DOCUMENT RESUME

ED 069 934 VT 018 018

AUTHOR Young, Robert C.
TITLE Vocational Education Planning: Or Making Do with Imperfect Data.
PUB DATE 72
NOTE 27p.; Presentation at the American Vocational Association Convention (Chicago, Ill., December 2, 1972)

EDRS PRICE MF-$0.65 HC-$3.29
DESCRIPTORS Cost Effectiveness; *Educational Finance; Educational Needs; Information Needs; Institutional Role; Labor Market; Manpower Development; Manpower Needs; Mathematical Models; *Program Evaluation; *Program Planning; *Resource Allocations; Speeches; State Programs; Vocational Development; *Vocational Education
IDENTIFIERS *American Vocational Association

ABSTRACT

To better plan and evaluate vocational education programs at the state level, a mathematical formula was evolved for allocating resources to local education agencies (LEA's) which would reflect: (1) manpower needs, (2) vocational education needs, (3) relative ability to pay, and (4) excess costs. A "curricular priority matrix" and a geographic allocation formula would prove less costly than extensive cost-effectiveness analysis for purposes of program evaluation. In order to determine financial allocations for each curriculum, a modified synthesis of two funding approaches is suggested. For the "training related openings strategy", the planner funds priority curriculums only as justified by the projected number of job openings in occupations related to their vocational training. An alternative plan, the "labor market success strategy," utilizes job satisfaction information in conjunction with student course preferences as major determiners of program funding levels. This second approach is suggested for local planning, especially when considering the scarcity of adequate labor market data. The importance of institutional flexibility for effecting necessary changes is emphasized. (AG)

VOCATIONAL EDUCATION PLANNING: OR MAKING DO WITH IMPERFECT DATA*

Robert C. Young**

Educators today are engulfed in a tidal wave of planning proposals: some distinct, but many overlapping. PPB; systems, cost-benefit, cost-effectiveness, and rate of return analyses; the manpower and social demand approaches; and disjointed incrementalism are recommended by various proponents.[1] The latter is guilty of suggesting present data systems are adequate for the job, while other proposals, in their ideal forms, would require massive data systems, unlikely in the near future. Responding to appeals for better program evaluation and planning--such as those of the National Advisory Council on Vocational Education and the President's Commission on School Finance[2]--this paper draws techniques, perspectives, and criteria from all of the foregoing proposals and suggests a specific eclectic model, feasible in cost and operational terms.

STATE RESOURCE ALLOCATION PROBLEMS

Assuming that the administrators and planners operate within an institutional environment characterized by the flexibility necessary for plan implementation (see Appendix A), several important questions face the vocational educational planner:

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*Prepared for the program on "Planning and Evaluation of State Programs," Research Section, New and Related Services Division, American Vocational Association Convention, Chicago, December 2, 1972.

**Specialist in and Adjunct Assistant Professor of Economics, The Center for Vocational and Technical Education and Department of Economics, Ohio State University. Views and opinions expressed here do not necessarily reflect those of Ohio State University or any of its subdivisions.

1) What are the goals and objectives for which vocational education is held accountable?

2) How can such objectives be reconciled when conflicting or integrated where lacking a common denominator?

3) What proportion of vocational education's resources should each geographic area receive?

4) Which instructional programs (including the general and college prep tracks) best impact upon the multiple goals established?

5) How much should each curriculum receive within geographic areas?

6) Finally, the equity problem, what percent of vocational education's funds should go to the poor, blacks, physically handicapped, academically talented, etc.?

Beyond recognizing that the goals and objectives of vocational education range through the political, social, economic, and academic realms, that some goals and objectives may conflict with others, and that rational planning demands the explicit identification of preeminent objectives--beyond these, this paper will simply reference alternative sets of goals and objectives[3] and alternative means of selecting objectives for a particular state[4] and assume that the program administrators have identified their principal evaluative objectives. The rest of the resource allocation problems, and means for their resolution, will be dealt with in turn.

RESOURCE ALLOCATION TO SUB-STATE REGIONS

Vocational education planners at the state level are responsible for the distribution of federal and state monies to local education agencies (LEA's). The allocation of resources to curricula within the subregions is a responsibility generally relegated to the local decision-makers, although many states do retain the power of final approval of local programs funded with state or federal monies. For the distribution of federal funds to LEA's, the U. S. Office of Education has required that

states utilize an allocation system reflecting (1) manpower needs, (2) vocational education needs, (3) relative ability to pay, and (4) excess costs. These criteria will be discussed and then incorporated into a formula for allocating dollars to the LEA's.

Manpower and Vocational Education Needs

"Vocational education needs" are assumed, for the purposes of this planning model, to be identical with "manpower needs." The problem in isolating "vocational education needs" from "manpower needs" is typified in the proud proclamations of various vocational educators that their students would have made good even without vocational education! The obvious question then is, did their students really "need" vocational education? Why not give the resources to someone who needs them and would not otherwise have made good. "Vocational education/manpower needs," then, will be used to reflect a situation where labor market success may be less than satisfactory without additional vocational education resource inputs.[5]

The allocation formula suggested below incorporates the concepts of vocational education/manpower "needs" through three concepts: (1) the geographic distribution of age-specific unemployment, (2) the relative wages earned by the relevant population, and (3) the existing, efficient, and effective vocational education programs that are to continue receiving funds in the future.

Ability to Pay

The "relative ability of a district to pay" is reflected below through the concept of the LEA's per-capita income rather than taxes paid or property tax assessed valuation. There are three reasons for this. First, taxes paid may be less than the potential for paying taxes. Second, assessed property values are an inaccurate index of

ability to pay.[6] Finally, there is some question regarding the legality of real estate taxes as the financial base for education.[7]

Excess Costs[8]

The excess cost concept utilized in the formula below is one which reflects, as nearly as available data will allow, the relative cost of providing education of identical quality in one area of the state rather than another. If the state has educational cost indices which reflect the relative differences in price levels of a similar market basket of educational goods and services throughout the state, those indices would be ideal. Such an educational price index could then be used to compensate LEA's on their costs due not to wastage, differences in program structure (emphasis on expensive curricula), or differences in program quality, but rather on the basis of differences in the cost of programs if the set of offerings were identical. In the likely event that the state would not have indices of relative educational costs for LEA's, it might turn to proxies for that information such as the U.S. Department of Labor's cost-of-living indices.[9] These indices are available for very large SMSA's, regional classes of non-metropolitan areas, and the urban United States. These indices would be crude, but at least they may serve to provide some extra funds to the very expensive metropolitan areas. When better indices are available, they should be used.

