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Abstract

This repcrt contains intrcductcry material on cost-benefit analysis, reviews cf ccst benefit studies by Andrew J. Corazzini and by Jacob J. Kaufman and cthers, a discussion of the basic concepts cf ccst-benefit analysis, and a discussicn cf two possible apprcaches tc cost-benefit analysis cf vccaticnal educaticn: (1) vocational versus academic education, and (2) vccational versus vocaticnal educaticn, which includes cn-the-jcb training costs fcr graduates cf the various curriculums. The repcrt ccncludes: (1) The typical study thus far has been limited in sccpe; an implicit prcblem has been that of ccmparing different means as alternate means tc the same ends, (2) The vccaticnal versus vccaticnal education apprcach wculd render unlike curriculums ccmparable, and (3) Cost-benefit analysis is a useful decisicnal tool for allccating funds, but it assesses only the eccncmic efficiency cf a prcgram. A plan for a pcssible ccst-benefit analysis study cf vccational education is presented in the appendix. (JK)

Cost Benefit Analysis - Trade and Technical Education

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July 1969

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COST BENEFIT ANALYSIS-TRADE AND TECHNICAL EDUCATION:

FINAL REPORT

August, 1969

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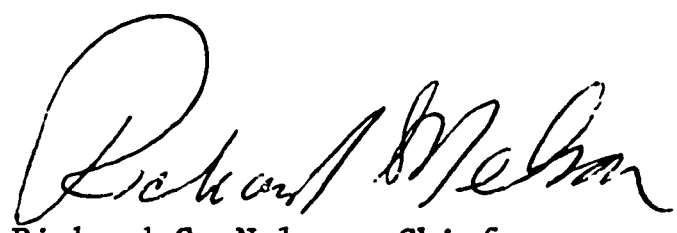
FOREWORD

In a time when school costs are rising rapidly, and competition for tax dollars is greater, the task of deciding which endeavors are more worthy of financial support is a critical problem. Cost-benefit analysis is a technique for comparing the relative economic efficiencies of competing programs, and the results of cost-benefit analysis provides a rational basis for the allocation of funds to programs.

Although cost-benefit analysis is frequently discussed, the conceptual and operational characteristics of cost-benefit analysis are not widely understood. This is because cost-benefit analysis is a developing technique, and information concerning it is scattered in a multitude of articles and books. This report brings together information from many of these sources to provide the reader an understanding of the concepts and operations of cost-benefit analysis. Two cost-benefit studies of vocational education are reviewed, and a rationale and plan for a future cost-benefit analysis study of vocational education is presented.



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ABSTRACT

This report contains background information to introduce the reader to cost-benefit analysis, a review of cost-benefit studies carried out by Corazzini and by Kaufman et.al., to indicate what has been done, a discussion of the basic concepts and operations of cost-benefit analysis, and a discussion of two possible approaches to cost-benefit analysis of vocational education. In addition, a plan for a possible cost-benefit analysis study of vocational education is included in the appendix.

The two possible approaches discussed are called the vocational versus academic education approach, which has been used in studies completed to date, and the vocational versus vocational education studies. The vocational versus vocational education approach is suggested as a means of making cost-benefit studies more valid and meaningful by including on-the-job training costs for graduates of the various curricula.

The conclusions of the report are (1) the typical study completed thus far has been limited in scope and by the implicit problem of trying to compare different means as alternate means to the same ends, (2) the vocational versus vocational education approach would render unlike curricula comparable for cost-benefit analyses, and (3) cost-benefit analysis is a useful decisional tool for the allocation of funds in that it will assess the economic efficiency of a program, but that is all it will assess.

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INTRODUCTION

CHAPTER I

INTRODUCTION

Cost-benefit analysis is a method of assessing the economic efficiency of alternate means of attaining desired ends. As applied to educational programs, it is a new and developing procedure which, although much discussed, is not widely understood. This report is an attempt to bring together the concepts and operations of cost-benefit analysis pertaining to vocational education into a relatively concise summary. We have also tried to go beyond what appears in the literature to propose a more conceptually sound and comprehensive plan for cost-benefit analysis of vocational education.

The report consists of chapters containing background material to introduce the reader to cost-benefit analysis, a review of two cost-benefit studies to gain an understanding of what has been done, a discussion of basic concepts and operations of cost-benefit analysis, development and discussion of two approaches to cost-benefit analysis, and some concluding remarks.

The literature pertaining to cost-benefit analysis is scattered in a vast multitude of books, articles and reports. Although we have tried to give due credit, many bits of information appear in a number of sources making footnoting cumbersome and awkward. Nevertheless, we have tried to point out when opinions are our own and we take full responsibility for errors or inaccuracies which may appear in either information we have taken from the literature or in the opinions and conclusions we have drawn.

Background Information

Cost-benefit analysis is one of several input-output analysis techniques. In the following sections, we very briefly introduce cost-benefit analysis and its close relatives, cost-effectiveness analysis and system analysis, and trace their historical development.

Cost-benefit analysis. Cost-benefit analysis is an evaluative technique which relates total value of a program to the total costs of the program. The fundamental theoretical limitation of this technique is that all values of costs and benefits must be quantified in terms of dollars.

The questions cost-benefit analysis can answer are: (1) Does the sum of the benefits of the program exceed the sum of the costs (benefits minus costs)? (2) How do the costs and benefits of one means to an end compare with the costs and benefits of another means? In the first instance the determination is the economic pay-off of a program, and in the second, the relative economic efficiency of alternative means to the same end. In either application, cost-benefit analysis is a useful tool to maximize benefits for a given level of costs, or to minimize costs for a given level of benefits.

Cost-effectiveness analysis. Cost-effectiveness analysis is an evaluative technique which relates costs of a program to quantified levels of effectiveness. In this analysis, costs are stated in dollars, and effectivenesses are stated in quantified terms related to the goals of the program. An example of an effectiveness statement is, "X percent of the graduates of the program remained employed for one year in occupations related to their training." Cost-effectiveness analysis is particularly

valuable for assessing programs whose outputs are not measurable in dollar values, and is useful in maximizing effectiveness levels for a given cost, or for minimizing cost for a given effectiveness level. The measure is the effectiveness/cost ratio.

System analysis. System analysis is a more broad and generic term. It is an evaluative technique which relates inputs of a program to the outputs where both inputs and outputs must be quantified, but neither of them are required to be in terms of dollars. System analysis includes both cost-benefit analysis and cost-effectiveness analysis, which are actually more restricted applications of system analysis.

Historical Development

Cost-benefit analysis was first used, and was largely developed during the 1930's by the Army Corps of Engineers as a technique for evaluating and justifying proposed dam and watershed projects. At that time, the legislative requirement that the dollar benefits of any such project must exceed the dollar costs was introduced so that the projects would "pay-off" for the taxpayers. In this type of application, cost-benefit analysis is a relatively straight-forward calculation and estimation of dollar costs and benefits for each component of the project. Costs and benefits were typically figured at several levels for each component of the project to help determine the most desirable combination of components and the economically best combination of levels of components for the project.

System analysis and cost-effectiveness, starting during World War II and continuing from then, were largely developed by the Rand Corporation primarily as means of evaluating military preparedness.

The Department of Defense has applied these techniques to a greater extent than has any other agency. The Defense Department's PPB (Planning, Programming, Budgeting) system is an outgrowth of application of system analysis in its broad sense, and is designed to make evaluation of programs practical on a continuing basis.

An interesting off-shoot of system analysis is called operations research. This is an applied research method for solving (or "suboptimizing" as the computer people like to call it) problems in business and industry.

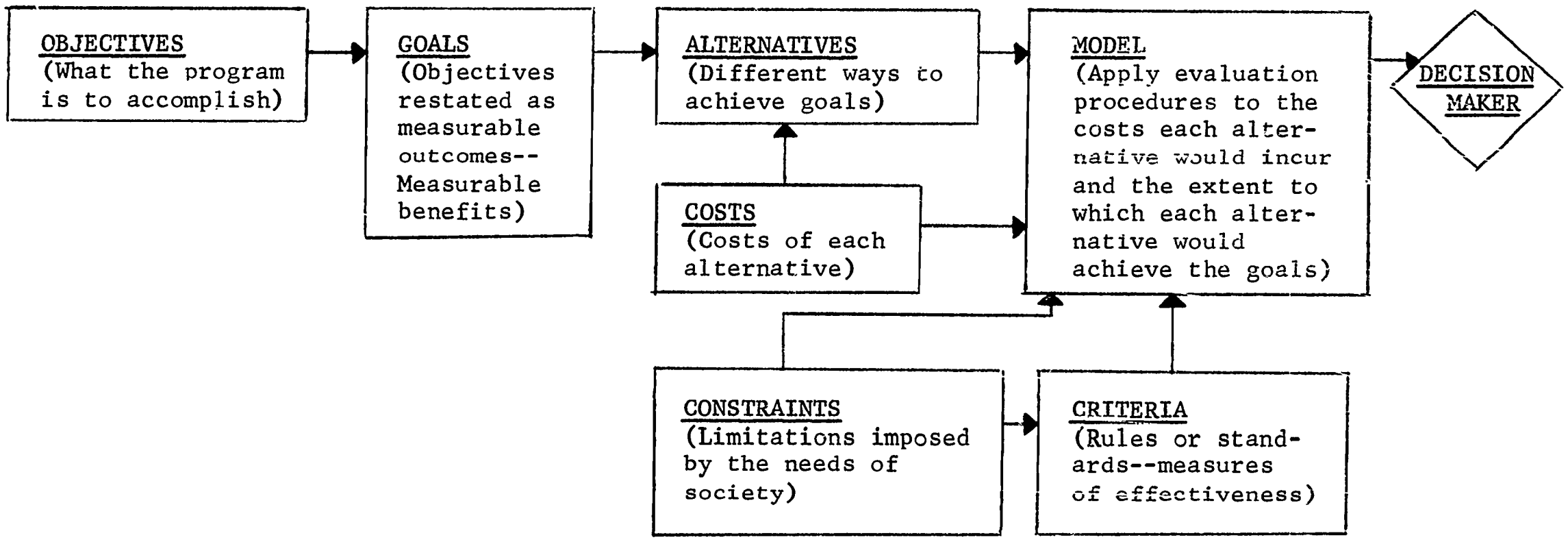
Components of Cost-Benefit Analysis

Cost-benefit analysis, a technique for relating dollar benefits of a program to the dollar costs has some essential components regardless of what kind of program is to be examined. The components are the objectives and goals, the alternatives, the costs, the constraints, the criteria and the model. In this section we briefly describe these components, which are also shown in diagrammatic form in Figure 1. This section and Figure 1 are a synthesis of concepts from many sources.

