D R A F T

ECONOMIC CRITERIA FOR EDUCATION AND TRAINING

R.S. Eckaus *

The economic aspects of education are conventionally not separated from its other features. This reflects wisdom, on the one hand, for all the social characteristics of education are closely bound together. On the other hand it may reflect despair at extricating the seemingly inextricable personal, sociological and political elements from the economic. Yet the current surge of enthusiasm for education rests to a considerable degree on presumptions of its economic benefits. The recent attempts to measure "human capital" and the rate of return on it are efforts to explore the basis for these presumptions and, in this way, to establish economic criteria for education. In this paper I will criticize the use of rate of return criteria for education and suggest an alternative approach.

Criteria, if they deserve the name, must serve to discriminate among the alternative policies which are faced. In the field of education, economic criteria must help to decide how much of what kind of education is to be given. "More" or "less" are unacceptable as "criteria" as they are useless to the educational planner or budget maker who must decide on enrollments and expenditures.

Investigation of the economic aspects of education does not demean its other aspects but should, in fact, help to put them in a clearer light. It is an attempt to remove some of the mystique from a sector which already absorbs substantial resources and to which it is widely urged more resources should go. In such an analysis it is necessary first of all to have a clear understanding of the special economic characteristics of education and educated labor. That will be the objective of Section I. The conclusions of

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Section I will be used in Section II to evaluate the working of the "price system" in education and criteria for education based on it. In Section III an alternative approach to the formulation of criteria for education is proposed and some illustrative empirical results presented. Section IV will discuss briefly the application of this approach to education and manpower planning.

I. The Special Economic Characteristics of Education

To organize the analysis it is useful to distinguish the demand and supply influences for training and education and those for trained and educated labor and to trace the interconnecting relations. Educated labor is a durable productive factor and education is the processing which adds qualities to that factor. Education may be thought of as analogous to the investment process which "develops" natural resources. This, briefly, is the rationale for the treatment of educated labor as a capital stock and of education as a capital goods producing industry. There are important and essential relations between the two. However just as the construction industry is not confused with a hydroelectric installation, the economics of the "education industry" should not be taken as identical to the economics of educated and trained labor.

Trained and educated labor has unique characteristics as a productive factor but also some features in common with other factors which can certainly be substituted for it over a wide range of tasks. It is not necessary to catalogue its features here but some of those, related to education and training, can be examplified.

Labor is a particularly flexible resource whose "processing" via education does not necessarily reduce the scope of its application while improving the quality of its performance in specific lines. Yet, like machines and natural resources, education and skills can be made obsolete by new developments in education and technology. This is, in fact, one meaning of "technological unemployment". Though, perhaps, more significant for "lower"

rather than "higher" levels of education and training, it can happen to M.D.'s and engineers as well as handloom weavers. The difference between "vocational" and "general" education is, in part, a distinction with respect to the specificity of the training and, therefore, its susceptibility to technological obsolescence.

The demand for training and education as capital creation is derived from the demand for trained and educated labor. One aspect of this capital creation by education is its function as a searching and selection procedure. As in the development of natural resources, it is impossible to know fully the potentialities of the "basic resource" until it has been through the "improvement process". This exploration and screening function of education seems to have a different character at different levels and for different types of education and is undoubtedly related to the cultural setting of the educational process and to social, occupational and geographic mobility.

Both general education and vocational education, however, are much, much more than preparation for production. The motives for "supplying" and "demanding" education are only partly related to its characteristics as an investment process. It is a misleading and narrow view of the role of education in society to think otherwise.

If education is not just an investment good, then it is also a "consumption good"; but it is of a special kind. Though economists traditionally do not inquire into the origins of the consumers' patterns of tastes, but take them for what they are, manifesting themselves through the character of the reactions to price and income changes, it is important to pursue this case some distance. Undoubtedly some education is obtained just like people buy, say, an automobile. They enjoy what they have over a period of time both for itself and for its social characteristics as a status symbol, for example. The "consumer satisfactions" are found in both general or liberal education and in specialized and vocational education.

Education is also a means of achieving social mobility, even apart from and independently of, the economic mobility it may confer. Social mobi-

lity, moreover, is of general, public as well as individual and private significance in a society committed to the enhancement of individual opportunity. Thus, another feature of education both as a consumption item and an investment good, is its "public" or "collective consumption" good aspects[1]. The distinguishing feature of these goods is that they are enjoyed "in common in the sense that each individual's consumption of such a good leads to no subtraction from any other individual's consumption of that good"[2]. Though this may not characterize all of the consumption aspects of education, it is certainly true of some of them. It is also true of some part of that education which is primarily for improving productive capacity. It characterizes the "production of knowledge" via the research which is based on an educational system. On the other hand, since teaching requires scarce resources, the conveying of knowledge is not completely the production of a collective consumption good, but some of the benefits of education in improved citizenship and society do have that aspect. The more tolerant society and more effective democracy which, hopefully, flow from education are public goods. It is also true of that part of education which does not make use of resources specifically for the purpose of teaching but goes on constantly and unconsciously in the round of social intercourse. The quality and amount of this type of education depends, in turn, at least in some degree on the type of education which does absorb resources.

Though the concepts of an investment demand and a consumption demand for education can be distinguished, the two aspects are tied closely together by an essential feature of education and labor: the pervasive effects of all types of education on the qualities of a worker. This means that much of that education whose original motive was "consumption" either public or private, is going to have some effect on work performance. In spite of specialization there must be a wide range of jobs in which it is

1. These have been pointed out by a number of persons. See Richard A. Musgrave, The Theory of Public Finance. New York 1959, pp. 11-12.
2. P.A. Samuelson, "The Pure Theory of Public Expenditure," Review of Economics and Statistics, XXXVI, 1954, p. 387.

impossible to divide and use separately the qualities of a man. In these occupations, whatever he is doing, all the qualities of the worker will in some measure affect his job performance. Many of the justifications of a "liberal" education, interestingly enough, are based on this point: that it is, indirectly, the broadest type of vocational training. The potential of a return to consumption education, does not, however, imply that all education is the creation of human capital; when the return is realized, it is on capital; when it is not, there is only a consumption good there.