Geographic Allocation Formula

These approaches to interpreting the mandatory USOE criteria might then be integrated into an allocation process in the following fashion:

STEP I: Determine the current distribution of vocational education funds by LEA's;

STEP II: Determine, via some evaluation scheme, such as cost-effectiveness analysis or the curricular priority matrix suggested below, any programs which have continually failed to meet established impact standards and which consequently will be eliminated in the next planning cycle;

STEP III: Assuming sufficient funds are available, continue funding residual programs at current funding levels; if inadequate funding is available, or more funds are needed to start new and critical programs, apply more stringent evaluation standards to existing programs;

STEP IV: Sum the funds available through programs eliminated in Step II and funds available due to any expansion in the overall availability of federal and/or state vocational education funds;

STEP V: Allocate the funds available through Step IV to LEA's according to the following formula (constrained, of course, for each local area by the number of students willing to enroll in proposed new programs):

$$\text{LEA RESIDUAL FUNDS} = \left[\frac{\text{LEA Need Index}}{\text{Sum of LEA need Indices for State}}\right] \times \text{Total Residual Vocational Education Funds,}$$

where:

$$\text{LEA NEED INDEX} = \text{LEA Age-Specific Follow-Up Rate of Unemployment} \times \text{LEA Age-Specific Population} \times \frac{\text{Mean State Age-Specific Follow-Up Wage Rate}}{\text{Mean LEA Age-Specific Follow-Up Wage Rate}} \times \frac{\text{State Per Capita Income}}{\text{LEA Capita Income}} \times \frac{\text{LEA Educational Cost Index (or Proxy)}}{\text{State Educational Cost Index (or Proxy)}}$$

Concepts incorporated in the above equation might be defined for secondary vocational education planning as follows:

LEA Residual Funds: The funds to be allocated to the local vocational education agency out of those federal and state funds available through either the elimination of former programs or budgetary increases.

LEA Age-Specific Follow-Up Unemployment Rate: The unemployment rate of young people, say, 18-21, who have not gone on to higher education, as estimated by the follow-up survey of former students (vocational, general, and college preparatory), from the LEA.

LEA Age-Specific Population: In this allocation of secondary funds, that group currently in the educational system (total not likely to enter the college preparatory program, not just vocational),

who will be eligible for vocational education during the period for which plans are being devised, and who might experience similar unemployment as their predecessors unless better training or education is provided: e.g., the maximum potential vocational education clientele.

Mean State (or LEA) Age-Specific Follow-Up Wage Rate: The mean wage estimated for the respective area (state and local) through the follow-up survey of all former students (vocational, general, and college preparatory), who entered the labor market soon after departing from high school.

State Residual Vocational Education Funds: Funds remaining for disposition by state agency after funding those present programs that will continue to be funded on through the planning period, and after funding state overhead and administrative expenses.

State (or LEA) Per Capita Income: The average or per-capita income of the population in the state (or local) education planning area.

State (or LEA) Educational Cost Index: An index or estimate of the relative level of cost of providing a given level of educational services in an LEA as opposed to the state average (see above discussion).

If the state feels that one (or more) of the above factors is more (or less) important than the other factors, that factor could, of course, be weighted accordingly.

Whether the above allocation strategy is conservative or reformist would, of course, depend on the criteria used as well as the quality of existing programs. Effective application of rigorous evaluative criteria (academic, social, and/or manpower) to determine funding continuation in Step II would help to assure the distribution not only of "residual funds" but also continuation funds in accord with the need for vocational education's impact upon the state's social, educational and/or economic problems.

The above procedures, then, indicate the kind of analysis that might be used for the geographic distribution of secondary vocational education funds according to the labor market difficulties of youth. One might use a similar analysis to allocate post-secondary and adult education funds, recognizing that the populations differ and that consequently the wage and unemployment data will differ. In the case of post-

secondary and adult needs for vocational education, especially, one must remember to net out those requiring labor market assistance other than training. Many of the adults will, for example, already have acquired job skills, and their needs will be other than training. To the extent that the cause of their unemployment is not a lack of skills but inadequate aggregate demand, or a need for other manpower assistance such as job availability information, counseling, mobility subsidies, or legal aid (where discrimination precludes job openings), a region's need for post-secondary/adult vocational education funds would be reduced.

CURRICULAR PRIORITIES

Several means are available for the evaluation of curricular priorities. Cost-benefit, rate-of-return, and cost-effectiveness analysis are three of the more widely discussed. Their virtues and vices also have been thoroughly examined elsewhere. The principal virtue of these, when well implemented, is the comprehensive nature of their analyses. In their strengths, however, also lie their weaknesses: most educational systems cannot afford to conduct model cost-effectiveness analyses of all their curricula and programs.

As a consequence of the high cost that would be involved in conducting cost-effectiveness analyses of all vocational educational programs in all schools, the Curricular Priority Matrix (Figure 1) is proposed as an approach that may provide a reasonable first approximation for curricular priorities.[10] Generally, the matrix would indicate high priority for those programs which were relatively successful in pursuing agreed upon goals. The set of criteria to be used along the horizontal axis may be determined by the planning agency seeking the advice of superior authorities, such as state or local boards,

legislative bodies, or advisory committees. If the agency wishes to place particular stress upon a particular criterion, that column could be multiplied by a factor in proportion to the desired emphasis for that criterion, as in the column, "Serving Disadvantaged," which has received a weight of two for illustrative purposes.

Figure I

CURRICULAR PRIORITY MATRIX[1]
(hypothetical, for secondary school programs)[2]

CURRICULUM-OCCUPATION:	PRIORITY CRITERIA:[3] Net Openings[4]	Student Interest[5]	Academic Performance	Entry Wages	Seniority Wage	Job Satisfaction	Entry Requirements	Curricular Cost[6]	Serving Disadvantaged (Weight = 2)[7]	CURRICULAR PRIORITY INDEX	RANK PRIORITY ORDER
Nurse, Registered	1*	1	3	3	2	3	0	1	3x2=6	(20)**	x***
Licensed Practical Nurse	1	1	2	2	1	2	3	2	2x2=4	18	4
Nurse Aide	1	0	1	1	0	0	0	3	1x2=2	(8)	x
Typist	1	1	2	2	1	2	3	3	2x2=4	19	3
Machinist: Institutional	1	1	3	2	3	2	2	0	3x2=6	(20)	x
Machinist: Coop Ed	1	1	3	2	3	2	2	3	3x2=6	23	1
Carpenter	0	1	2	3	3	2	1	1	2x2=4	(17)	x
Computer Operator	1	1	3	3	3	3	1	1	3x2=6	22	2

Footnotes to the table follow the discussion of the Calculation of Cell Scores.