Objectives and goals. Any cost-benefit analysis starts with the objectives of the program under scrutiny. Although the objectives of a program are statements of what the program is designed to accomplish, the objectives of education are typically stated in terms which do not lend themselves to objective measurement and dollar quantification. As measurement and quantification are essential to cost-benefit analysis, it is necessary to restate the objectives of an educational program in

FIGURE 1

COMPONENTS OF COST-BENEFIT ANALYSIS



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specific measurable terms called goals. The goals are actually statements of the benefits of the educational program to be measured.[1]

Alternatives. The alternatives are different means to the accomplishment of the goals. For example, in Jacob Kaufman's study, vocational education and academic education were alternatives.[2] In a study of an existing program the alternatives are limited to the ways that are being used to attain the goals, however, in a projective study, the alternatives may include any schemes, simple or complex, radical or conservative, which conceivably could provide progress toward achievement of the goals. If the analysis demonstrated that one alternative is less desirable or less efficient than another, it should be discarded, but discarding of alternatives should be based upon the analysis rather than merely throwing them out at this stage of the procedure because of someone's judgement or opinion.[3]

Costs. The next step in the analysis is to derive the costs for each alternative. Obviously, the primary source for social cost information concerning on-going educational programs is the financial records of the schools. The greatest difficulty in obtaining cost information for on-going programs is that the records are organized along administrative budget lines so that the amounts spent on each portion of the program

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[1]Arnold Kotz, ed. Occupational Education--Planning and Programming, Volume 1 (Menlo Park, California: Stanford Research Institute, September, 1967), p. 46.

[2]Jacob J. Kaufman, et. al., An Analysis of the Comparative Costs and Benefits of Vocational Versus Academic Education in Secondary Schools, Preliminary Report (University Park, Philadelphia: Institute for Research on Human Resources, The Pennsylvania State University, October, 1967).

[3]Roland M. McKean, Efficiency in Government Through Systems Analysis (New York: John Wiley and Sons, 1958), p. 27.

cannot be directly picked out.[4] Thus, the accuracy of the cost data becomes dependent upon the estimate of the proportions of costs assigned to each portion of the program.

Constraints. Constraints are limitations imposed by the needs and wants of society. An example of a constraint is the desire for equality of opportunity in education for all children. There are many other constraints ranging from the concept of local control of the school by an elected board of trustees to the concept of separation of church and state extended to the idea that religion may not be taught in the public schools. Kaufman carefully discusses constraints imposed by the imperfect economy which may invalidate the evaluative criteria of cost-benefit analysis.[5] Constraints are apparent in all parts of the analysis, but should be taken into particular consideration in the criteria and model to avoid errors in social efficacy of the results of the analysis.

Criteria. The criteria are the standards or rules by which the benefits and costs of the alternatives are judged. Basically, the criteria would be used in the model to determine which of the alternatives was more economically efficient.

The model. The model is a mathematical and literary statement in which the benefits and costs of the alternatives, the constraints

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[4]Werner Z. Hirsch, "Planning Education Today for Tomorrow," Reprinted from Urban Affairs Quarterly, Volume II, No. 1, September, 1966, Los Angeles: Institute of Government and Public Affairs, University of California, Reprint No. 28, p. 9.

[5]Kaufman, et. al, A Cost-Effectiveness Study of Vocational Education (University Park, Pa.: Institute for Research on Human Resources, The Pennsylvania State University, March 1969), pp. 49-59.

and criteria are brought together to determine which of the alternatives is, or are, more economically efficient subject to the constraints. A good model will take into account factors other than the one under scrutiny--the effect of the educational program. These other factors would include anything which conceivably alters the measure of benefits independently of the educational program. Such factors as race or ethnic group and economic conditions of the community should be included among these.

The output of the model--the results of the analysis--provides information concerning the economic efficiency of the alternatives so that the person or group who must determine how the funds will be allocated may more rationally decide.

CHAPTER II

STUDIES OF COST-BENEFIT ANALYSIS OF VOCATIONAL EDUCATION

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There have been a number of cost-benefit studies of vocational education completed, but rather than review all of them, we have chosen to review only two in this report. We believe that by critically reviewing these two studies, those by Corazzini and by Kaufman, et. al., a concise overview of the conceptual and operational problems of performing cost-benefit analyses will be presented.

Corazzini, Vocational Education, A Study of Benefits and Costs[6]

Corazzini compared the costs of academic and vocational high schools in Worchester, Massachusetts, and compared the economic benefits to the individual and to the local community. He reported that the public per pupil costs for vocational education for males (high school and post-high school) were 2.3 times greater than the public per pupil costs for the regular high school programs. When the private opportunity costs in the form of foregone earnings were added to the public and private costs, the ratio for males was reduced to 1.40 times as expensive as regular high school education.

He found that starting salaries were only slightly higher for vocational graduates than for regular high school graduates, and he

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[6]Andrew J. Corazzini, Vocational Education, A Study of Benefits and Costs (Princeton, New Jersey: Princeton University, 1966).

argued that this differential would likely decrease with time. Starting salaries for post-high school vocational graduates were only slightly higher than for vocational high school graduates.

Corazzini concluded that:

1. Publicly subsidized on-the-job training should be considered as an alternative for vocational education.
2. As dropout prevention, the benefits of graduating from high school were not great enough to justify the excess costs of vocational education.
3. He concluded the report by questioning the economic value of the vocational education program.

The only favorable conclusion Corazzini reached concerning vocational education in Worchester was that it was somewhat more effective in promoting upward social mobility than was the academic curriculum.[7]

Corazzini's study suffers from a number of weaknesses and shortcomings. The following discussion of these weaknesses and shortcomings is largely based upon Kaufman, et. al's. criticism.[8]

1. The benefit data in Corazzini's study pertained only to the period immediately following graduation. In that the period after graduation is often very unsettled as far as regular employment for the graduate is concerned, the data for that

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[7]Corazzini, op. cit., pp. 115-117.
[8]Kaufman, et. al., Preliminary Report, pp. 152-154.

period are of questionable value for making projections. In fact, any projections based upon this data must be considered highly speculative.

2. Wage rates were compared rather than actual earnings. This precluded consideration of the proportion of time the students were actually employed, a factor which could drastically affect the benefits side of the equation.

3. Socio-economic factors which may significantly affect wages and employment were not controlled. Differences between the vocational and the non-vocational graduates' performance might have been due to differences in their background instead of the effects of the curricula.

4. An implicit assumption of Corazzini's study was that the two curricula were different means to the same end. In that vocational education and academic edu ation may have quite different functions, the circumstances under which they are compared must be rigorously clarified if misleading conclusions are to be avoided.

5. The interdependency of the economic effects of education were neglected. It was assumed that they were merely additive. Any change or difference in the economic situation external to the school would significantly affect earnings and employment quite apart from the influence of education.

6. The cost-benefit comparison of vocational versus academic education was discussed as if society were static. For example, it was estimated that on-the-job training would be less expen-

sive for society while completely neglecting the possibility that if industry found it necessary to expand its investment in on-the-job training, the costs to the public in the form of higher product prices might actually be greater than the costs of the vocational program.

It is entirely possible that Corazzini's conclusions were completely valid for the situation in Worchester, Massachusetts in 1963-64, however, because of the aforementioned shortcomings of the study, there is no way to be sure whether or not this is the case. Probably the major contribution of this study is that it broke ground for future studies. The action of making a good, honest attempt to perform a cost-benefit analysis of education in itself would show future researchers part of the way and some of the pitfalls to be avoided regardless of whether or not they agreed with the conditions and results of the study.

Kaufman, Stromsdorfer, Hu, and Lee, Costs and Benefits of Vocational Education Versus Academic Education, Preliminary Report, and A Cost-Effectiveness Study of Vocational Education[9]

This is the landmark study conducted to date. The preliminary report was published in 1967, and the final report in March 1969. The two purposes of the study were: (1) to develop a methodology for conducting an empirical study of the costs and benefits of vocational education, and (2) to conduct an empirical study which allowed the drawing of conclusions about the economic efficiency of vocational education.[10]

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[9]Kaufman, et. al., Preliminary Report; Kaufman, et. al., A Cost-Effectiveness Study of Vocational Education.

[10]Kaufman, et. al., Preliminary Report, pp. 2-3.

The discussion of conceptual and methodological problems contained in both reports should be considered as required reading for anyone interested in cost-benefit analysis of vocational education.