The inalienability of labor is another characteristic which makes the market for trained and educated labor profoundly different from other factor markets, and, in turn, creates special features in the demand for education. The law prohibits, except in certain professional sports in the United States, a man from selling permanent title to himself or his services or anyone else from doing so. These restrictions on labor are found only occasionally with respect to land in some countries.

Because of inalienability of labor each individual must necessarily stand as an individual proprietor with respect to his own labor services and investment in his education. The convention may also be appropriate that, below the age of "reason" or "consent", parents act as the proprietors in investing in the education of their offspring, with an identity of ultimate interests. As in proprietorships of other types, business fortunes and personal interests are inseparably connected. But especially in education economic goals are inextricably bound together with ambitions which may be only indirectly and loosely associated with economic goals. The practical difficulties of an optimal policy of investment in education are magnified by the "small proprietorship" character of the "investors". Long time horizons, uncertainty and a high personal rate of time discount are essential features of this decision with no possibilities for the individual or family of effectively spreading or insuring against risks[1]. Uncertainty

1. These factors help account for the limited use of loan programs for undergraduate college education. At the professional levels where knowledge is greater and payoff more certain there seems to be greater use of educational loans.

as to individual development, though a fundamental characteristic, can be

offset by sponsorship of large groups. Hence there is an externality in the

reduction of risk by large scale investment in this sector which cannot be

captured through individual decisions. This is, in part, the justification

for government sponsorship of education[1].

Hirers of labor, in turn, are concerned with the flow of labor

services with the particular qualities created by education and training.

Since they cannot be owners of the labor itself, they face different pro-

blems in contemplating educational "investment" as compared to investment

in physical plant and equipment. In effect, inalienability of labor intro-

duces an additional element of risk which is not present in other types of

investment of the loss of expected benefits. It would be unwarranted, how-

ever, to claim that this forecloses all labor education and training by

firms. All that is necessary to justify such training, as with other types

of investment, is an expected profit on a necessarily chancy undertaking.

In turning to the "supply" of education, this paper will not

attempt to examine the technology of the "production" of education. One can

say that, as compared to other types of investment activity, there has been

relatively little systematic economic analysis of this production but there

is a new wave of interest which will undoubtedly lead to more knowledge of

this sector.

The difficulties in evaluating the quantity and quality of the

educational product are a major source of obscurity in analysing education

as a production process. The effects are so varied and the standards so con-

troversial for so much of education that comparison is difficult. Tests of

short run proficiency are often judged not to be adequate; tests of long run

effects create problems of valuation. Even where the objectives are as li-

mited and well defined as in the field of vocational education the evaluation

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1. This is the rationale first given by P.N. Rosenstein-Rodan for a "big
   push" in order to reduce risks and thereby stimulate more investment than
   would otherwise occur and thus accelerate economic development. See P.N.
   Rosenstein-Rodan, "Problems of Industrialization of Eastern and South-
   eastern Europe", Economic Journal,   1943.

of alternative techniques is admittedly at a rudimentary stage.

These problems of evaluating the "product" at each educational level make identification and separation of the contribution of each stage quite difficult. There does not appear to be only one possible pattern of educational progression; different combinations of "processing" at each stage appear to be able to yield similar "products".

These latter technical characteristics of investment in education as well as the other market characteristics cited above may help provide the rationale for the overwhelming significance of the role of government as the supplier in this sector. However, whatever the reasons, the facts cannot be denied. Both directly, by provision of public education in various forms, and indirectly, as, for example, by the grant of fiscal privileges, government has the decisive role. This, in turn, as will be shown, has special significance for the supply of educated labor.

There is an analogy between investment in physical capital and investment in education but there are also special features to education and educated labor which restrict its application. The implication of these special features for the use of market criteria for education must now be examined.

II. The criteria of the price system: the measurement of human capital and its rate of return.

One of the first impulses of an economist who wants to determine the economic significance of a factor is to look at its price and total value and, if it is a capital factor, its rate of return. These aspects are also the first apparent basis for developing a "policy" for the factor, to encourage or limit its development. Much of the current as well as the older research in this field has followed this line. The recent work of Prof. T.W. Schultz Rudolph Blitz and others on the "human capital" created by education is in this some vein [1]. Other than as a curiosum, the value of human capital is

1. T.W. Schultz, "Capital Formation By Education", Journal of Political Economy, vol.48, Dec. 1960, pp. 571-583; Rudolph C. Blitz,

interesting because it can be used to compute rates of return and as a means for imputing to the various factors their economic contributions.

Prices are essentially involved both in the estimation of the human capital created by education and in the estimation of the rate of return on it. These prices, however, to be useful in making estimates which can serve as a basis for policy decisions on the allocation of resources, must reflect the relative scarcities of the factors involved. To be sure, the reflection is always distorted to some degree by the imperfections which exist in any market and yet prices continue to be used. One issue here is whether there are prices in the "markets" for education and educated labor which can be used for valuing human capital and its return. It will also be necessary to ask whether these prices have been applied to the appropriate quantities.