*GENERAL RANKING OF CELL SCORES:[8]
0 - inappropriate for vocational education
1 - low priority score
2 - moderate priority score
3 - high priority score

**Parentheses may be used to indicate that according to one criterion or more, the program is inappropriate for vocational education.

***Scored inappropriate for secondary vocational education under one or more criteria.

Calculation of Cell Scores for the Curricular Priority Matrix

Net Openings

0 - Insufficient training related labor market openings to warrant a vocational education training program.
1 - Training related openings likely to be adequate to absorb at least the minimum number of graduates entering training related occupations deemed necessary before offering such a curricular program.

Student Interest

0 - Enrollment likely to be insufficient to warrant a program.
1 - Sufficient numbers of students will enroll to warrant a program.

Academic Performance

0 - Controlling for student aptitudes and attitudes, the academic skill effects of this program appear sufficiently injurious to disqualify it for financial support.
1 - The program does not impede academic skill development.
2 - Students, controlling for aptitudes and attitudes, appears to substantially improve academic performance.

Entry Wages

0 - Entry wage is below federal minimum wage.
1 - Low but acceptable entry wages.
2 - Moderate entry wages.
3.- Very good entry wages.

Ideally, these would be annual earnings from full-time--40 hour week and 50 weeks--labor force participation (not necessarily full-time employment, however) in this occupation. Earnings, wages, and income are used synonymously here. Consequently, unemployment would be reflected in lower earnings over that period. A sophisticated data system might utilize some estimate of the program's financial impact (discounted lifetime earnings net of opportunity cost) instead of this and the following criterion. Another net impact concept would be the vocational education terminee's income minus the income earned by members of the control group, say, the general education or college preparatory terminee.

Seniority Wages

0 - Earnings for graduates from this program after, say, five or ten years are insignificantly above those of non-vocational graduates of similar aptitudes (or, in the case where that data is not available, insignificantly higher than unskilled labor).
1 - Modest wages, but above untrained and unskilled.
2 - Good earnings.
3 - Very good income.

Job Satisfaction

0 - Very low job satisfaction.
1 - Moderate job satisfaction.
2 - High job satisfaction.
3 - Very high job satisfaction scores.

Entry Requirements

0 - Some entry requirements make the program inappropriate for vocational education at the secondary level (e.g., post-secondary training is required, and secondary related training is not a prerequisite for that post-secondary training, or, the program might be deemed inappropriate for vocational education financial support if there were no training requirements necessary for entry into the occupation and the untrained were as competent as the trained entrants on the job).
1 - Vocational education may be, but is not always, helpful in obtaining a job; other barriers to entry play an important role.
2 - Pre-employment training will probably be helpful in obtaining a job.
3 - Pre-employment training is critical to obtaining a job.

Curriculum Cost (per pupil)

0 - Prohibitive, much more expensive than alternative forms of training for the same occupation (e.g., on-the-job or apprenticeship training).
1 - High cost program (it would be useful not only to compare costs among vocational education programs but also between vocational education and other programs, the general and academic).
2 - Moderate costs.
3 - Very low cost (say, equal to or less than general and academic programs,

Serving Disadvantaged (Socio-economically)

0 - The program does not provide satisfactory entry level wages or job satisfaction for the disadvantaged.
1 - The program enrolls a reasonable number of the disadvantaged but provides only modest wages and job satisfaction.
2 - The program enrolls a reasonable number of disadvantaged and provides them with good income and job satisfaction.
3 - The program enrolls a reasonable number of the disadvantaged and provides them with outstanding earnings and satisfaction in employment.

The weight of 2 under this criterion is for illustrative purposes only. The actual weight could obviously be more or less, as determined by decision-makers.

NOTES TO CURRICULAR PRIORITY MATRIX:

[1]Separate matrices might be calculated for each clientele grouping--e.g., physically handicapped, retarded, very bright, etc.

The cell scores indicated do not apply to any particular geographic area: some are based on national data, some on the nature of the occupation or training, and some on the intuition or biases of the author. They are hypothetical and for illustrative purposes only. The column weights are strictly hypothetical and should be varied in accord with the community's objectives for vocational education, as the education authority is best able to interpret them. Some communities may wish to add additional columns and/or subtract others.

[2]Secondary program priority rankings may be quite different than post-secondary rankings: e.g., whereas nursing instruction is given a zero "entry" ranking for secondary programs--because one cannot go into the registered nursing profession with simply a secondary preparation--, nursing would receive a high entry ranking for post-secondary programs. A similar matrix clearly could be developed for post-secondary program using the same technique.

[3]The inclusion and exclusion of particular criteria is clearly arbitrary. For example, it could easily be argued that "occupational criticality" should also be included here, for it cannot easily be argued that wages are universal reflectors of the employee's real total contribution (monetary and non-monetary) to society. For a discussion of these and other criteria, see Young, Clive, and Miles, Vocational Education Planning: Manpower, Priorities, and Dollars; Chapter III.

[4]Net openings is scored as either 0 or 1 to indicate that there are or are not sufficient openings to warrant a program, the other criteria (except student interest) then being used to reflect the importance of that program relative to other programs.

[5]Student interest, like net job openings, is classified on a 0 to 1 basis, receiving a zero only if there were inadequate student interest to warrant a program.

[6]Costs may well be a function of the capacity of the program to serve effectively the needs of the disadvantaged. That is, a program which attempts to serve their needs may require special remedial or more intensive programs than those designed to serve students with average high school literary and mathematical skills. For this reason one may wish to estimate costs either on (1) the assumption that a reasonable percent of the disadvantaged will be served in all programs--this would be in accord with the recommendation of the National Advisory Council that the disadvantaged be retained in the "mainstream" rather than relegated to their own programs, or (2) the assumption that special programs for the disadvantaged will be established and their costs estimated accordingly. Per student costs will, of course, be partially determined by enrollment (through economies of scale) as well as equipment, materiels, faculty, etc. costs. (Very low course enrollments lead generally to relatively high per student costs.)

This criterion could, like net openings and student interests, be applied in a 0-1 fashion, where programs exceeding some maximum cost simply are not funded. Or, the criterion could be dropped in favor of a cost conscious strategy discussed below (Section "On Cost Conscious Strategies"). If the data is available, this score should also consider the relative cost of such skill development on-the-job.