For the empirical study, three cities were selected, and cost data were gathered for the vocational-technical, vocational-academic, vocational-comprehensive, academic, and general curricula of the high schools within these cities. The data available were not sufficiently uniform to make comparisons easy, and the data for one city was incomplete, so that no cost-benefit analysis could be performed for that city.[11]

Benefit data were based upon the labor market histories of a sample of graduates of the January and June 1959 and 1960 high school classes. Mail questionnaires were sent to the graduates, and the total sample size was limited to 1,255. The sample was found to be highly weighted toward females. The labor market histories covered the six years following graduation, and information on seven sets of independent variables was also obtained. These were curriculum, sex, race, marital status, city of graduation, IQ measures, and father's education.[12] The socio-demographic characteristics, other than curriculum which may affect labor market performance, were controlled by means of multiple regression analysis.[13]

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[11]Kaufman, et. al., A Cost-Effectiveness Study of Vocational Education, pp. 226-227.

[12]Ibid., p. 227.

[13]Ibid., p. 232.

The findings of the study declare that "vocational-technical graduates earned significantly more and were employed significantly longer than the graduates of the other four curricula over the six-year post-graduation period."[14] As an investment, vocational education in the two cities where analysis was possible, was found to be economically efficient, and the evidence suggests that funds should be shifted from the other curricula to the vocational-technical high school curriculum.[15]

Some related issues were also covered in the study. For example, it was discovered that dropouts from the vocational-technical curriculum fared better on the labor market than did dropouts from the other curricula.[16]

Regarding on-the-job training, one hundred twenty-nine employers in the three cities of the study were interviewed, and it was found that employees who were graduates of the vocational-technical high school curriculum averaged 12.64 weeks less on-the-job training than did employees who were graduates of the other curricula. The vocational-technical graduates not only required less on-the-job training, but they also received higher wage rates while in training, thus increasing the internal rate of return to vocational-technical education.[17]

Kaufman's study is the most carefully and rigorously designed study to date. Two problems appeared during the empirical study which

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[14] Ibid., P. 233.
[15] Ibid., p. 234.
[16] Ibid., p. 235.
[17] Ibid., p. 236.

should be noted, however. The sample of high school graduates is highly weighted toward females by a ratio of about three to one. If nothing else, this will lower the absolute level of measured money and employment benefits, because males were found to earn more than females and to be employed a greater portion of the time. Males averaged $415 per month over the six year period while females averaged only $236. Employment rates for the six year period were 90 percent and 72 percent for males and females respectively.[18] This suggests the desirability of analyzing the costs and benefits for males and females separately, and perhaps also on the basis of curricula for related groups of occupations.

The second problem is concerned with extracting the costs of the curricula. Kaufman et. al. state that aggregation of costs, underreporting, and lack of data render the cost portion of the report of a preliminary nature and subject to revision. This problem lies not in the design of the study, but rather in the schools' budgeting and accounting procedures. School budgets are, or perhaps we should say were until recently, invariably organized along administrative lines. This makes it very difficult to assign costs to a particular program because programs almost always cut across administrative lines. The program budgeting plans being implemented in a number of districts across the country are the first step toward solving this problem.

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[18]Kaufman, et. al., Preliminary Report, p. 95.

Discussion of Cost-Benefit Studies of Vocational Education

It would be extremely naive to state that any more than the first steps have been taken in the area of cost-benefit analysis of vocational education--or of any education. Even the Kaufman study, which is by far the most comprehensive and rigorous we have seen, is by no means complete in its collection and analysis of data, and the authors carefully point this out.

There appear to be two major problem areas in the application of cost-benefit analysis to any educational program. These may be summarized as problems concerning the objectives of education and problems concerning the costs of education.

The objectives of education are usually not stated in terms which lend themselves to objective measurement, and secondly the objectives of education are sometimes difficult, if not impossible to assign monetary values. Earnings and employment may be used as indices of the utility value of education, but these exclude other factors which exist and certainly have monetary value as, for example, better citizenship. Attempts currently being made to redefine the objectives of education as specific measurable goals, and research in the evaluation of education will help with this problem. As it stands now, however, any cost-benefit analysis of education must necessarily be quite incomplete because no one knows how to measure the benefits of education, or even what the benefits of education actually are.

The second major problem concerns the identification of program costs. Schools are organized into administrative units and their

budgets follow these administrative lines. Cost-benefit analysis is concerned with programs, and programs almost always involve more than one administrative unit. As each administrative unit usually serves more than one curriculum, it becomes very difficult to determine the amount of money spent on any particular curriculum. The accuracy of the estimate of costs then becomes dependent upon the knowledge, understanding, and skill of the person making the estimate.

Progress is being made in the area of the cost problems in those school districts which are changing to program budgets. Unfortunately, some of these program budget schemes appear to be merely "doctored-up" administrative budgets, but even the poorest of them are a step in the right direction. Better program budget plans will undoubtedly greatly facilitate deriving social costs for cost-benefit analysis by assigning costs along program lines rather than along administrative lines.

The two cost-benefit studies cited were both concerned with the traditional general objective of vocational education--that of preparing young people to enter and be successful in occupations. The newer objectives of vocational education--that of being an active agent to promote upward socio-economic mobility (equal opportunity for all), and that of retraining workers desplaced by changes in technology are not seriously considered in either study. Both of these objectives have great economic significance but are too new to be included in either study. With regard to upward socio-economic mobility, cost-benefit

studies of the Job Corps Centers are likely to provide the first definitive clues. Somers, who studied the retraining displaced workers in a number of M.D.T.A. training programs, has stated, "The most significant conclusion to be derived from these studies is that the retraining is a sound social investment."[19] However, neither of these objectives has yet been studied as a component of public school vocational education.

There are very real and very large problems to be overcome before cost-benefit analysis of education can provide more than clues as to how funds should be allocated. Mood and Powers summarized the situation very well when they said, "We are not pessimistic about operations analysis of the American education system. We are merely convinced that a comprehensive quantitative model is a very big job which will require large resources and many years."[20] It must be pointed out, however, that the Kaufman study represents a very large step toward that comprehensive quantitative model.

The foregoing problems are not valid reasons for not performing cost-benefit analysis. Nevertheless, these should be considered as limitations to such analyses at the present time. It is even conceivable that these problems may cause the results of an analysis to favor an alternative which is really not the most economically efficient choice. However, it will be only through experience in performing analyses that the technique will be refined and the results more meaningful.

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[19]Gerald F. Somers (ed.), Retraining the Unemployed. (Madison: The University of Wisconsin Press, 1968), p. 7.

[20]Alexander M. Mood and Richard Powers, Cost-Benefit Analysis of Education (Washington, D.C.: U.S. Office of Education, 1967), p. 13.

CHAPTER III

BASIC CONCEPTS AND OPERATIONS IN COST-BENEFIT ANALYSIS

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BASIC CONCEPTS AND OPERATIONS IN COST-BENEFIT ANALYSIS

Cost-benefit analysis is based upon the idea that while the needs or wants of society are unlimited, the resources available to meet those needs are limited, and therefore it is desirable to allocate those resources to meet the needs as efficiently as possible. Stated another way, cost-benefit analysis is a method for determining which alternate means to attaining an objective, or which mix of means to the objective will provide the greatest return on the investment dollar. To maximize the return on the investment, the costs of the alternatives and the dollar benefits attributable to each alternative are compared. The following section provides an explanation of what goes into these comparisons and how they are made.

Elements of Cost-Benefit Analysis

The elements of cost-benefit analysis are the benefits resulting from the program, the costs of the program, the discount rate or interest rate, and the length of time involved. Figure 2 lists these elements in an outline form. Rather than discuss all of these elements, we will discuss only the points we believe need more explanation.

It should be understood that earnings, income, and fringe benefits are indices of productivity. Since the value of a person's productivity is very difficult to measure directly, but his salary is a good indicator of his productivity, this more convenient, and readily available figure is used.

FIGURE 2

THE ELEMENTS OF COST-BENEFIT ANALYSIS[21]

BENEFITS

Society

1. Additional earnings attributed to occupational education (gross of taxes).

2. Other additional income (output) attributable to occupational education (gross of taxes).

   a. to cover costs of fringe benefits.

   b. rendering other factors of production more productive.

   c. increasing productivity of future generations as the better educated induce progeny to become better educated.

   d. benefits of future educational programs undertaken as a result of the current programs.

3. Effects of reducing transfer payments.

   a. additional income generated by resources released from administration of transfer programs.

   b. additional income as disincentive effects of taxes necessary to finance transfers are removed.

4. Better citizenship and reduced costs to society of bad citizenship.

Individual

1. Additional earnings attributable to occupational education (net of taxes).

2. Fringe benefits associated with additional earnings.

3. Stipends received (if any) while enrolled in occupational education program.

4. Value of the program to enter other educational programs in the future.

5. Increased psychic income.

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[21]Bruce F. Davie, "Cost-Benefit Analysis of Vocational Education: A Survey" United States Congress, House of Representatives, Committee on Education and Labor, Vocational Education Improvement Act Amendments of 1967. Hearings before the General Subcommittee of Education, 90th Congress, 1st Session, on H.R. 8525 and related bills, April 12, 13, 17, 1967. (Washington: Government Printing Office, 1968), pp. 106-107.

Transfer payments refer to money that is transfered within the economy from one person's or group's use to another, and welfare payments are an example of transfer payments. Since transfer payments are a redistribution of the income of a society, changing the level of transfer payments does not raise or lower the economy except as they may use up or release funds which may have a better return if otherwise invested. The benefit to the economy associated with reduction of transfer payments is actually the increased productivity of the person whose transfer payments has been reduced. If a person on welfare obtains employment, the economy is strengthened by the amount he earns and is essentially neither strengthened nor weakened by the reduction in welfare payments.

The dollar value of citizenship is extremely difficult to determine. The costs of police and fire protection can be readily determined, but these would provide only very rough indices of citizenship. Other matters, such as community participation and civic responsibility, although definitely of economic value, are very hard to measure.

The discount rate is based upon the ideas that interest must be paid on money borrowed, and that money to be received in the future is not worth as much to an individual as money in hand. The choice of discount rate is an important consideration in any cost-benefit analysis because the choice of too high or too low a rate may cause a good alternative to be rejected or a poor one to be accepted. To combat the problem of choice of discount rate, commonly a low and a high rate are both used with six percent and ten percent as common choices.