In the estimation of human capital the major part of the "investment" costs are conventionally taken to be the expenditures by government on education. This is also the procedure adopted in valuing the output of these government services for the national income accounts. Yet what may be an acceptable procedure for the latter purpose can hardly be justified as a basis for resource allocation. By no stretch of the imagination can the cost of the "supply" of education be generally presumed to reflect real relative scarcities of factors. It is not true of public education and most private schools can hardly be taken to be the profit maximizers in a competitive industry which are called for by the customary estimation procedure. Profits of any kind are even explicitly ruled out in the U.S. if private schools are to receive fiscal advantages. Philanthropic support of private institutions has an effect similar to that of government sponsorship in making actual costs different from the prices which should be used to estimate educational investment.

Substantial amounts of specially vocational education are, of course, supplied by private trade schools and businesses, including apprenticeship programs, sometimes with union participation. The private trade school tuition may very well accurately reflect costs and be a firm basis

for rational calculations. Individuals also may sometimes "pay" for the education provided by business by accepting a lower wage than they would otherwise demand and receive. However, there is no reason to suppose that the relative benefits of the education to the firm and the worker can always be positively identified and allocated. The limitations on appropriability discussed above effectively fore-stall this on the employer's side. The limited transferability of specialized training is a barrier to the full appropriation by labor of such benefits. Thus, it cannot be assumed with respect to this type of education either that the "costs" of the training are reliable guides to real social costs.

The distorting effects in the supply of education of prices and costs which do not reflect real relative scarcities carry over into the demand for education. It is difficult even to identify an effective price for education to which the individual student and his family may be considered to be responding. Certainly the taxes required to support educational systems are seldom, if ever, conceived of as prices of education nor would a rational man so consider them since they are payments fixed irrespective of the "amount" of education taken by a household. The amount recognized as a price is, therefore, zero for elementary and secondary education and the college tuition which may be paid has in most cases little to do with any costs.

The fiction of consumers responding freely to market prices is in any case a particularly distorted view of educational reality. At the lower levels, education is compulsory in most countries in the sense that, if it is made available by a government agency, children are required to attend the schools. Moreover, as has been pointed out before, in a discussion of the use of national income estimates as a measure of welfare, that the conditions under which government services are offered preclude the use of the costs of these services as an accurate measurement of market preferences or relative factor scarcities[1].

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1. Francesco Forte and James Buchanan, "The Evaluation of Public Services", _The Journal of Political Economy_, Vol. LXIX, no. 2, April 1961, pp. 107-121.

Apart from the valuation problems which arise in every estimate of capital stock and which are especially intractable with respect to government supplied education, there are difficulties in estimating the opportunity costs of the labor inputs foregone when they are occupied in education. These arise essentially because of the inalienability of labor: the "raw material" of the education investment process is not purchased on the market. Prof. Schultz meets this problem by taking market values, i.e. wages, for equivalent age groups as the appropriate prices of the labor inputs into the education process. There are a number of possible objections to this procedure. On the theoretical level, market prices are, at best, reliable indicators of relative scarcities only for marginal changes in factor availabilities. Thus, the use of wages from even the most competitive labor market would not be valid for computing the opportunity costs of the major shifts in labor allocation envisaged in Prof. Schultz's calculations. Moreover, if the intention is to estimate the opportunity cost to society, it is also necessary to take into account the different levels of saving which will prevail, and what might have been done with the additional investment if full employment were maintained. If full employment were not assumed to be maintained, then there is even less basis for the original procedure. Prof. Schultz recognizes that his method is a "partial equilibrium approach" which does not take into account, mutatis mutandis, the alternative effects of a wholesale transfer of school-age workers into or out of the labor market. However, he seems to claim that his is only a partial equilibrium problem.

The intertwining of public and private, economic and non-economic, consumption and investment motives in the giving and getting of education implies that only a part of the expenditures on education could, in any case, be likened to the process of creation of human capital. The attribution by Prof. Schultz of all education to this process is unwarranted. Can it really be claimed, for example, that training for production is the only motivation for education to literacy? Or, putting aside the arbitrary convention which excludes housewives services from the national income, is

it clear in most societies, including the U.S. that at all levels the education of women makes the same contribution to national output as that of men?

Different types of formal education may have separate products with "consumption" and "investment" proportios but these may also be joint products. Certainly not all these educational expenses can be attributed to capital formation.

On the other hand, that part of education not given in formal schooling but which contributes to the creation of productive skills in labor should be considered as part of the stock of human capital. There are no grounds for disregarding on-the- job training and other types of vocational education even though it is not a part of regular schooling, whoever pays for it. The fact that such training is often an external economy which cannot be recaptured due to the inalienability of labor makes it especially difficult to value. But such valuation difficulties are not confined to vocational education. The presence of public good elements in general education means that a market price for education even if approximated would not be one which would reliably indicate real demand and supply influences.

The special economic characteristics of education which obstruct the estimation of human capital also create difficulties in the estimation of rates of return. The "externalities" of education mean that even a competitive system could not be expected to generate prices which reflect true relative scarcities. There are, moreover, other elements affecting relative wages which obscure the influence of education so that none of the existing studies can claim to have isolated its particular marginal contribution. The distinction of returns to native ability, for example, and those to education is particularly difficult because of the selection process in education which, on the whole, advances and educates those in the system with greater talent. It might be maintained

that the distinction is not necessary because the question really is the social return to investment in education and individual talents are part of the resources available to society upon which the investment "processing" takes place. This is a legitimate point of view but would not warrant the use of rates of return so computed as evidence of the profitability of large scale additional programs where the talent pool was already intensively exploited. This condition is not likely to be binding soon however, in nearly any country but there are still other problems in rate of return computations.

It may be a more serious objection to the rate of return calculations that an individual's education and income is likely to be correlated with his father's wealth or income as well as with each other. No attempt has yet been made to pull that effect out of the data.