[7]The specific weight to be placed on this criterion, like the others, is clearly arbitrary. In support of a somewhat greater emphasis on this criterion are the texts of the 1968 Vocational Educational Amendments (P.L. 90-567; Section 123-6B) and the U.S. Office of Education Regulations for State Plan Programs (Vocational Education Amendments of 1968, Section 102.51-3d.

[8]Whether absolute values of data will receive cell scores of 0, 1, 2, or 3 will, of course, depend upon the conditions of the local community. For example, an entry wage of $2.50 might be considered relatively low in a prosperous metropolis, whereas in a relatively remote depressed area it might be considered good.

One might choose to make the cell scores continuous rather than discrete. This might be done by determining the range between high and low values for that criterion, and determining the portion of the gap covered by the achievement of that curriculum.

The prime value in such a system for priority determination lies not in the final index for each curriculum but in the recognition of several evaluative criteria, each program's relative strengths and weaknesses when measured against these criteria, and the explicit acknowledgement of these at the time of decision-making regarding program resources. The summary index for each program should not be looked upon as sacred, but rather as a first approximation of program priorities. If the planning or administrative agency at any level--state, school district, or school--wishes to deviate from such an ordering of priorities in its program development, it clearly should be allowed to do so, if it provides a sound and EXPLICIT argument for so doing. If deviations from the index hierarchy become the rule rather than the exception, however, it may imply that goals, criteria, and/or criteria weights must be revised in light of newly revealed real community preferences.

Basic to the rationale for this approach to planning is the assumption that only by examining programs by specified criteria can one hope to arrive at a more rational planning process and an understanding of that process by relevant clientele, including in that clientele students, taxpayers, governmental budgetary personnel, and legislators. This explicit exposition of the reason for program funding, in terms of both past achievement and future objectives, is critical both to the accountability for past programs as well as garnering of support for future plans. The Curricular Priority Matrix, then, may be considered not simply as a planning instrument but also a program implementation instrument to make clear to the public the potency of each curriculum when weighed against explicit criteria.

Subgroup Matrices

It is conceivable that one might develop a separate set of curricular rankings for each of vocational education's clientele: e.g., (1) those of average aptitude (a sex breakdown here would be appropriate, to avoid eliminating female programs); (2) minority group members likely to experience labor market difficulties due to their socio-economic backgrounds; (3) the mentally retarded; and (4) the physically handicapped. The use of such subgroup curricular priority matrices would reflect the fact that the impact, design, and costs of programs will very likely reflect the clientele to whom programs are addressed.

CURRICULA, LABOR MARKETS, AND FUNDING LEVELS

Two approaches will be considered for determining the financial resources to be allocated to each curriculum. The first, the "training related openings strategy," is based on the simple idea of demand minus supply, a concept reflected in requirements for state vocational education plans submitted to the U. S. Office of Education. Having subtracted from gross annual openings the supply anticipated from other sources, the planner funds priority curricula, as a maximum, no more than is warranted by the forecasted number of job openings in occupations related to their training.

The second means for determining funding levels for curricula through the use of labor market information is dubbed the "labor market success strategy." This "labor market success strategy" utilizes, say, wage and job satisfaction information combined with student course preferences as key determinants of the level of program funding. This strategy is suggested as an alternative to the first, especially for

local planning, because the data required for the first is very scarce, methodologically inadequate, or non-existent.[11]

Training Related Openings Strategy

This strategy is a synthesis of the manpower and a modified cost-effectiveness approaches to educational planning. The strategy utilizes, first, either the above curricular priority matrix or cost-effectiveness analysis to determine a hierarchy for funding, and second, manpower forecasts[12] to determine a maximum level of funding for each curriculum.

Numerous vocational education planning documents already contain estimates of "net openings" that are suggestive of appropriate funding levels for service areas, or curricular clusters. In addition to the data and methodological shortcomings of such calculations,[13] however, another weakness of such plans is typically that they do not suggest a rationale for providing priorities to one curriculum before another. In other words, simply the knowledge that X openings are anticipated in occupation Y is insufficient information for determining whether resources should be allocated to training for that occupation.

Curricula clearly differ substantially in the incentives and subsequent psychological and economic rewards they offer the student, and curricula should not all be considered equal in the eyes of the planner. Given that--through the use of cost-effectiveness or -benefit analysis, a curricular priority matrix, or some other evaluative technique--some curricula have been determined "more equal" than others, one may then turn to "net openings" and student curricular preference information to determine levels of funding for the relatively high ranking curricula.

The training related openings allocations strategy might, then, take the following form:

1. Order the curricula according to a specified evaluative technique;

2. Provide funding to curricula according to this order;

3. Determine the difference between the per student cost of each vocational education curriculum and the general curriculum;

4. Determine the annual expected number of net training-related job openings for the curricula;

5. Determine the number of students interested in enrolling in the various curricula;

6. Appropriate no more dollars to curriculum X (in order of their above priority) than the following product:

   The difference between that vocational education's per student annual cost and the general curriculum's per student cost times the lesser of

   a. the number of students flowing through the curriculum necessary to produce sufficient job-seeking graduates to fill the training related openings, or

   b. the number of students preferring the program.

The formula for this training related placement strategy's curricular allocation ceiling would look like this (where, Y = net annual training related openings):

$$\begin{pmatrix}\text{Maximum Appropriation to Curriculum X}\end{pmatrix} = \begin{pmatrix}\text{Curriculum X's Extra Vocational Cost Per Student}\end{pmatrix}\left[\begin{array}{l}\text{lesser of}\left\{\begin{array}{l}\left(\begin{array}{l}\text{Number of Students in Curriculum X to Assure Y Students Annually Seeking Training-Related Placement}\end{array}\right)\\ \text{----------OR----------}\\ \left(\text{Number of Students Preferring Curriculum X}\right)\end{array}\right.\end{array}\right]$$

A few comments are in order concerning the elements in the calculation:

"Curriculum X" refers to a complete program of vocational preparation for a particular occupation and would include all occupationally specific courses within a school system leading to the preparation of graduates

for that occupation; and thus "curriculum X" would include, say, sophomore through senior courses specifically intended to prepare draftsmen but would exclude general courses such as English or mathematics.