Time is a factor in any cost-benefit analysis in that the benefits must repay the cost in a reasonable length of time. The length of time that benefits of a program will continue is difficult to determine and often must be estimated. For some factors such as the intergenerational effects of increased education, the benefits will continue to accrue indefinitely. Other factors, such as the increased earning power of an individual due to his education may extend only for his working life, and his marginal, or extra earning power may extend for some shorter length of time.

Evaluation of Costs and Benefits.

The costs and benefits of each alternative of a program, together with the elements of discounting and time, may be evaluated in three different ways. These are: (1) present value of net benefits, (2) rate of return, and (3) benefit/cost ratio. These three evaluation techniques are presented in Figure 3.

The present value of net benefits is the value of the discounted benefits minus the value of the discounted costs and provides an indication of how well a program will "pay off." The decision rule for choosing among present values of net benefits is to choose the programs having the highest values and to reject any programs having a negative value.

The rate of return in essence tells how large a dividend investing in the program will pay each year. The decision rule for rates of return is to choose programs having the highest rates of return and to reject any program having a rate of return less than the social discount rate.

FIGURE 3

THREE EVALUATION TECHNIQUES[22]

The Three Criteria:

I. Present Value of Net Benefits: $\sum_{t=0}^{n} \frac{B_t - C_t}{(1+i)t}$

II. Rate of Return: $\sum_{t=0}^{n} \frac{B_t - C_t}{(1+r)t} = 0$

III. Benefit/Cost Ratio: $\sum_{t=0}^{n} \frac{B_t}{(1+i)t} \Big/ \sum_{t=0}^{n} \frac{C_t}{(1+i)t}$

where B_t = benefits in year t
C_t = costs in year t
n = number of years spanned by the analysis
i = social discount rate
r = rate of return

The Three Decision Rules:

I. Choose programs having the highest present values of net benefits; reject any program having a negative present value of net benefits.

II. Choose programs having the highest rates of return; reject any program which has a rate of return less than the social discount rate.

III. Choose programs having the highest benefit/cost ratios; reject any program having a benefit/cost ratio less than one.

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[22]Davie, op. cit., p. 108.

The benefit/cost ratio, which is the sum of the discounted benefits divided by the sum of the discounted costs, provides a comparison of the relative values of benefits to costs. The decision rule for the benefit/cost ratio is to choose programs having the highest ratios and reject any program having a ratio of less than one.

It cannot be pointed out too strongly that these cost-benefit analysis evaluation techniques provide measures of economic efficiency only and do not provide any indication of social value. It is possible that a most economically efficient alternative might be completely socially unacceptable and that a somewhat economically inefficient alternative might be acceptable, for over-riding social reasons. Although the results of a cost-benefit analysis might indicate a socially undesirable action because of limitations of the technique, it is also just as possible that the results of the analysis might be unacceptable because there is no way to quantify the benefits of the program in monetary terms.

MEASURES OF COSTS AND BENEFITS

As a plan for cost-benefit analysis of vocational education proceeds from the theoretical and conceptual to the operational aspects, it becomes necessary to decide exactly which measures of cost and benefit are to be used and just how they are to be obtained. These measures will be discussed within the groupings of social costs, social benefits, private costs, and private benefits.[23]

Social Costs

Social costs include current costs, capital costs, cost correction factors, costs from non-school support, gross earnings foregone by students, incidental costs to students associated with school attendance, job search costs, and on-the-job training costs.

Current costs. Current costs are the operating costs of the program. Although the current costs of an educational program will usually be by far the largest portion of the total costs, there is at present no easy, direct way of extracting these costs. As was discussed before, this is because the school budget and accounting system is organized along the administrative lines of the school rather than along program lines. The current costs of an educational program will be included within the following budget subaccounts in the California school system: administration, salaries of certificated personnel, other expenses (instruction), auxiliary services (health, welfare, psychological services,

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[23]Except as noted, the following discussion of costs and benefits is largely adapted from Kaufman, et. al., Preliminary Report, pp. 28-31, 67-69.

attendance, etc.), operation of school plant, fixed charges, and transportation of pupils. Some of these costs can be assigned to the various programs on a direct per pupil ratio basis. However, in other cases this is not possible because, for example, the costs of supplies are greater for laboratory programs than for straight classroom programs. In some cases the costs of supplies ordered for specific programs can be isolated in the accounting records, but in others the amount spent must be determined through a perceptive estimate.

An axiom of cost-benefit analysis is that joint costs cannot be prorated. That is to say, costs incurred jointly by more than one program cannot be separated to assign a share of the costs to any one program. The reasoning behind this is that, typically, if the goods or services were purchased for each program separately, the costs would be greater. Another way to look at joint costs is that if the goods or services purchased are essential to more than one program there is no logical way of distributing these costs from an economics point of view. Joint costs usually do not present a great problem in cost-benefit analysis because cost-benefit analysis is based upon marginal or excess costs and benefits rather than average costs and benefits. Average costs and benefits must be considered when deciding whether or not to institute a new program, but marginal co ts and benefits are the basis for evaluating continuing programs or for decisions concerning the allocation of funds among programs.

A perceptive and practical scheme for determining the average and excess costs of programs was presented by Frank Yett in a research

paper in 1957.[24] In this paper, Yett describes a method of determining what proportion of a school's expenditures in each budget subclassification was spent on the vocational Homemaking program. The same general procedure repeated for vocational education should provide good cost information. Yett's procedure is to determine the percent of each subclassification which was spent on the school program "commonly" and the percent which was spent on specific programs. The specific programs are then examined to determine the comparative per student expenditure of the remaining funds. Although this technique may sometimes be at odds with the admonition concerning prorating of joint costs, it is the best method we have found for determining average and excess costs.

Capital costs. Capital costs, including site acquisition, site improvements, physical plant and buildings including remodeling, and equipment costs present a problem for cost-benefit analysis in that the life of these items is usually longer than the life of the program, and almost always longer than the period of the study. Ideally these costs should be figured on a cost per student contact hour basis or some other comparable measure, but this type of measure is almost impossible to determine. A practical and convenient measure of capital costs is found through the use of the capital recovery factor. This formula provides a level amount of capital lost annually rather than the actual amount or proportion of the capital used in any one year.[25] The capital recovery factor formula is given in Figure 4.

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[24]Frank A. Yett, Vocational Homemaking Education Program Costs in California Public Schools. (Los Angeles: Division of Vocational Education, University of California, 1957).

[25]Kaufman, et. al., Preliminary Report, p. 72.

FIGURE 4

CAPITAL RECOVERY FACTOR (CRF)[26]

$$c=C_o i(1+i)^n/ (1+i)^n - 1$$

where:

c = Capital recovery factor (annual capital lost).

C_o = Present value of capital in use.

i = Social opportunity cost of capital or investment funds (interest rate)

n = Number of years over which benefits are returned (project life or capital investment life).

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[26]Adapted from Kaufman, et. al., Preliminary Report, p. 72.

Cost correction factors. Cost correction factors are based upon the premise that since schools do not pay taxes, the school's dollar will buy more goods and services than will a private citizen's dollar. Cost correction factors are the subject of a lively debate among economists, but as best we can determine, the use of cost correction factors is highly questionable and thus probably should not be used in cost-benefit analyses of educational programs.

Costs from non-school support. Costs from non-school support would include the costs of materials and equipment donated or loaned to the school. As some vocational programs rely heavily upon equipment donated or loaned by industry, and the costs of this equipment are borne by the public in the form of higher prices paid for the goods or services of the industry, the value of the equipment should be considered as a social cost. Subsidies from local, state or federal governments should also be included as costs of non-school support.

Gross earnings foregone by students. Gross earnings foregone by students must be considered as social opportunity costs. However, if the groups of students have very similar characteristics, the marginal difference in opportunity costs among these groups will be very small or non-existent. Foregone earnings are usually not considered for high school students, although they could be a significant factor in a study of junior college students.

Incidental costs to students. Incidental costs to students are those over and above the normal daily costs of attending school. The consideration of incidental costs is that of marginal or excess costs of attendance in one program as opposed to another.

Job search costs. Job search costs, if they are higher for graduates of one program than for graduates of another program, are marginal social costs which should be included in a cost-benefit analysis of vocational education. This factor has not been investigated to any extent in cost-benefit studies of vocational education, but it should be studied.

On-the-job training costs. On-the-job training costs are probably higher for academic graduates than for vocational graduates. As some of the costs of on-the-job training are probably passed on to the public in the form of higher product and services prices, the marginal on-the-job training costs of each group should be considered in cost-benefit analysis of vocational education. On-the-job training costs have not been studied except as they may be reflected in the salary rates of new employees, and this represents a real gap in cost-benefit studies of vocational education conducted to date.

Social Benefits

Social benefits of education include a greater rate of economic growth, good citizenship and reduction of crime, and the continuation and exploration of knowledge and culture.

Greater rate of economic growth. The greater rate of economic growth as a benefit of education is derived from the increased productivity of the workers who were educated. In that productivity is very difficult to measure directly, earnings before taxes are usually used as an indicator of productivity. Kaufman, et. al. also used the ". . . percent of time employed out of the total time which could be devoted to

civilian labor force participation. . ."[27] as an indicator of benefit. Although the employment data provide valuable social information, they are not essential in a cost-benefit analysis as periods of unemployment would reduce the worker's income and would show up as reduced benefits. We believe, however, that the employment data should be included as a part of a cost-benefit study to provide social information in addition to the economic assessment.

The monetary value of fringe benefits should be included as an indicator of social benefit. Although fringe benefits represent compensation to workers, they have not been considered in the studies we have seen. If the fringe benefits for one group of gradutates were found to be higher or lower than for another group of graduates, the results of the analysis might be significantly changed from what they would have been if fringe benefits had not been included.