Finally, in isolating the effects of education there are the problems which were discussed by the neo-classical economists under the headlines of "non-competing groups" and "compensating" and "non-compensating" differences in wages. It was well-recognized that the requirements of a higher education in some occupations led to "compensating" differences in wages to those occupations. But there are also wage differentials which could not be explained in terms of the supply and demand for labor as if it were an inanimate productive factor with no job preferences independent of simple wage calculations. By making these distinctions the neo-classical economists were recognizing the permanent "imperfections" which characterize the labor market and, therefore, the rates of return to education.

The seriousness of the elements of over- and under- and unknowingly, erroneous estimation of human capital and rates of return to education may be best appreciated by considering the effect of some reasonable variations in the methodology of such estimates. Certainly substantial changes in the magnitudes are quite possible. Suppose the arguments were accepted that all education to literacy was for purposes of citizenship and only a proportion of women's education should be counted as investment equal to the proportion of women in the labor force. Or suppose the rate of

return was calculated on the education of the labor force in different industries. Would the low rate of return on teachers' education be a signal to stop educating teachers? Considering the consumption-investment, joint product character of much of education, what rate of return as currently computed would clearly signal that there should be "loss"? A reasonable answer considering the uncertainties and risks involved might be as low, say, as 2-3%, which is far below any current estimate. The practical consequences of the calculations of human capital and its rate of return judged in this way seem to lead to "more" education. But, how much and what kind?

III. An Alternative Approach: Computing Educational Requirements

The existence of real economic requirements for education and training is not contradicted by the presence of various obstacles to the use of market values in measuring the amount of productive education and the return on it. An alternative approach is to attempt to estimate these requirements directly. It will be seen that this approach can produce the kind of information needed for educational policy of "how much" and "what kind" of additional education is required for growth. It is not a novel approach; in one form or another it has and is being widely used[1]. The example given here can be considered as a more detailed calculation with wider coverage. It makes explicit the type of data which is used and what would be necessary to improve the empirical base. As a by-product, moreover, it would provide the necessary basis for calculating the costs of creating a labor force with the desired set of skills.

The first stage is the calculation of current requirements for education as an investment which creates productive factors. When this has

1. The work of the Perspective Planning Division of the Planning Commission of the Government of India provides an excellent example of this approach in spite of the limited data. The estimates by SVIMEZ, Trained Manpower Requirements for the Economic Development of Italy, Rome,1961 are very much in the same spirit as was the work of Prof. Seymour Harris, The Market for College Graduates, Cambridge, Mass., 1949.

been done, the means of extrapolating future requirements will become clear.
The following types of information are necessary:

1) a complete listing of employment, sector by sector, in job
categories which permit the distinction of the differential
education and training requirements for each sector;

2) a description for each job category of the amounts of the
various types of education which are required for an average
level of performance of the job.

With information of this type it would be possible to classify
all employment by education types and levels and, therefore, to find in to-
tal and sector by sector, the educational requirements of the labor force.
These results would not indicate how much education had actually been given
and received in schools but the amounts effectively used in operating the
economy.

This approach would omit "unemployed education" and whatever
education was obtained and used only for consumption purposes. It would
also omit that amount of education which is provided as the system performs
its searching and selection functions as mentioned above. This latter
omission should be made up in order to translate educational requirements
into enrollments. This, in turn, can be accomplished by use of "wastage"
coefficients which, for the various stages of the educational system, relate
total "outputs" to total "initial" "enrollments, on the other hand it would
include all that education used which was obtained as a joint-product of
education for "consumption" or "citezenship" purposes.

The potential of this approach as well as its own set of pro-
blems may, perhaps, be appreciated best by means of an example of its appli-
cation to the U.S. economy. The basic data requirements, as specified above,
can not be met fully for the U.S. but can be approximated. The sectoral
employment information by job categories requires occupational census.
This is approximated in detail in published data only by information obtained
in the U.S. population censuses of 1940 and 1950[1]. A population census is

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1. U.S. Bureau of the Census, Occupation By Industry, 1950 Population Census
   Report P-E No.IC.

a notoriously poor source of such information since responses are obtained
from individuals rather than firms. Responses often come from housewives
and other persons on behalf of the employed worker rather than the worker
himself. Reports of job categories and industry classification are thus
subject to individual errors of ignorance and, perhaps, to systematic biases
due, for example, to self-inflation. In an occupational census, moreover,
there are obvious limits to the detail possible in job classification but
the U.S. Census of Population suffers as well from an inconsistent amount
of detail[1].

The second type of information, the description of the educa-
tional requirements of each type of job is obtained from the impressive
compilation of information in Estimates of Worker Trait Requirements for
4000 Jobs[2]. This publication indicates separately the "Specific Vocational
Preparation" (SVP) and the "General Educational Development" (GED) required for
an average performance in each of the jobs. The former is estimated in
Table I by placing the job in one of the following nine classes of periods
of preparation which include all the types of vocational schooling, on the
job training and actual job experience necessary taking into account the
possibilities of substitution among these different types of preparation.

1. Dancers and dietitians are distinguished while "clerical and kindred work-
   ers, not elsewhere classified" and "operatives and kindred workers, not
   elsewhere classified" make up sixteen per cent of the 1950 labor force.
   The situation is not quite so bad in the analysis of individual sectors
   as the general character of workers in these "not elsewhere classified"
   categories can sometimes be determined.

