, 1968.

Relevant but unable to obtain for review.

Fein, Rashi. "Brookings Institution Conference on Vocational Education: Introduction" in Vocational Education Supplement to Journal of Human Resources, v. 3, 1968.

Seems relevant but unable to obtain for review. Was referenced in several bibliographies.

Droit, "Vocational Training Costs: Results of a Pilot Study and An Essay in Methodology" in International Labor Review, 1968.

Relevant. Suggests a method for the analysis of instructional costs of vocational education. Unable to obtain for review, however.

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