Good citizenship and reduction of crime, and the continuation and exploration of knowledge and culture. The other social benefits of education, good citizenship and reduction of crime, and continuation and exploration of knowledge and culture have never been satisfactorily measured in an economic sense. The intergenerational effects of education, particularly the relative effectiveness of one educational program as opposed to another in promoting upward social and economic mobility needs to be explored. If a program were found to be effective in moving its graduates upward both socially and economically,

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[27]Kaufman, et. al., Preliminary Report, p. 90.

the benefits of the program would continue to accrue to society for generation after generation. This effect has been pretty well demonstrated for college attendance, but the comparative effects of high school curricula upon non-college attending and vocational graduates has not been investigated.

A word of caution is necessary concerning intergenerational effects, however. In that the graduates of a program who earn more because of the program they attended, will be better able to provide their offspring with more education, it is quite easy to double-count the intergenerational effect as an additional benefit, where it is actually an overlapping benefit of increased earnings.

Private Costs and Benefits

Private costs and benefits are considered to assess whether or not it is to an individual's advantage to avail himself of the program. Before a person decides to enroll in an educational program, he gathers some information about the program to see what advantages it offers him. In asking the question, "What's in it for me?", the person is really performing a rudimentary cost-benefit analysis, although he probably never thinks of it as such. A formal cost-benefit analysis of private costs and benefits provides decision information, then, for the potential student. It also provides decision information for the person or group responsible for allocation of funds for the program, in that it would provide an indication of how attractive the program would be to the potential student, just as the analysis of social costs and benefits would provide an indication of the economic value of the program to society.

Private costs. Private costs include earnings foregone by students net of taxes, incidental costs associated with school attendance, job search costs, and on-the-job training costs.

Earnings foregone by students represent the difference between what the students would have earned if they did not attend the program and what they did earn while attending the program. These earnings are figured on the basis of spendable money--that is, after taxes have been deducted. Although earnings foregone by students may amount to a considerable amount of money for post-high school age students, they are usually not a consideration for high school students. Further, if two groups of students have essentially the same characteristics, the marginal differences in foregone earnings and other opportunity costs will be small or non-existent. This latter point is important when choosing between programs, but the amount of foregone earnings is important when deciding whether or not to enroll in any program.

Incidental costs associated with school attendance probably needs no further explanation.

Job search costs would include costs incurred by the individual while seeking employment. If a student were placed by the institution in an occupation immediately upon graduation, job search costs might equal zero, and if the student remained unemployed for a time after graduation, or if he utilized the services of a private employment agency, his job search costs might become a very considerable amount.

Costs to persons voluntarily out of the labor force should not be considered as job search costs, either in the social or private

sense, because it must be assumed that these persons are receiving benefits which are at least equal to what they would receive if they were employed. The person voluntarily out of the labor force remains out of the labor force because the monetary or psychic benefits he receives while unemployed are worth more to him than what he would receive if he were working.

On-the-job training private costs are usually very difficult to isolate because they usually are in the form of lower wages. This does not upset the cost-benefit equation, however, in that if on-the-job training costs are essentially missing from the equation, this amount is exactly offset by the reduction in benefits in the form of wages. Thus the benefit/cost ratio is unaffected.

Private benefits. Private benefits of education include additional earnings due to education, broader appreciation of our environment, and acquisition of knowledge for its own sake. Of these, only additional earnings due to education lends itself to ready measurement in money terms. The additional earnings due to education would be measured as spendable income, that is, as income after taxes.

The other two benefits, broader appreciation of our environment and acquisition of knowledge for its own sake, tend to defy measurement in economic terms. To a large extent, these benefits involve psychic income rather than monetary income, and are impossible to assign dollar values.

CHAPTER IV

POSSIBLE APPROACHES TO COST-BENEFIT ANALYSIS OF VOCATIONAL EDUCATION

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POSSIBLE APPROACHES TO COST-BENEFIT ANALYSIS OF VOCATIONAL EDUCATION

There are two approaches to cost-benefit analysis of vocational education which, in our estimation, have merit. These are what we have chosen to call vocational versus academic education and vocational versus vocational education.

Vocational Versus Academic Education Approach

Vocational versus academic education is the general format of the studies conducted to date. In this plan, education is the program, and vocational education and academic education are the alternatives. This plan, if carefully and thoughtfully pursued, can provide very meaningful comparisons between the alternatives. The major limitation of this approach is the implicit connotation that vocational and academic education are both alternate means to the same ends. This limitation, unless rigorously controlled, may lead to false or misleading conclusions. With no intention to belittle the valuable pioneering work that has been done comparing vocational and academic education, it is our belief that this approach has inherent limited value because it may be a comparison of unlike items, and thus the comparisons may not always be valid.

Vocational Versus Vocational Education Approach

To meet the objections to the vocational versus academic approach, we propose the vocational versus vocational education approach. In

this scheme, vocational education is the program, and any two or more of the following would be the alternatives.

1. Vocational education high school curriculum.
2. Academic high school curriculum and on-the-job training.
3. General high school curriculum and on-the-job training.
4. Industrial arts high school curriculum and on-the-job training.
5. Cooperative work experience program.
6. Job Corps training.
7. Vocational education junior college curriculum.
8. Academic junior college curriculum and on-the-job training.

Although on-the-job training is mentioned specifically only for four curricula where on-the-job training costs are expected to be greatest, these costs should be considered for all of them. On-the-job training costs would be reflected in two ways--as lower starting wage rates and as costs incurred by the employers to train their workers. As the costs to the employer are passed on to the public in the form of higher prices for products and services, these costs should be included in the social costs of the program. In that on-the-job training costs have not been studied to any extent, this part of the cost-benefit study would be a large undertaking in itself, and would make the gathering of data more complex.

Probably the major limitation of the type of study we are suggesting is its complexity. We believe that a study of this nature would be of little value if conducted on a very small scale because the costs of establishing procedures would probably be too high to justify the results of the study. Therefore, we suggest the study be conducted on a fairly substantial scale involving at least two or three hundred graduates.

We believe that Kaufman's choice of variables provides an excellent format for the study, although it might be desirable to supplement his list of variables. We suggest that the following list of variables would be appropriate to the study:

Independent variables

A. Primary independent variable:

Influence of the particular curriculum pattern on the labor market performance of the students as defined and selected for the study.

B. Additional independent variables which might affect the dependent variables (control variables).

1. Sex
2. Race and/or ethnic group
3. Intelligence quotient or some other measure of mental ability
4. Marital status--number of dependents
5. Father's education
6. Father's occupation (probably only one of the two factors education and occupation is necessary)
7. Community economic conditions
8. Home conditions (father absent in childhood, mother working in childhood, number of siblings, etc.)

Dependent variables

A. Primary dependent variable:

Labor market experience of students for the period of the study.

B. Specific dependent variables:

1. Percent of time employed for the period of the study.
2. Percent of time employed for the first year of the study.
3. Percent of time employed for the last year of the study.
4. Percent point difference between the time employed during the first year of the study and the time employed during the last year of the study.
5. Average monthly earnings for the period of the study.
6. Average monthly earnings for the first year of the study.
7. Average monthly earnings for the last year of the study.
8. Difference in monthly earnings between the first and last years of the study.
9. Change in social class from father to student.

CHAPTER V

CONCLUSIONS

CHAPTER V

CONCLUSIONS

Cost-benefit analysis of vocational education is a worthwhile but difficult procedure which is now in its infancy. The typical cost-benefit study concluded to date has been limited in scope and by the implicit problem of trying to compare means to different ends as alternate means to the same ends. Kaufman's study comes closer to meeting this problem than has any other, and his study provides the best conceptual, operational, and decisional information of any study we have seen.

To meet the problems of trying to compare unlike alternatives, we suggest a format for comparing vocational education with vocational education. In this plan, we believe that academic education becomes comparable with vocational education if the costs of on-the-job training are included, particularly if they are included in the social costs measure.

The final conclusion we have reached is that cost-benefit analysis is a useful decisional tool for the allocation of funds. A well-done cost-benefit study will provide an indication of which alternative means to an end will provide the greatest economic return to the society and to the individual, but this is all it will provide. It will assess the economic efficiency of a program, but not its social efficiency, and social matters may outweigh economics in some cases. Therefore, the results of a cost-benefit analysis should be used as evidence, but not the only evidence, upon which the decision to allocate funds is based.

Like any other tool, cost-benefit analysis can be used or misused, and can be used for social good or evil. How and for what purpose a tool is used depends upon the wisdom and intent of the person using the tool.

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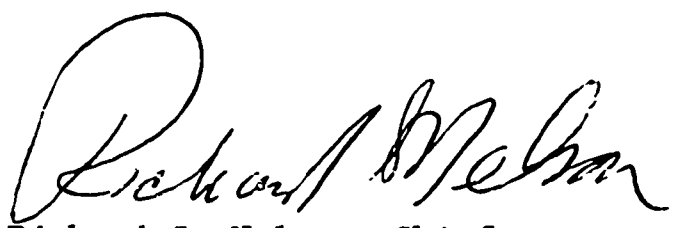
FOREWORD

In a time when school costs are rising rapidly, and competition for tax dollars is greater, the task of deciding which endeavors are more worthy of financial support is a critical problem. Cost-benefit analysis is a technique for comparing the relative economic efficiencies of competing programs, and the results of cost-benefit analysis provides a rational basis for the allocation of funds to programs.

Although cost-benefit analysis is frequently discussed, the conceptual and operational characteristics of cost-benefit analysis are not widely understood. This is because cost-benefit analysis is a developing technique, and information concerning it is scattered in a multitude of articles and books. This report brings together information from many of these sources to provide the reader an understanding of the concepts and operations of cost-benefit analysis. Two cost-benefit studies of vocational education are reviewed, and a rationale and plan for a future cost-benefit analysis study of vocational education is presented.