2. U.S. Department of labor, Bureau of Employment Security, U.S. Employment
   Service.

Table I

SVP categories	Training Time
1	Short demonstration only
2	Short demonstration - 30 days
3	30 days - three months
4	3-6 months
5	6 months - 1 year
6	1-2 years
7	2-4 years
8	4-10 years
9	over 10 years

The classification of jobs in SVP categories was made to reflect current practice including customary apprenticeship periods and promotion schedules both of which may differ substantially from the necessary learning periods. This source of bias could also be corrected when making estimates for particular sectors with knowledge of the character of the vocational preparation in that sector.

The GED requirements are indicated by classifying the job in one of seven categories, each described by a scale of general educational development as in the accompanying Table II. These general description of levels of language and reading skills, mathematical competence and general reasoning ability are not easily translatable into conventional school years in the U.S. because of the variability of the achievements of school systems. This would be less of a problem in countries with uniform standards. The translation in Table III below is obviously a controversial one and is not intended to be definitive. In particular, it should not be taken as the views of the Bureau of Employment Security[1].

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1. I have had conflicting advice in making this translation and, perhaps, have chosen that which represents the "higher standards" for the general school system.

Table II* — Scale of General Educational Development

State of development involving <u>capability</u> to immediately function in <u>one or more</u> of the following ways:

Level	Reasoning Development	Mathematical Development	Language Development
7	Apply principles of logical or scientific thinking to a wide range of intellectual and practical problems. Deal with non-verbal symbolism (formulas, scientific equations, graphs, musical notes, etc.) in its most difficult phases. Deal with a variety of abstract and concrete variables. Apprehend the most abstruse classes of concepts.	Work with a wide variety of theoretical mathematical concepts and make original applications of mathematical procedures, as in empirical and differential equations.	Comprehension and expression of precise or highly connotative meanings, as in — Journal of Educational Sociology — Scientific Monthly — Works in logic and philosophy, such as Kant, Whitehead, Korzybski. — Literary works, such as Stein, Elliot, Auden
6	Apply principles of logical or scientific thinking to define problems, collect data, establish facts, and draw valid conclusions. Interpret an extensive variety of technical instructions in books, manuals, mathematical or diagrammatic form. Deal with several abstract and concrete variables.	Make standard applications of advanced mathematics, as differential and integral calculus.	Comprehension an expression as of — Saturday Review of Literature, Harper's. — Scientific American. — Invitation to Learning (radio program).
5	Apply principles of rational systems[1] to solve practical problems. Interpret a variety to instructions furnished in written, oral, diagrammatic, or schedule form. Deal with a variety of concrete variables.	Perform ordinary arithmetic algebraic, and geometric procedures in standard, practical applications.	Comprehension an expression as of — Popular Science — America's Town Meeting of the Air (radio program).

Level	Reasoning Development	Mathematical Development	Language Development
4	Apply common sense understanding to carry out instructions furnished in written, oral, or diagrammatic form. Deal with problems involving several concrete variables.	Make arithmetic calculations involving fractions, decimals and percentages.	Comprehension and expression as of - Reader's Digest - American Magazine - Lowell Thomas (radio program).
3	Apply common sense understanding to carry out detailed but uninvolved written or oral instructions. Deal with problems involving a few concrete variables.	Use arithmetic to add, subtract, multiply, and divide whole numbers.	Comprehension and expression as of - "Pulp" detective magazines - Movie Magazines - Dorothy Dix - Radio "soap operas".
2	Apply common sense understanding to carry out spoken or written one- or two-step instructions. Deal with standardized situations with only one or two, very occasional, variables entering.	Perform simple adding and subtracting.	Comprehension and expression of a level to - Sign name and understand what is being signed - Read simple materials, such as lists, addresses and safety warnings. - Keep very simple production records.
1	Apply common sense understanding to carry out very simple instructions given orally or by demonstration. No variables.	None———————————————————	No speaking, reading, or writing required.

[1]Examples of "principles of rational systems" are: bookkeeping, internal conbustion engines, electric wiring systems, house building, nursing, farm management, ship sailing.

+ Taken from U.S. Department of Labor, Bureau of Employment Security, U.S. Employment Service, Estimates of Worker Trait Requirements for 4,000 Jobs, p.111.

Table III

GED category	School Year Equivalent in Years
1	0
2	4
3	7
4	10
5	12
6	16
7	18

Application of the SVP and GED estimates to the Census of Population categories involved further approximation due to the differences in job classification and, especially, because of the grossness of the Census of Population job classification. This was done, however, with the results shown in Table IV. In this Table, the distribution of the labor force in each SVP and GED category is presented for the major industries distinguished by the Census of Population. For each industry also the average level of training (SVP) and education (GED) is calculated[1]. This provides a detailed description of the education and training requirements of the labor force in each covered industry. From Table IV industries can, for the first time, be distinguished according to the various types of education and skills which they require. A casual attempt was made to relate the individual GED and SVP averages computed to capital intensity, depreciation and other features of each industry without success. These possible relations require more investigation, however.

1. This further calculation involved reducing the ranges of the SVP categories to single numbers which was done as follows:

SVP categories	Training Time	SVP categories	Training Time
1	0	5	9 months or 0.75 years
2	15 days or .041 years	6	1.5 years
3	60 days or .165 years	7	3 years
4	4.5 months or .375 years	8	7 years

The approach has also been used on the data of the Occupational
Census of 1940 with the overall results shown in Table V and VI compared
to the results for 1950. Since, however, the same job descriptions were
used both in 1940, the method could only reveal the effects of movements
between jobs. No allowance could be made for the possible upgrading or
downgrading of the skill and education requirements of the same job as be-
tween the two years.