"Curriculum X's extra vocational cost per student": this refers to the fact that per student cost varies according to the curriculum, and general curricula are, on the average, less expensive than technical curricula. High equipment and materials costs generally tend to raise the cost of a vocational program as compared to a course in, say, algebra or literature. Even within the vocational schedule, there is considerable variation, the technical programs tending to be more expensive than the business and office occupations.[14] 'Extra vocational cost" is here defined as the difference between the cost of a specific vocational program--not "business and office" occupations, which refers to a broad program area, but, say, stenography or general clerical--and the general (non-vocational and non-college preparatory) curriculum. It is assumed, in other words, that sufficient dollars are already available to provide a general education, and that the vocational education financial planner has the problem of providing only sufficient extra dollars to enable the implementation of those priority programs which cost more than the general curriculum. State or federal vocational education funds, then, will not be provided to programs costing less than the general curriculum. Those inexpensive programs could be funded from the regular state foundation grant program.

"Y," net annual training related openings, considers other sources of trained manpower, the demand for such manpower, and whether there is any residual training task left for vocational education after other more efficient sources of supply are estimated and subtracted from demand.

"Number of students in curriculum X to assure Y students annually seeking training related placement" refers to the fact that the annual output of a set of trained graduates is the consequence of a flow of students through the program over a period of time, some of whom will drop out of school, some of whom will be transfers from other curricula, and some of whom will not graduate for two or more years. It will be necessary to provide funding each year for the entire program flow which is necessary to provide for the annual output of trained manpower: the greater the annual output, the greater the size of the flow necessary to produce that output. The reason "students annually seeking" (trained related placements) is used is to avoid the problem that might arise from a historical low training related placement rate being due to the number of students seeking related placements being greater than the number of openings available.[15]

"Number of students preferring curriculum X": this is included as an alternative to the previous factor because if there is an insufficient number of interested students flowing through the program to fill the openings, then the use of the previous product would result in superfluous funding of the program (at a level sufficient to support a larger number of students than actually enrolled). It is assumed that programs will not be funded if student interest is so low as to make the program inefficient due to very small class size. "Interested students" cannot be interpreted simply as enrollees. For example, if students are in a

situation where only agricultural education is offered, in addition to the general curriculum, the fact that a substantial number of students enroll in the agriculture program cannot be interpreted as an endorsement of the value of the agricultural curriculum. Perhaps, given the option of a distributive education, trade and industrial education, or a technical curriculum, substantial numbers would switch enrollment. Thus, a critical instrument for these strategies is the curricular preference survey.

These calculations, then, provide a ceiling on programmatic funding. To fund completely the high priority programs to the limit of their calculated openings may--given current vocational funding--severely restrict the variety of programs offered in any one school. Such a decision also places great confidence in one's ability to forecast "net openings." If, for example, on-the-job training, output from private training institutions, or vertical mobility accounted for a larger portion of total supply than anticipated, much training might go unutilized following graduation. To fund less than the ceiling on funding would help: (1) avoid these consequences of employment forecasting errors, (2) avoid the concentration of vocational education's subsidy, and (3) avoid the total cyclical elimination of marginal but acceptable programs when there is budgetary instability.

The precise proportion of openings that should be funded will have to be determined through other criteria. A state might decide to implement a safety factor by funding only, say 25-50 percent of the net openings in the top priority curricula/occupations. Or the frequency distribution of, say, wages (via existing area wage surveys) might be examined and funds cut off for that portion of openings below some given level. Establishment of a minimum number of vocational education curricula for schools of given size and funding would be another possibility.

Due to the problems of geographic mobility, adoption of this strategy would be most reasonable at the national level, and proportionately less useful the smaller the planning region. In underdeveloped

rural areas, one must be particularly wary of a local training-related openings strategy, for here it is more likely that one should be training for jobs other than those which exist in that specific local area. If one uses related openings estimates for planning in such small underdeveloped communities, the most relevant openings concepts may well be state, regional, or national openings rather than local openings.

Labor Market Success Strategy

The second strategy, the "labor market success strategy," would depend less on data external to the vocational education system--such as occupational forecasts, guesstimates of on-the-job training, community wages, or job openings data that might be supplied by state employment services--and more on follow-up data collected by the vocational or, preferably, the entire school system. This would be the strategy of allocating funds to those programs which produce--after standardizing for socio-economic background and aptitude--graduates who experience relative labor market success, measuring success in terms of income as well as job satisfaction. Clearly, other strategies than those relating to labor market success could be elaborated and implemented by the appropriate school authorities, simply by substituting other criteria (e.g., academic performance, or social cohesion) for those of labor market success. Labor market success is elaborated upon here simply because that is the typical rationale used in support of vocational education.

Resource allocation under this strategy would proceed as follows: (1) rank curricula according to, say, the Curricular Priority Matrix (or cost-benefit or -effectiveness analysis, if resources are available), placing heavy weights on labor market success criteria (income and job satisfaction), and (2) working one's way down the ranks of the curricula

from the highest to the lowest priority, each curriculum's maximum appropriation would be equal to the product of its annual extra vocational curricular cost per student times the expected number of interested students. Expressed in formula form this would be:

MAXIMUM APPROPRIATION TO CURRICULUM X	=	EXPECTED NUMBER OF INTERESTED STUDENTS	X	EXTRA VOCATIONAL CURRICULAR COST PER STUDENT

Note: Definitions for the factors here are the same as their definition under the "related openings strategy."

As discussed under the training related openings strategy, there are various grounds for requiring some diversity in the set of programs provided to each area. These grounds also apply under this strategy.

The basic difference between this strategy and the earlier training related openings strategy is that the labor market success strategy recognizes two basic problems in the training related openings strategy. First, information about geographic and occupationally specific demand and supply is very spotty. Critical information gaps concerning the quality and quantity of on-the-job training, vertical occupational mobility, and other sources of a particular locale's manpower, such as military returnees, correspondence courses, and geographic mobility weaken the analytical base necessary to operate a clean "training related openings strategy."

The second reason for suggesting an alternative to the related openings strategy is that high school curricular decisions are not always consistent--nor should they necessarily be--with career decisions. Consequently, the number of slots provided in a curriculum through this strategy is less determined by related openings than by the student's curricular preference and subsequent labor market success. A national

follow-up survey has shown, for example, no significant economic advantage to the student for taking a related job.[16] Also, the timing of the school and labor market decisions, as well as the knowledge and attitudinal bases on which they are made, are quite different, and thus there is no reason to believe or insist that they be consistent. One review of theories of vocational development indicated, for example, that "Most. . . major theories. . . agree. . . that the average young person does not have sufficient vocational maturity in the ninth or tenth grade. . . to select a particular vocational area for specialization."[17]

Nor is it clear that permission to enter courses reflecting student curricular preferences is counter to the school system's objectives. If, for example, enrollment in courses students perceive to be interesting (say, auto mechanics or agriculture) results in fewer dropouts than would occur if the students were forced--through restriction of the number of seats--into less interesting classes, then retention in school may result in the acquisition of generalized skills (communication and math, for instance) that might not have occurred if the student were not allowed to enter a high preference curriculum. When graduates of a vocational curriculum do experience labor force entry problems, the labor market success strategy suggests the planner should begin searching, either, for alternative curricula to which to allocate his resources, or for means to modify the existing curricula to enhance the probability of the students' labor market success.