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APPENDIX

A COST-BENEFIT ANALYSIS OF VOCATIONAL EDUCATION VERSUS OTHER CURRICULA INCLUDING ON-THE-JOB TRAINING COSTS

Proposal for Research

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ABSTRACT

A COST BENEFIT ANALYSIS OF VOCATIONAL EDUCATION VERSUS OTHER CURRICULA INCLUDING ON-THE-JOB TRAINING COSTS

The purpose of this study is to compare the economic efficiency of junior college vocational and technical education as occupational preparation with those of selected junior college and high school curricula when on-the-job training costs are included. More specifically, the purpose of the study is to determine the relative costs and benefits accruing to the graduates and to society, and to determine which of these are attributable to the junior college vocational-technical and academic curriculums, and the high school academic, industrial arts, and general (other non-academic) curriculums when on-the-job training costs are included.

The study is to be a cost-benefit analysis of the various curricula, with primary attention paid to the costs and benefits to society. Socio-demographic characteristics which affect labor market performance other than the curricula are to be controlled by matching the graduates of the various curricula on the basis of a selected list of these characteristics. The fundamental differences between this and previous cost-benefit studies of vocational education are that this study includes the heretofore unexamined costs of training the new employee on the job, and that the background variables affecting labor market performance are to be controlled primarily by matching rather than by multiple regression analysis.

The most important probable contribution of this study is that it will provide a more inclusive and realistic assessment of the economic efficiency of the curriucla studied by including the costs of training the new employee on the job. The most immediate and direct use of the findings of the study will be action the district studied--the San Diego Unified School District--may take based upon them.

Very briefly, the method of the study will be to establish a study sample of matched groups of graduates of the curricula. Concerning these graduates, cost information will be obtained from school records, and on-the-job training costs will be obtained from their employers. Benefit information and employment histories will be obtained from the graduates by means of interviews. Multiple regression analysis will be used to test the quality of the matching. For each curriculum, the present value of net returns, the internal rate of return, and the benefit/cost ratio will be calculated.

PROBLEM AND OBJECTIVES

Statement of Purpose

The purpose of this study is to compare the economic efficiency of junior college vocational and technical education as occupational preparation with those of selected junior college and high school curricula when on-the-job training costs are included. More specifically, the purpose of the study is to determine the relative costs and benefits accruing to graduates and to society, and to determine which of these are attributable to the junior college vocational-technical and academic curriculums, and the high school academic, industrial arts, and general (other non-academic) curriculums when on-the-job training costs are included.

The study is to be a cost-benefit analysis of the various curricula with primary attention paid to the costs and benefits to society. Socio-demographic characteristics which affect labor market performance other than the curricula are to be controlled by matching the graduates of the various curricula on the basis of a selected list of these characteristics. The fundamental differences between this and previous cost-benefit studies of vocational education are that this study includes the heretofore unexamined costs of training the new employee on the job, and that the background variables affecting labor market performance are to be controlled primarily by matching rather than by multiple regression analysis.

Review of Literature and Related Research

This study is to be based upon and go forward from previous cost-benefit analyses of vocational education. The studies which provide most of

the background for this study are Corazzini, Vocational Education, A Study of Benefits and Costs,[1] Kaufman, et.al., Costs and Venefits of Vocational Education Versus Academic Education in Secondary Schools, Preliminary Report,[2] and Kaufman, et.al., A Cost-Effectiveness Study of Vocational Education.[3]

Corazzini compared the costs of academic and vocational high schools in Worchester, Massachusetts, and examined the economic benefits to the individual and to the community. His method compared the school system's regular high schools with its vocational high schools giving particular attention to the relative costs of the two types of education and compared the starting salaries of the graduates. He also compared the types of jobs open to the graduates and studied the job experience of a sample of vocational graduates to determine the extent to which vocational training was utilized.[4]

As a result of his investigation, Corazzini questioned the economic value of vocational education. This study, however, suffers from a number of weaknesses and shortcomings. The following discussion of these weaknesses and shortcomings is not meant to detract from Corazzini's pioneering study, but is offered to show ways in which more meaningful results can be obtained. The discussion is largely based upon the criticisms of Kaufman and his associates.[5]

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[1]Andrew J. Corazzini, Vocational Education, A Study of Benefits and Costs (Princeton, New Jersey: Princeton University, 1966).

[2]Jacob J. Kaufman, Ernst Stromsdorfer, Teh-Wei Hu, and Maw Lin Lee, An Analysis of the Comparative Costs and Benefits of Vocational Versus Academic Education in Secondary Schools, Preliminary Report (University Park, Pennsylvania: Institute for Research on Human Resources, The Pennsylvania State University, October 1967).

[3]Jacob J. Kaufman, Teh-Wei Hu, Maw Lin Lee, and Ernst W. Stromsdorfer, A Cost-Effectiveness Study of Vocational Education (University Park, Pennsylvania: Institute for Research on Human Resources, The Pennsylvania State University, March 1969).

[4]Corazzini, op.cit., p. ii.

[5]Kaufman, et.al., Preliminary Report, pp. 152-154.

1. The benefit data in Corazzini's study pertained only to the period immediately following graduation. In that the period immediately after graduation is often very unsettled as far as regular employment for the graduate is concerned, the data for that period are of questionable value for making projections. In fact, any projections based upon this data must be considered highly speculative.

2. Wage rates were compared rather than actual earnings. This precluded consideration of the proportion of time the students were actually employed, a factor which could drastically affect the benefits side of the equation.

3. Socio-economic factors which may significantly effect wages and employment were not controlled. Differences between the vocational and non-vocational graduates' performance might have been due to differences in their background instead of the effects of the curriculum.

4. An implicit assumption of Corazzini's study was that the two curricula were different means to the same end.

5. The interdependency of the economic effects of education were neglected. It was assumed that they were merely additive. Any change or difference in the economic situation external to the school would significantly affect earnings and employment quite apart from the influences of education.

6. The cost-benefit comparison of vocational versus academic education was discussed as if society were static. For example, it was estimated that on-the-job training would be less expensive for society while completely neglecting the possibility that if industry found it necessary to expand its investment in on-the-job training, the costs to the public in the form of higher product prices might actually be greater than the costs of the vocational program.

It is entirely possible that Corazzini's conclusions were completely valid for the situation in Worchester, Massachusetts, in 1963-64, however, because of the aforementioned shortcomings of the study, there is no way to be sure whether or not this is the case. The major contribution that Corazzini did make, however, is that his study broke ground for future studies. The action of making a good, honest attempt to perform a cost-benefit analysis of education in itself showed future researchers part of the way and some of the possible pitfalls of this type of research problem regardless of whether or not they agreed with the conditions and conclusions of the study.

The landmark cost-benefit study of vocational education conducted to date was done by Kaufman, Stromsdorfer, Hu, and Lee.[6] The purposes of this study were: (1) to develop a methodology for conducting an empirical study of the costs and benefits of vocational education, and (2) to conduct an empirical study which allowed the drawing of conclusions about the economic efficiency of vocational education.[7]

In their two reports, the authors discuss previous studies and consider very carefully the theoretical and practical problems of applying systems analysis techniques to educational programs to develop a rationale and plan for the empirical study. The following paragraph describes the study in a nutshell.

> There are four main steps involved in the study. First, all costs and benefits were identified and representative data were collected. Second, the conceptual difficulties were resolved, where possible, and the appropriate investment decisions were determined. Third, the data were analyzed by statistical methods, and, by comparing costs and benefits, the return to the investment was ascertained. Finally, other issues which might affect the analysis were considered.

Three cities were selected for the empirical study and cost data were gathered for the vocational-technical, vocational academic, vocational comprehensive, academic, and general curricula. The data available were not sufficiently uniform to make comparisons easy, and the data for one city was incomplete, so that no cost-benefit analysis could be performed for the city.[9]

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[6] Kaufman, et.al., Preliminary Report; Kaufman, et.al., A Cost-Effectiveness Study of Vocational Education.

[7] Kaufman, et.al., Preliminary Report, pp. 2-3.

[8] Kaufman, et.al., A Cost-Effectiveness Study of Vocational Education, p. 226.

[9] Ibid., pp. 226-227.

Benefit data were based upon the labor market histories of a sample of graduates of the January and June 1959 and 1960 classes. Mail questionnaires were sent to the graduates, and the total sample size was limited to 1,255. The sample was found to be highly weighted toward females. The labor market histories covered the six years following graduation and information on seven sets of independent variables was also obtained. These were curriculum, sex, race, marital status, city of graduation, IQ measures, and father's education.[10] When the benefits were analyzed, multiple regression analysis was used to control for socio-demographic characteristics other than curriculum which may affect labor market performance.[11]

The findings of the study were that "vocational-technical graduates earned significantly more and were employed significantly longer than the graduates of the other four curricula over the six-year post-graduation period."[12] As an investment, vocational education in the two cities where analysis was possible was found to be economically efficient, and the evidence suggests that funds should be shifted from the other curricula to the vocational-technical high school curriculum.[13]

Some related issues were also covered in the study. Vocational education as dropout prevention was examined, and although no conclusions concerning dropout prevention were possible, it was found that dropouts from the vocational-technical curriculum fared better on the labor market than did dropouts of the other curricula.[14]

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[10] Ibid., p. 227.
[11] Ibid., p. 232.
[12] Ibid., p. 233.
[13] Ibid., p. 234.
[14] Ibid., p. 235.