The averages for both GED and SVP show a general upgrading of the
education and skill requirements of the labor force as between the two years.
The distribution shows how it took place. Although the proportion of work-
ers in the two lowest SVP categories was higher in 1950 than in 1940, the
upward shift of workers in all the other categories more than over-balanced
that. From comparison of the GED averages for 1940 and 1950 it can be said
that the average general education requirements in the labor force went up
by about 4 per cent. A comparison of the GED distributions shows that the
need for workers with at least some high school education increased by about
8.5 per cent between 1940 and 1950, moving from 71.4 per cent to 77.6 per
cent of the labor force. The GED category with the fastest rate of growth
of requirements was that of the college post-graduate level.

The emphasis of this approach in determining educational require-
ments is demonstrated by a comparison of the achieved levels of education in
the labor force with those estimated to be necessary. In 1940 and 1950 the
proportions of employed persons with at least a full high school education
were 31.2 per cent and 39.0 per cent respectively. Those needing that much
education for their jobs according to this study were 28.5 per cent and 32.4
per cent of the labor force.   On the other hand, the higher education in
the labor force is quite fully employed: in 1940 and 1950 the percentage of
employed persons having four or more years of college were 5.9 and 7.4 re-
spectively while the percentages of those requiring such an education were
7.1 and 7.4 per cent. This seems to show a growing amount of "unemployed"
high school education in the labor force.

Table IV - Distribution of the U.S. Labor Force in 1950 According To Requirements for General Education and Vocational Preparation (in percentages) and Average Requirements (in years)

Industrial Sectors	General Education Categories								Special Vocational Preparation Categories								
	1	2	3	4	5	6	7	Average (in years)	1	2	3	4	5	6	7	8	Average (in years)
	Years of Schooling								Period of Training								
	0	4	7	10	12	16	18		0	0 to 1 month	1 to 3 months	3 to 6 months	6 to 12 months	1 to 2 years	2 to 4 years	4 to 10 years	
Agriculture, forestry and fisheries	-	34.23	2.47	62.19	0.78	0.26	0.07	7.91	-	1.62	34.15	1.06	0.15	61.96	0.88	0.18	1.03
Agriculture	-	34.84	1.23	63.14	0.48	0.25	0.06	7.90	-	0.37	34.74	0.97	0.13	63.03	0.59	0.17	1.04
Forestry	0.21	0.14	44.83	12.20	40.00	1.31	1.31	9.61	0.21	43.20	0.55	10.45	1.66	2.63	40.03	1.38	1.41
Fisheries	-	0.11	88.39	5.45	5.17	0.31	0.57	7.51	-	88.31	0.61	3.84	0.73	0.57	5.52	0.42	0.26
Mining	0.02	0.88	8.81	17.15	69.56	1.19	2.39	11.33	0.02	4.10	0.79	8.67	5.86	5.08	73.51	1.97	2.50
Metal mining	0.03	0.90	6.31	13.78	74.97	1.36	2.65	11.55	0.06	4.37	0.52	7.83	4.47	5.18	73.46	4.11	2.63
Coal mining	0.03	0.81	8.50	9.79	80.01	0.36	0.50	11.34	0.03	5.35	0.26	6.47	2.20	5.21	79.75	0.73	2.57
Crude petroleum and natural gas extraction	-	0.53	4.10	27.54	59.56	2.61	5.66	11.65	-	1.56	2.04	10.31	14.60	4.55	63.03	3.91	2.38
Nonmetallic mining and quarrying except fuel	0.03	1.15	14.78	15.21	66.70	0.66	1.47	10.98	0.03	3.31	0.85	17.60	5.50	5.47	65.40	1.84	2.28
Construction	0.02	0.25	25.20	16.50	54.35	1.25	2.41	10.58	0.02	20.06	1.27	9.66	2.28	3.12	56.03	7.56	2.32
Manufacturing	0.17	0.93	12.73	59.15	22.86	1.63	2.53	10.30	0.18	13.88	1.15	49.70	5.21	5.41	18.90	5.57	1.27

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Industry	General Education Categories								Special Vocational Preparation Categories								
	1	2	3	4	5	6	7	Avg.	1	2	3	4	5	6	7	8	Avg.
Logging and wood products except furniture	0,02	0,19	45,98	32,92	20,28	0,42	0,19	9,05	0,02	39,50	2,65	31,48	3,49	10,65	11,66	0,55	0,71
Logging	0,02	0,10	86,40	4,94	8,21	0,22	0,10	7,58	0,02	73,23	4,61	9,58	2,01	3,41	6,73	0,41	0,37
Saw mills, planing mills and mill work	0,02	0,23	38,21	37,30	23,64	0,42	0,18	9,26	0,02	32,81	2,18	34,75	4,07	13,45	12,21	0,51	0,78
Miscellaneaus wood products	-	0,12	19,67	57,05	22.02	0.77	0.37	9.33	-	18.75	1.91	51.28	2.70	7.10	17.27	0.99	0.92
Furniture and Fixtures	0.05	0.05	14.18	60.29	23.95	1.04	0.44	10.14	0.05	9.83	1.12	52.27	3.15	5.94	26.65	0.99	1.18
Stone,clay and glass products	0.18	0.41	21.54	58.29	16.18	1.99	1.41	9.87	0.18	20.61	1.82	50.85	2.53	4.73	16.92	2.36	0.96
Glass and glass products	0.34	0.34	12.59	69.77	13.99	2.03	0.94	8.98	0.36	14.30	0.88	61.83	2.05	4.03	14.89	1.66	0.88
Cement and concrete, gypsum and plaster products	0.03	0.82	30.25	46.07	19.80	0.89	2.14	9.63	0.03	25.58	1.03	42.38	3.42	5.25	19.46	2.85	1.05
Structural clay products	0.04	0.23	39.14	45.61	12.30	1.05	1.63	8.99	0.04	35.73	5.14	37.20	1.83	4.24	14.00	1.83	0.79
Pottery and related products	0.17	0.11	14.32	72.94	8.32	2.72	1.42	9.99	0.17	13.87	1.47	66.27	2.04	4.13	10.18	1.87	0.77
Miscellaneous non-metallic mineral and stone products	0.23	0.23	13.82	56.17	24.68	2.36	2.51	10.38	0.23	15.06	1.46	45.75	3.22	6.11	24.38	3.78	1.25