Ideally, comprehensive planning would look at which jobs were taken and sought by which students, and then attempt to design the curriculum to make it increasingly attractive to the student as well as to make it increasingly relevant to the skill needs of the labor market. Such an optimum oriented strategy would require a great deal of expensive data

and analysis concerning work tasks, curriculum content, costs of alternative training programs, employment forecasts, and technological trends. This paper's sub-optimal labor market success strategy, however, says that because planners have limited research and development resources, they will not worry about improved curriculum design or training related placement for those courses which have turned out successful labor market entrants. Instead, planners will scrutinize only those programs whose graduates (controlling for aptitude) continue to experience labor market difficulties relative to other programs (such as the general curriculum) and suggest program modifications must be made and/or resources cut back. Vocational education programs are generally more expensive, and if they are not providing explicit payoffs, there would appear little reason for continuing their support. The same may be said of general education programs, of course. When they are substantially inferior to vocational education programs, if the marginal cost of the vocational education programs are feasible, some of the general curriculum's resources should be shifted to the vocational arena.

The rationale supporting the use of the labor market success strategy is strongest at the secondary and local levels. It is at the local level, particularly in areas other than major SMSA's, that data problems concerning geographic mobility most severly complicate the planning. In underdeveloped rural areas, it may be very important to provide training for jobs in which there are no local openings but which may facilitate urban migration. Consequently, the use of simply the labor market success of graduates, or state or national openings data (rather than local), may be appropriate in the less developed areas. The labor market success strategy is also more appropriate at the

secondary rather than the post-secondary level for two principal reasons: First, the nature of training provided at the secondary level is more general than is true at the junior college level. Second, due to the increased maturity and experience of the post-secondary student, he tends to have more commitment to an occupation and is thus more likely to take a training related job than is true for the secondary student.

Cost/Coverage Strategies

Both of the above strategies may easily be modified to acknowledge the fact that vocational education has a responsibility to serve as many of its potential students as possible. Obviously, one way it may do this is by keeping its extra vocational costs per student relatively low, thereby enabling greater coverage with given resources. The cost/coverage strategies, then, would proceed along these lines:

(1) Rank all curricula according to some impact analysis design, such as the curricular priority matrix described above;

(2) Group the curricula according to their respective extra vocational education cost, above the cost of general education programs (say, very high, high, ..., very low extra vocational education cost per student);

(3) Eliminate from funding consideration those curricula not meeting minimum standards, say, minimum wage earnings, literacy for graduates, less than 25 percent unemployed, etc.;

(4) Fund first, from the lowest extra vocational education cost grouping, those curricular programs with the highest priority ranking, working down to lower priority rankings within the lowest cost grouping, and providing funds to the so selected curricula to the extent of student interests or related openings times the extra vocational education per student cost (as discussed in the preceding strategies);

(5) If sufficient funds exist, after funding all viable curricula in the lowest cost category, work up through the more expensive curricula according to the same process.

Another cost-conscious variant would be simply to establish a

maximum extra vocational education per student cost (say, $500) that would be paid and then fund the highest priority curricula within the extra cost and total resources constraints. This may not maximize student coverage as well as the previous option, but it may improve the quality of the programs. Analysis of specific state data would help determine which cost strategy might be preferred, according to the specific costs and benefits of specific curricula.

APPENDIX A

COMMENTS ON THE INSTITUTIONALIZATION OF

CONTROLLED CHANGE

Perhaps more important to the planning-implementation sequence than the planning documents themselves is the institutional framework with which the planning takes place. Is the agency structured so as to be aware of and facilitate responses to environmental change? What are the internal and external facilitators or inhibitors of such responses? For example, are tenured staff, antiquated equipment, unions, industrial pressures, or other institutional constraints constricting program vitality?

As opposed to a relatively static definition of planning as "the process of preparing a plan," a more effective concept would be "an institutionalized change process responsive to environmental needs." There are a number of ways that controlled/guided change may be institutionalized in vocational education so as to facilitate plan implementation. Among the techniques or conditions conducive to such change are the following:

1) A fundamental information collection and analysis system appropriate for the internal and external monitoring of the system, including as a bare minimum the following:

   i) Close administrative ties with related agencies would be a useful supplement here (e.g., active advisory committee members from the employment service, boards of higher education, and departments of economics).

   ii) A fairly detailed student follow-up system that would cover all school districts or regions, say, over a 3-5 year period, contacting at least 70% of students within regions during the year that region is to be followed up.[a]

   iii) A program cost accounting system, that will yield relatively accurate program cost estimates, including amortized capital expenditures.

iv) A student classification and accounting system whereby unduplicated head counts of students are available, classifying the student by, as a bare minimum, categories such as the following: IQ, rough socio-economic groupings; and whether physically or mentally handicapped.[b]

2) Provision of this information to planners, concerned citizen groups, and vocational education clientele (students, parents, and industry).

3) Managerial incentives sufficient for inducing adherence to program guidelines.[c]

4) Expanded cooperative work experience programs, to cut costs due to expensive equipment, minimize the rigidities inherent in tenured but obsolete staff, increase the flexibility in program offerings, and provide on-site experience for the youth.[d]

5) Increasingly modularized and individualized instruction, to enable student designed curricula, stimulate student interest, and facilitate replacement of antiquated modules with the most current without requiring complete renovation of the curriculum.

6) Improved analysis of potential program alternatives: due to high analytical cost, this would be especially applicable at the federal level and include natural experiments, random innovations, and "systematic experiments."[e]

While none of these are new propositions, they do represent concepts so important as to warrant their repetition and promotion here, as they are still far from universal throughout the system.

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[a]Seventy percent is suggested because up to that point, statistics appear to be a function of the level of response. Small annual state samples are discouraged as each local area must know which of its own programs (which may be better or worse than the state average) is relatively effective.

[b]Some of these data are collected in Harold Starr and Richard A. Dieffenderfer, A System for State Evaluation of Vocational Education, revised (Columbus: Center for Vocational and Technical Education, Ohio State University; 1972).