Regarding on-the-job training, one hundred twenty-nine employers in the three cities of the study were interviewed, and it was found that employees who were graduates of the vocational-technical high school curriculum averaged 12.64 weeks less on-the-job training than did employees who were graduates of the other curricula. The vocational-technical graduates not only required less on-the-job training, but they also received higher wage rates while in training, thus increasing the internal rate of return to vocational-technical education.[15]

Within the limitations of the Kaufman study, then, high school vocational education was found to be economically efficient within the cities studied. It is interesting that this much more rigorously conceived and executed study produced findings almost opposite those of the Corazzini study. However, Kaufman's study and some of the problems encountered in its conduct, suggest some alternate approaches to cost-benefit analysis of vocational education which might prove more fruitful. For instance, Kaufman's sample was heavily weighted with female graduates. Because young women marry and leave the labor market during the first few years following graduation from high school, and because young men tend to assume the position of the family wage earner during the same period, it would seem reasonable to concentrate a study upon male graduates.

Corazzini attempted to compare the costs and benefits of post-high school technical curriculum with those of the high school curricula as part of this study. It would seem that this type of comparison would prove valuable in investigating the relative economic efficiency of different levels of curricula, particularly if the study were to take into account socio-demographic characteristics which have been demonstrated to affect labor market performance.

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[15] Ibid., p. 236.

The problem of controlling for socio-demographic characteristics which affect labor market performance was not considered in Corazzini's study. Although Kaufman met this problem by the use of multiple regression analysis, he was not able to completely control for these variables. However, it seems reasonable that control of the socio-demographic characteristics could be practically achieved by matching the graduates of the various curricula on the basis of these characteristics. Even though the individuals selected to represent the various curricula are matched on the basis of those characteristics, multiple regression analysis should still be used to test for equality of variables.

On-the-job training costs should be included in a cost-benefit analysis of vocational education because these costs are passed on to the public in the form of higher costs for goods and services and to the employees in the form of lower wages. Kaufman looked into on-the-job training costs but did not include them in his analyses, and Corazzini mentioned them in his conclusions without actually studying them in any way. Failing to include the costs of on-the-job training in a cost-benefit study could result in serious underestimation of the costs of a program, and if the costs of on-the-job training differ for the various curricula, inaccurate and misleading conclusions could result from the study.

It would seem, then that a more complete and meaningful cost-benefit analysis study of vocational education would (1) include comparisons between the high school and junior college curriculums as well as comparisons among curriculums at each of these levels, (2) control for socio-demographic characteristics which affect labor market performance through matching the

graduates selected for the sample, and (3) include on-the-job training costs to provide a more complete measure of the social costs of the various curricula. These three considerations provide the rationale for the point of departure for this study.

Statement of Objectives

The objective of this study is to compare the economic efficiency of junior college vocational-technical education with those of the junior college academic and the high school academic, industrial arts, and general (other non-academic) curriculums within the San Diego Unified School District.

The primary independent variable of the study is the influence of the particular curriculum pattern upon the labor market performance of the graduates selected for the study. Specific independent variables, which are to be used as control variables, are:

1. Sex
2. Age
3. Intelligence measure
4. Race or ethnic group
5. Father's occupational level
6. Marital status

The primary dependent variable of the study is the labor market experience of the graduates for the period of the study. Specific dependent variables to be examined are:

1. Percent of the time employed since graduation.
2. Percent of the time employed the first year after graduation.
3. Percent of the time employed the third year after graduation.
4. Percent of the time employed the fifth year after graduation for high school graduates only (this is the last year of the study for the high school graduates).

5. Percentage difference between the time employed the first year after graduation and the time employed the third year after graduation.

6. Percentage difference between the time employed the first year after graduation and the time employed the fifth year after graduation for high school graduates only.

7. Mean monthly earnings since graduation.

8. Mean monthly earnings for the first year after graduation.

9. Mean monthly earnings for the third year after graduation.

10. Mean monthly earnings for the fifth year after graduation for high school graduates only.

11. Difference in mean monthly earnings between the first and third years after graduation.

12. Difference in mean monthly earnings between the first and fifth years after graduation for high school graduates only.

13. Mean number of changes of employer for any reason.

14. Mean number of changes of general type of employment for any reason.

DESCRIPTION OF PROCEDURES

This study is to be an investigation of the relative economic efficiencies of vocational-technical education and other curricula. Comparisons are to be made between the junior college and high school levels as well as among the curricula at each of these levels. In that the results of cost-benefit analysis can be no better than the data used in the analysis, a large portion of the effort expended in this study will be directed toward acquisition of necessary and meaningful data.

The empirical study will utilize graduates of the San Diego, California junior colleges day programs and regular high schools. Graduates of the evening junior college programs and continuation high schools will not be included.

The sample of vocational-technical graduates will be composed of all of the January and June 1967 male graduates of vocational and technical curricula of the San Diego junior colleges day programs who are living in the San Diego area, are available for employment in the civilian labor market at the time of the study, and who are willing to participate in the study. Junior college graduates who graduated from high school before January 1965 will not be included.

The samples of graduates of other curricula will include junior college January and June 1967 male graduates of the academic curricula who do not go on to a four year college or university, and high school January and June 1965 male graduates of the academic, industrial arts, and general (other non-academic) curricula who never entered college or who attended college one semester or quarter or less. These graduates

must be living in the San Diego area and be available for employment in the civilian labor market at the time of the study. They must be willing to participate in the study and will be selected to match the socio-demographic characteristics of the vocational-technical graduates.

The socio-demographic characteristics which will be controlled in the study are sex, age, intelligence, race or ethnic group, father's occupational level, and graduate's marital status. Sex will be controlled by including only males, age will be controlled by including only the January and June 1967 junior college graduates and the January and June 1965 high school graduates. Intelligence measure, race or ethnic group, father's occupation, and graduate's marital status will be controlled by matching the other graduates with the vocational-technical graduates on the basis of these characteristics.

The study will be conducted in four phases. These are: (1) a preliminary phase wherein the final arrangements for the study will be made and the sample will be established; (2) a data acquisition phase to gather the cost, benefit, and labor market history data; (3) an analysis phase where the cost and benefit comparisons will be made; and (4) a terminal phase to write, publish, and present the results of the study.

Preliminary phase.

During this part of the study, final arrangements with schools to obtain access to the student records and financial records will be made. The student records will be used to develop lists of graduates according to curricula. For each graduate, the following information

will be obtained from the school records: (1) name, (2) last known address, (3) phone number (if available), (4) racial or ethnic group (if available), (5) intelligence measure, and (6) age.

After the lists of graduates are completed, as many of the graduates as is practical will be located to determine whether they are living in the San Diego area, are available for employment in the civilian labor market, and are willing to participate in the study. If the graduate is willing to participate, information concerning the graduate's father's occupation and the graduate's marital status will be obtained. Corrections in the graduate's address and phone number will be made as needed. If not previously determined, the graduate's racial or ethnic group will also be noted at this time.

As much as possible of the communications necessary to locate the graduates will be done by telephone, however, such matters as discussing the purpose of the study with the graduates and requesting information from them will be done in face to face interviews.

Once the information concerning the graduates is completed, the graduates will be formed into groups of one graduate from each curriculum matched on the basis of sex, intelligence measure, age, racial or ethnic group, father's occupation, and marital status. The actual matching process is to be accomplished by means of automatic data processing equipment.

A second contact with the graduates will then be made. The graduates selected for inclusion in the sample will be so informed, and the names and addresses of their employers will be obtained at this time. The graduates not to be included in the sample will also be contacted. Why they were not included in the sample will be explained to

them and they will be thanked for their interest and cooperation.

The last step of the preliminary portion of the study will be to contact the employers of the graduates selected for the sample to explain the study to them, with particular emphasis upon the on-the-job training costs portion, and to request their cooperation.

The data acquisition phase. The data acquisition phase will entail gathering data concerning the costs of schooling, the costs of on-the-job training, job search costs, and the value of benefits to the graduates. In addition, employment history data for each graduate will be collected.

The school financial records will be used to provide cost information for each of the curricula. Both current costs and capital information will be obtained. At the high school level, only marginal or excess costs need to be considered, however, at the junior college level both marginal and excess costs must be included. This is because as the level of education being examined changes upward from high school, all costs are excess. Marginal and average costs will be determined largely by following a procedure for determining excess costs developed by Yett.[16]

An estimate of the annual costs of capital invested in each of the curricula will be made on the basis of the acquisition costs of capital items and the capital recovery factor formula. This formula provides a level amount of capital lost annually rather than the actual amount of capital used in any one year.

On-the-job training costs will be obtained from two sources--from

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[16]Frank A. Yett, Vocational Homemaking Education Program Costs in California Public Schools (Los Angeles: Bureau of Vocational Education, University of California, 1957).

the employers and from the graduates. Information from the employers will be used to provide the best estimate possible within the limitations of the study, concerning the costs of on-the-job training which seem to be assumed by the employers, but which actually are passed on to the public in the form of higher prices for goods and services. Current costs to the employer will take the forms of costs of training the employee and costs of lower productivity beyond that indicated by the employees lower beginning salary.

Capital costs to the employer will be an estimate of the amount of capital at reduced productivity because of inexperienced and/or untrained employees.

On-the-job training costs will also be indicated in the salaries the graduates receive. This is because an inexperienced and, thus, less productive worker receives a lower salary than a more productive worker. The salaries the graduates receive will therefore provide information concerning on-the-job training costs.

Benefit information will be obtained from the graduates and will include gross salary rates, gross annual earnings, and employment histories. Data concerning the value of benefits other than salary the graduates receive will also be gathered.

Analysis phase. The third phase of the study will be the analysis of the data. The first step in the analysis will be to determine the effect of the curriculum upon labor market performance as indicated by gross annual income when the socio-demographic characteristics included in the study are controlled. This step will serve both as a check upon the matching of the graduates and will provide better control of those characteristics than matching alone can accomplish. Multiple regression analysis is the statistical technique which will be used to accomplish this step

of the analysis. Automatic data processing equpiment will be used extensively throughout the analysis of the data.