Industry	General Education Categories								Special Vocational Preparation Categories								
	1	2	3	4	5	6	7	Avg.	1	2	3	4	5	6	7	8	Avg.
Primary metal industries	0.18	0.56	23.54	49.00	23.38	1.16	2.18	9.95	0.18	21.28	1.34	36.67	6.64	10.61	19.58	3.70	1.19
Blast furnaces, steel works and rolling mills	0.16	0.77	25.94	45.02	24.74	1.17	2.20	10.04	0.16	23.79	1.28	33.74	7.24	8.97	20.81	4.01	1.23
Other primary iron and steel industries	0.13	0.17	21.44	53.05	22.63	1.13	1.45	9.97	0.14	19.42	1.03	36.74	6.58	15.61	17.61	2.87	1.15
Primary nonferrous industries	0.29	0.45	18.96	54.54	21.47	1.21	3.08	10.12	0.31	16.08	1.53	45.96	4.86	9.03	16.71	5.52	1.24
Fabricated metal industries	0.11	0.16	9.91	54.70	30.80	2.08	2.24	10.60	0.11	10.42	0.86	46.13	8.92	5.23	25.03	3.30	1.31
Fabricated steel products	0.12	0.18	10.26	55.62	29.34	2.15	2.33	10.57	0.12	10.77	0.89	46.91	9.18	5.32	23.58	3.23	1.26
Fabricated non-ferrous metal products	0.03	0.12	7.30	49.03	40.22	1.71	1.59	10.81	0.03	8.03	0.72	41.12	7.19	4.58	34.77	3.56	1.56
Not specified metal industries	-	0.23	11.74	49.20	35.22	1.13	2.48	10.61	-	10.38	0.23	43.57	8.80	5.42	26.41	5.19	1.46
Machinery, except electrical	0.15	0.12	5.96	52.43	35.21	2.80	3.33	10.94	0.16	8.22	1.37	40.58	4.95	7.32	28.77	8.63	1.77
Agricultural machinery and tractors	0.30	0.15	10.08	55.43	29.31	2.48	2.26	10.58	0.30	10.67	0.99	45.60	7.42	6.32	24.16	4.54	1.36
Office and store machines and devices	-	0.06	2.28	64.08	26.56	4.28	2.74	10.94	-	8.82	1.09	50.23	4.91	3.74	24.53	6.68	1.48
Miscellaneous machinery	0.15	0.13	5.80	48.29	39.10	2.81	3.72	11.05	0.15	7.72	1.06	39.12	7.67	4.72	29.99	9.57	1.84
Electrical machinery equipment and supplies	0.14	0.11	5.43	66.34	19.73	3.05	5.20	10.81	0.14	6.62	0.94	57.22	4.94	5.16	17.40	7.58	1.38

Industry	General Education Categories								Special Vocational Preparation Categories								
	1	2	3	4	5	6	7	Avg.	1	2	3	4	5	6	7	8	Avg.
Transportation Equipment	0.23	0.28	8.10	53.02	32.51	2.48	3.38	10.81	0.23	8.20	0.93	45.00	8.52	4.42	26.32	6.38	1.54
Motor vehicles and motor vehicle equipment	0.32	0.32	9.14	58.97	27.57	1.92	1.76	10.48	0.32	8.99	0.68	52.27	9.41	4.27	18.85	5.21	1.27
Aircraft and parts	0.09	0.11	2.90	45.98	37.11	4.21	9.60	11.65	0.09	3.62	0.74	38.32	4.95	4.95	37.04	10.29	2.08
Ship and boat building and repairing	0.02	0.41	10.21	31.68	53.08	2.35	2.25	11.04	0.02	10.76	2.59	17.77	8.76	3.27	50.35	6.49	2.15
Railroad and miscellaneous transport equipment	0.05	0.15	10.27	50.60	32.65	3.36	2.92	10.77	0.05	10.27	1.07	39.46	9.63	7.11	26.52	5.89	1.54
Professional and photographic equipment and watches	0.06	0.31	3.90	63.53	24.70	3.48	4.02	10.88	0.06	6.56	1.08	52.23	4.33	5.37	23.79	6.58	1.44
Professional equipment and supplies	0.08	0.05	3.32	60.33	28.08	3.56	4.58	11.03	0.08	6.56	1.18	48.24	4.47	5.12	27.53	6.82	1.59
Photographic equipment and supplies	–	0.91	5.42	65.22	19.39	4.56	4.50	10.80	–	7.70	0.78	52.62	4.41	7.31	19.78	7.38	1.43
Watches, clocks and clockwork operated devices	0.09	0.35	3.79	72.00	20.51	1.76	1.50	10.49	0.09	5.02	1.14	65.13	3.70	3.61	16.64	4.67	1.08
Miscellaneous manufacturing industries	0.09	0.09	5.70	68.85	22.56	1.55	1.16	10.45	0.09	8.32	1.06	58.64	3.95	4.73	19.63	3.58	1.16
Food and Kindred Products	0.14	0.29	17.07	62.49	18.01	0.94	1.06	9.96	0.14	21.30	1.35	49.11	3.58	4.31	18.56	1.65	0.96
Meat products	0.03	0.29	18.45	69.54	9.87	1.10	0.72	9.75	0.03	21.25	1.14	59.67	3.22	3.47	9.09	2.11	0.73
Dairy products	0.09	0.17	19.56	63.67	14.67	0.79	1.05	10.49	0.09	16.75	2.65	52.79	5.40	6.10	15.10	1.11	0.87