[c]Among such incentive alternatives are the following: performance contracting, with careful pre- and post-tests; education/training vouchers, which would facilitate non-public school alternatives when such programs fell short; and managerial rewards, using, say, 1-25 percent

of USOE funds to reward very effective programs and a real threat of a loss of funding when programs failed to meet minimal standards (say, a minimum wage for graduates). The National Advisory Council on Vocational Education has suggested that 25% of federal funds be used on incentive payments for effective state pursuit of national objectives. Fourth Report, January 16, 1971.

[d]For support of the concept of cooperative education, see U. S. Department of Labor, Manpower Administration, Assessing the Economic Scene (Washington, D. C.: USGPO; 1969), Roy W. Menninger, Speech to the Chicago Executive's Club, May 16, 1969, reprinted in Executives' Club News, May 23, 1969, Rupert N. Evans, "Cooperative Programs: Advantages and Disadvantages and Factors in Development," American Vocational Journal, May 1969; and James Coleman, "How Do The Young Become Adults," American Educational Research Association Invited Address, April 4, 1972.

[e]Alice M. Rivlin's Systematic Thinking for Social Action (Washington, D.C.: Brookings Institution; 1971) is an excellent discussion of related problems and potentials.

FOOTNOTES

[1]Mark Blaug has pointed out the complementary nature of the three approaches to Educational Planning (manpower, rate-of-return, and social demand) in his "Approaches to Educational Planning." The Economic Journal, June 1967. See also, Walter M. Arnold, Vocational, Technical, and Continuing Education in Pennsylvania: A Systems Approach to State-Local Program Planning (Harrisburg: Pennsylvania Department of Public Instruction; 1969); G. G. Somers and W. D. Woods (ed.), Cost-Benefit Analysis of Manpower Policies (Kingston, Ontario: Industrial Relations Center, Queens's University; 1969); David Braybrooke and Charles E. Lindbloom, A Strategy of Decisions (New York: Free Press; 1963); George Z. F. Bereday and Joseph A. Lauwerys (eds.), Educational Planning: The World Year Book of Education 1967 (New York: Harcourt, Brace, and World; 1967); Harry J. Hartley, Educational Planning, Programming - Budgeting: A Systems Approach (Englewood Cliffs, N. J.: Prentice - Hall; 1968); and Harold A. Hovey, The Planning Programming-Budgeting Approach to Government Decision-Making (New York: Prager; 1968).

[2]On the paucity of data currently available for vocational education planning, see Malcolm S. Cohen, Progress Report on the Feasibility of a Labor Market Information System (Ann Arbor: University of Michigan, Department of Economics; October 1971); Wilbur J. Cohen, "Education and Learning," The Annals of the American Academy of Political and Social Science, September, 1967; Charles L. Schultze, "A Data System for Measuring and Analyzing Public Programs," Monthly Labor Review, March, 1970; and National Advisory Council on Vocational Education, Fourth Report, January 16, 1971; President's Commission on School Finance, Schools, People, and Money: Final Report (Washington, D.C.: USGPO; March, 1972), Chapter X.

[3]See for example, Arnold Kotz (ed.), Occupational Education: Planning and Programming, Vol. I (Menlo Park: Stanford Research Institute: 1967), pp. 39-40 and 183-193; Harold Starr and Richard A. Dieffenderfer, A System for State Evaluation of Vocational Education, revised (Columbus: Center for Vocational and Technical Education, Ohio State University; 1972). Robert C. Young, William V. Clive, and Benton E. Miles, Vocational Education Planning: Manpower, Priorities and Dollars (Columbus: Center for Vocational and Technical Education, Ohio State University; 1972), Chapters I and III.

[4]"Until there is far more evidence collected on the problem of criteria in education, and until observation of the criteria yield measurements of attainment that can be related to input and cost measures, the best planning models will be ignoring the fundamental problems of education and training." Russell Davis, "On the Development of Educational Planning Models at Harvard, CSED: An Algebraic History of Activity in One Small Place," in Richard H. P. Kraft (ed.), Education and Economic Growth (Tallahassee: Florida State University, College of Education; 1968), quoted in Mary Jean Bowman, "A Response to Papers on 'Educational Planning,'" Comparative Education Review, October, 1970.

Several means exist for determining the goal hierarchy. See, A. Myrick Freeman, III, "Project Design and Evaluation with Multiple Objectives," in The Analysis and Evaluation of Public Expenditures: The PPB System (Washington, D.C.: USGPO; 1969), Vol. I; C. West Churchmen, Russell L. Ackoff, and E. Leonard Arnoff, Introduction to Operations Research (New York: Wiley; 1967), Chapter 6; and Norman P. Uhl, "Identifying College Goals the Delphi Way," Administration and Organization, Topical Papers and Reprints No. 2 (Durham, North Carolina: National Laboratory for Higher Education; 1971).

[5]Of the thirteen states specifying their geographic allocation criteria and analyzed by the National Education Finance Project, nine used the number of pupils to assess "vocational education needs" in allocating funds to LEA's. Raw pupil counts, clearly, bear only the weakest relationship to the real "need" (as defined above) or areas for vocational funding. Use of pupil counts would mean supplying funds to an area regardless of whether zero or 100 percent of the students went on to college. Other criteria used are equally superficial, such as the number of high school students entering the labor force after high school, or the number of unemployed adults. Many youth successfully enter the labor force without vocational education, and many adults already have skills and require other forms of labor market support, such as mobility, job search and counseling, or legal (in discrimination cases) assistance. Pupil or population counts (without their incorporation into measures of unemployment) are clearly misleading because they do not indicate the need for funds based on shortfalls in labor market success or academic skill development. If one considers the "need for vocational education" the number of students wanting to enroll, this criterion will be included as a ceiling on funding, but use of the number of students wanting, or simply the number of students, as a proxy for "need" would appear to confuse the issue. Erick L. Lindman, Financing Vocational Education in the Public Schools (Los Angeles: University of California, Graduate School of Education, 1970), pp. 69-72.

[6]Charles S. Benson, The Economics of Public Education (Boston: Houghton Mifflin; 1961), pp. 168-9.

[7]See, The Supreme Court of the State of California and William N. Greenbaum, "Serrano V. Priest: Implications for Educational Equality," Harvard Educational Review, November, 1971.

[8]"Excess costs," as they are incorporated in the geographic resource allocation formula below, are defined quite differently than definitions generally used in state plans. Among those states participating in the National Educational Finance Project, "excess cost" was defined as the difference between the LEA's per pupil cost of vocational education and one of the following four cost concepts: (1) LEA's per pupil foundation amount, (2) state average per pupil cost of education--most frequently reported definition, (3) state average per pupil cost of education, or (4) the LEA's per pupil cost of education. Lindman, p.74.