The second step in the analysis of the data will be comparisons of the labor market histories of the graduates of the various curricula. Comparisons of the percents of time employed out of time available for the civilian labor market by curricula will be made and will be tested to determine whether the differences are significant. Comparisons of the average number of changes of employer, and of the average number of changes of general type of employment will also be made.

Graduates' earnings by curriculum will be compared. Their gross annual earnings will be compared to determine whether there are differences attributable to the curricula. These differences will be tested for statistical significance.

The final step in the statistical analysis will be the cost-benefit calculations and comparisons. For each curriculum, the present value of net returns, the internal rate of return, and the benefit/cost ratio will be compared to determine the relative economic efficiency of each curriculum.

Terminal phase. The last phase of the procedure will be to write the report of the study, publish the report, and present the report to the administration of the San Diego Unified School District.

The report will be written by the research staff and the project director. As the report is being written, it will be checked for accuracy by the economics consultant, the school finance consultant, and the statistician. The report will be printed by the Printing and Producation Department of the University of California, Los Angeles, and distribution of the report will be handled through the Division of Vocational Education,

University of California, Los Angeles. A formal presentation of the report of the study will be made before the appropriate officials of the San Diego Unified School District.

Time Schedule.

The time schedule for completion of the project is expected to be as follows:

I. Preliminary phase - eight months; begin September 1, 1969 and end April 30, 1970.

   A. Draw up lists of graduates from school records, including last known address and other information - begin September 1, 1969 and end January 30, 1970.

   B. Make initial contact with graduates to obtain consent to participate in study and to obtain matching information - begin December 1, 1969 and end March 30, 1970.

   C. Match graduates - begin April 1, 1970 and end before April 15, 1970.

   D. Make second contact with graduates to inform those selected for the sample, and to inform and thank the graduates not selected for the sample - begin before April 15, 1970 and end April 30, 1970.

II. Data acquisition phase - nine months; begin May 1, 1970 and end on or before January 31, 1971.

   A. Obtain cost data from school records.

   B. Obtain cost data for on-the-job training from employers.

   C. Obtain benefit data from graduates.

III. Analysis phase - six months; begin November 1, 1970 and end on or before March 31, 1971. This phase overlaps the data acquisition phase by three months because it is expected that analysis of the benefit data will begin before all of the cost data are in.

IV. Terminal phase - six months; begin March 1, 1971 and end August 31, 1971. This phase overlaps the analysis phase by one month because it is expected that it will be practical to begin writing the final report before all of the data have been analyzed.

A. Write final report - begin March 1, 1971 and end July 15, 1971.

B. Publish, present, and distribute final report - begin July 15, 1971 and end August 31, 1971.

USE TO BE MADE OF THE FINDINGS

The most direct and immediate use of the findings of the study will be the action the San Diego Unified School District may take upon the recommendations concerning the economic efficiency of the various curricula contained in the report. Less immediate, but probably more important, will be their contribution to the development of the cost-benefit analysis technique as applied to educational programs. The efficaciousness of the matching process, and of the inclusion of on-the-job training costs within the study, in particular, should be reflected in future cost-benefit studies of education.

Dissemination of the results of the study will be accomplished as follows: Printed copies of the report of the study will be provided to the San Diego Unified School District, the California State Department of Education, and selected universities throughout the nation. A limited number of copies of the report of the study will also be made available for interested institutions and individuals who may request them. The report will also be filed with ERIC to make it widely available.

PERSONNEL AND FACILITIES

Personnel

Bruce Reinhart, Principal Investigator, Supervisor, Research Section, Division of Vocational Education, and Assistant Professor, Graduate School of Education, UCLA. He has been awarded an M.A. in education from Northwestern University, a Ph.D. in education from the University of California at Berkeley and the Standard Teaching Credential with a Specialization in Junior College Teaching. During the past four years he has supervised research and service programs for the Division of Vocational Education at UCLA.

Publications:

Leadership for Vocational Education in California, 1968 (with Melvin L. Barlow).

"Occupational Preparation and Institutional Security in Adult Education," Journal of Secondary Education, California Association of Secondary Administrators, Burlingame, California, Vol. 42, No. 4, (April, 1967), pp. 156-161.

Profiles of Trade and Technical Teachers: Summary Report, 1967 (with Melvin L. Barlow).

Profiles of Trade and Technical Teachers: Comprehensive Report, 1968 (with Melvin L. Barlow).

Institutional Nature of Adult Christian Education, (Philadelphia: Westminster Press, 1963).

"Perceptions of Trade and Technical Teachers About In-service Training," Journal of Industrial Teacher Education, Lafayette, Indiana, Summer, 1968.

Profiles of Trade and Technical Leaders: Summary Report, 1969 (with Melvin L. Barlow).

Profiles of Trade and Technical Leaders: Comprehensive Report, 1969 (with Melvin L. Barlow).

"Trade and Technical Teachers: A Unique Teaching Force," Journal of Secondary Education, California Association of Secondary School Administrators, Vol. 43, No. 7, pp. 300-306.

"Perceptions of Trade and Technical Teachers About In-service Training," Journal of Industrial Teacher Education, National Association of Industrial Teacher Educators, Vol. 5, No. 4.

The AMIDS Program: An Appraisal of the First Six Months, 1969 (with William Broadbent).

The Vocational Student Information System for California, 1969.

Facilities

The facilities to be used in carrying out this study will include the following: (1) the Vocational Education Laboratory at the University of California, Los Angeles, will be used as the base of operations for the study. Office space, typing and keypunching will be provided at this location. (2) The University of California, Los Angeles, Campus Computer Network IBM 360-91 com ter equipment will be used for statistical operations. (3) The San Diego Unified School District will provide office space for the three analysts during the data gathering phase of the study.

In addition, the extensive collections of the University Research Library will be available for reference work, and university faculty members will provide advice and consultation in their fields of expertise.

Initiator Bruce Reinhart Duration of proposed activity:

Institution University of California, Los Angeles Beginning date: 9-1-69 Ending date: 8-31-71

Category	Project Cost by Line Item-- 1st Year		Project Cost by Line Item-- 2nd Year		Project Cost by Line Item-- Totals	
	Federal	Local	Federal	Local	Federal	Local
I. DIRECT COSTS						
A. Personnel						
1. Project Director (B. Reinhart) 25% @ $14,000/year		$3,500		$3,500		$7,000
2. Public Administration Analyst --School Costs, 50% @ $10,356/ year	$5,178		$5,178		$10,356	
3. Public Administration Analyst --On-the-job Training Costs, 50% @ $10,356/year	5,178		5,178		10,356	
4. Public Administration Analyst --Benefits, 50% @ $10,356/year	5,178		5,178		10,356	
5. Consultant--Economics (C. Nisbet), Dept. of Econ., UCLA, 10 days @ $100/day		500		500		1,000
6. Consultant--School Finance (W. Steinberg), San Diego Unified School District, 10 days @ $100/day	250	250	250	250	500	500

Category	Project Cost by Line Item-- 1st Year		Project Cost by Line Item-- 2nd Year		Project Cost by Line Item-- Totals	
	Federal	Local	Federal	Local	Federal	Local
7. Consultant--Vocational and Technical Education (M. Barlow) Div. of Vocational Education, UCLA, 10 days @ $100/day		500		500		1,000
8. Administrative Assistant (E. Shenkin), Div. of Vocational Education, UCLA, 5% @ $8,000/ year		400		400		800
9. Statistician, 10% @ $10,356/ year	1,036		1,036		2,072	
10. Programmer, 25% @ $10,860/year Beginning Feb. 1, 1970 and ending Mar. 31, 1971.	1,584		1,584		3,168	
11. Typist Clerk, 50% @ $4,980/ year	2,490		2,490		4,980	
12. Keypunch Operator, 50% @ $4,980/year, beginning Feb. 1, 1970 and ending Feb. 28, 1971	1,453		1,245		2,698	
B. Employee Benefits						
1. 10% of items IA1 - IA12	2,235	540	2,214	540	4,449	1,080

Category	Project Cost by Line Item-- 1st Year		Project Cost by Line Item-- 2nd Year		Project Cost by Line Item-- Totals	
	Federal	Local	Federal	Local	Federal	Local
C. Travel						
1. Auto Travel, 25,000 miles @ 11¢/mile	1,980		770		2,750	
2. 24 round trips @ $15/trip	180		180		360	
3. 24 days per diem @ $18/day	216		216		432	
D. Supplies and Materials						
1. Project materials	300		300		600	
2. Office supplies	300		300		600	
E. Communications						
1. Telephone, mail, etc.	600		600		1,200	
F. Services						
1. Duplicating forms and interview schedules	400				400	
2. Computer time, 3 hours @ $245/hour	184		551		735	
G. Final Report Costs						
1. 500 Preliminary Reports @ 63¢/each	315				315	

Category	Project Cost by Line Item-- 1st Year		Project Cost by Line Item-- 2nd Year		Project Cost by Line Item-- Totals	
	Federal	Local	Federal	Local	Federal	Local
2. 2,000 Summary Reports @ 63¢/ each			1,260		1,260	
3. 500 Comprehensive Reports @ $3.34/each			1,670		1,670	
H. Subtotal, Direct Costs	29,057	5,690	0,200	5,690	59,257	11,380
II. INDIRECT COSTS						
A. Predetermined overhead rates applicable to Federal grants and contract activity at the University of California, 44% of all direct salaries	12,785	2,266	13,288	2,266	26,073	4,532
III. TOTAL COSTS	41,842	7,956	43,488	7,956	85,330	15,912
IV. COST SHARING	81%	19%	81.7%	18.3%	81.4%	18.6%