Several reasons exist for rejecting these indices of excess cost as appropriate for geographic allocations. For example, good program cost data for geographic areas are very scarce. (Lindman, pp. 74-5) Even if good program cost data for existing programs were available, that would not necessarily warrant so distributing the resources. Differences in the structure and quality of vocational offerings might, or might not, warrant larger appropriations: why should a school district which has chosen to offer inexpensive curricula, to enable provision of training to a large number of students, receive fewer funds as a result of lower per student costs? Or why should an LEA which has carefully taken advantage of economies of scale be penalized for its efficiency? Finally, there may

be less legitimate reasons for high cost programs, such as the wastage of funds on underutilized plant, personnel, or equipment. To provide a district with more funds, based on their high ratio of vocational education to other costs, when this high ratio is due to inefficiency or waste, would seem grossly unjust.

[9]U.S. Department of Labor, Bureau of Labor Statistics, "A Guide to Living Costs," preliminary December, 1969; Geoffrey M. Moore and Maxine Stewart, "New Developments in Labor Statistics," Monthly Labor Review, March, 1972, p. 6; and, Jean C. Brackett, "Cost of Living: Area Data Demand and Supply," Selected papers from North American Conference on Labor Statistics (Washington, D.C.: USGPO; 1972).

[10]For another "curriculum evaluation model," which its authors recognize is "susceptable as well to human error" and requires "appropriate adjustment in the weightings made by the evaluator," see Peter Crane and Clark C. Abt, "A Model for Curriculum Evaluation," Educational Technology, October, 1969. The Pennsylvania "systems approach" (see, Arnold, work cited) has also developed a priority index. The Arnold, or Pennsylvania approach, however, proposes that "the educational program be biased in favor of the desired new industries" for a community. Thus, there is inherent in their planning system, a tendency toward oversupply of trainees in "desired new industries," as opposed to probable new industries or industries located outside the planning area, to which trainees might migrate to improve their economic condition beyond local prospects. (Arnold, p. 223). For a sound discussion of the evaluation of training programs, see Michael E. Borus and William R. Tash, Measuring the Impact of Manpower Programs (Ann Arbor: University of Michigan-Wayne State University, Institute of Labor and Industrial Relations; 1970). For additional support for "some kind of weighted average of several success measures," see Alice M. Rivlin, Systematic Thinking for Social Action (Washington, D.C.: Brookings Institution; 1971), pp. 128, 142, 143.

[11]Basic assumptions underlying both of these resource allocation strategies are that learning is facilitated when students are interested in the subject matter in which they are enrolled and that vocational curricular preferences should be enlightened through courses orienting students to the world of work. In the "labor market success strategy" student interest is the enrollment ceiling, subject to some minimum degree of labor market success of the graduates. In the "related openings" strategy, the enrollment ceiling would be the number of anticipated training related job openings, unless there were fewer students interested than there were job openings, in which case student curricular preference would again be the funding limit. Programs would be funded, however, only in the order depicted by the curricular priority matrix (or cost effectiveness data, if available for specific programs) and, as a maximum, to the extent determined by either net openings or student curricular interest, the latter, of course, being the ultimate constraint upon funding in both strategies.

It might be underscored here that the planning models proposed in this paper assume (1) that state plans are generally an aggregation of local plans, (2) that states typically have not and will not dictate completely the curricula to be offered in particular LEA's, and (3) LEA's lack the resources (financial and human) to undertake more sophisticated planning techniques. For planning at the state level, however, The Center for Vocational and Technical Education and the Oklahoma State Department of Vocational and Technical Education are currently developing linear programming models. For discussion of a linear programming model applied to a local area, oriented to correlating the output of graduates with employment trends, without any form of analysis of alternative program impacts on student labor market success, see James F. McNamara, A Mathematical Programming Model for the Efficient Allocation of Vocational Technical Funds, (Harrisburg: Pennsylvania Department of Education; 1970).

[12]See, Wisconsin State Employment Service, Project VISION: An Experiment with Occupational Needs Projection Techniques (Madison: Department of Industry, Labor, and Human Relations; 1970); Harold Goldstein, "The New Federal-State Occupational Employment Statistics Program," Monthly Labor Review, October, 1971; U.S. Department of Labor, Bureau of Labor Statistics, Tomorrow's Manpower Needs, Vol. 1-4 (Washington, D.C.: USGPO; 1969).

[13]Young, and others, work cited, Chapters II and III.

[14]J. Chester Swanson, Leadership Role, Functions, and Procedures and Administration of Vocational-Technical Education Agencies at the State Level, Vol. 3, Program-Cost Analysis of Vocational-Technical Education in a Junior College and in a United School District (Washington, D.C.: U.S. Department of Health, Education, and Welfare, Office of Education, Bureau of Research; 1969); William C. Morsch, Study of Community Colleges and Vocational Training Centers: Cost Analysis (Washington, D.C.: Bureau of Social Science Research; 1970); Ernest F. Anderson, Differential Costs of Curricula in Comprehensive Junior Colleges (Urbana: University of Illinois, dissertation; 1966).

[15]Acceptable reasons for a less than 100% training related placement rate, for example, might include the decision of trained women to postpone their careers and enter the household full-time rather than the labor market, or a change in the career interests of students near the end of their student careers. Less than 100% related entry, of those who sought related entry, however, under conditions of national full employment, would imply under this strategy, a cutback in future curricular funding.

[16]Gerald G. Somers, The Effectiveness of Vocational and Technical Programs, (Madison: Center for Studies in Vocational and Technical Education, University of Wisconsin; 1971), p. 205.

[17]Morgan V. Lewis, "Implications of Two Views of Vocational Guidance," Journal of Human Resources, Supplement, 1968) pp. 30-1. Also, S. H. Osipow: "... it must be recognized that it is not realistic to expect an individual to choose a career in the ninth grade, to train for it, and assume that the issue is forever more closed." Osipow also urges that (1) occupational/career education be provided through clusters and (2) as many options be made available to students as possible, so that the "broad, relatively undifferentiated, and rather changeable career preferences of adolescence are not caught in the rigid programming "likely to be breeders of high dropout levels, wasted training, and graduates with no saleable skills, or skills they will not use." (Samuel H. Osipow, "Implications for Career Education of Research and Theory on Career Development," paper prepared for National Conference on Career Education for Deans of Colleges of Education, Columbus, Ohio, April 24-26, 1972, pp. 10 and 15-17.)