Industry	General Education Categories								Special Vocational Preparation Categories								
	1	2	3	4	5	6	7	Avg.	1	2	3	4	5	6	7	8	Avg.
Canning and Preserving fruits, vegetables and sea foods	0.11	0.15	16.40	68.45	13.02	1.12	1.05	9.90	0.11	17.43	1.60	57.72	2.42	5.92	13.33	1.47	0.83
Grain-mill products	0.70	0.62	22.69	57.44	16.13	1.27	1.15	9.70	0.70	23.98	1.06	41.67	4.24	3.56	22.84	1.95	1.08
Bakery products	0.16	0.16	9.68	54.74	34.58	0.41	0.27	10.41	0.16	23.87	0.79	34.38	2.20	3.47	34.76	0.37	1.28
Confectionery and Related Products	0.08	0.20	8.20	80.96	9.24	0.64	0.68	10.01	0.08	13.18	0.88	68.78	2.83	3.90	9.16	1.19	0.70
Beverage Industries	0.08	0.31	22.68	56.47	18.37	1.05	1.05	9.81	0.08	24.60	1.49	45.82	4.15	3.92	18.42	1.52	0.93
Miscellaneous food preparations and kindred products	0.11	0.59	20.76	58.22	16.46	0.39	2.97	9.95	0.11	24.14	1.54	43.97	5.38	4.89	16.51	3.46	1.03
Not specified food Industries	-	0.47	11.95	62.61	18.14	2.67	4.16	10.47	-	19.87	0.94	45.00	3.85	5.91	18.77	5.68	1.22
Tobacco Manufactures	0.49	0.32	9.88	79.92	8.51	0.62	0.26	9.86	0.49	12.48	0.62	72.39	1.70	3.32	8.51	0.49	0.63
Textile Mill Products	0.70	0.60	12.21	69.02	16.29	0.60	0.56	9.93	0.70	7.74	0.78	60.11	7.42	5.34	17.00	0.91	0.94
Knitting mills	0.06	0.08	2.02	88.38	8.94	0.36	0.16	10.14	0.06	3.55	0.52	82.39	1.33	3.50	8.33	0.31	0.65
Dyeing and finishing textiles except knit goods	0.22	0.45	8.07	64.52	24.82	0.73	1.19	10.34	0.23	8.91	1.69	55.84	2.87	17.43	10.49	2.54	0.99
Carpets, rugs and other floor coverings	0.09	0.37	13.28	56.32	27.35	1.25	1.34	10.30	0.09	12.87	0.74	47.48	4.49	4.58	27.81	1.94	1.25
Yarn, thread and fabric mills	0.95	0.77	14.88	65.65	16.61	0.59	0.55	9.82	0.96	8.04	0.74	56.16	9.52	5.10	18.62	0.86	0.98
Miscellaneous textile mill products	0.06	0.73	8.28	74.10	15.53	0.68	0.62	10.10	0.06	10.64	1.41	63.68	3.44	4.62	15.14	1.01	0.80

Industry	General Education Categories								Special Vocational Preparation Categories								
	1	2	3	4	5	6	7	Avg.	1	2	3	4	5	6	7	8	Avg.
Apparel and other fabricated textile products	0.05	0.24	1.85	89.12	7.76	0.89	0.09	10.14	0.05	3.94	0.27	82.16	1.66	2.61	9.02	0.29	0.65
Apparel and accessories	0.04	0.24	1.60	89.89	7.28	0.89	0.06	10.14	0.04	3.61	0.28	83.14	1.63	2.51	8.55	0.24	0.64
Miscellaneous fabricated textile products	0.21	0.21	4.68	80.35	13.31	0.85	0.39	10.17	0.21	7.65	0.47	70.83	1.93	3.69	14.29	0.92	0.77
Paper and allied products	0.12	0.54	13.09	68.36	15.45	1.15	1.29	10.04	0.12	14.29	1.69	59.53	2.56	4.83	13.38	3.60	0.98
Pulp, paper and paper-board mills	0.11	0.91	16.36	64.60	15.60	0.80	1.62	9.93	0.11	16.55	2.36	55.86	2.78	5.70	13.24	3.40	0.82
Paper-board containers and boxes	0.16	0.19	11.00	71.16	15.59	1.18	0.72	10.08	0.16	11.94	0.86	63.97	2.02	4.18	13.14	3.73	0.97
Miscellaneous paper and pulp products	0.10	0.22	9.14	72.52	15.07	1.74	1.21	10.03	0.10	12.36	1.24	62.12	2.66	3.85	13.84	3.83	1.00
Printing, publishing and allied industries	0.08	10.65	3.40	34.65	42.24	1.93	7.05	10.78	0.08	17.39	2.97	24.08	4.16	1.70	21.11	28.51	2.79
Chemicals and allied products	0.05	0.40	13.32	59.04	17.77	2.23	7.19	10.64	0.06	17.29	1.55	44.74	4.02	6.12	17.44	8.78	1.44
Synthetic Fibers	-	0.40	10.07	68.02	16.20	1.01	4.30	10.40	-	8.72	0.74	62.35	4.36	3.17	14.49	6.17	1.17
Drugs and medicines	-	0.05	6.33	65.98	15.40	4.35	7.89	11.01	-	13.73	1.29	46.18	3.93	8.10	18.13	8.64	1.45
Paints, varnishes and related products	0.05	0.10	10.39	66.35	15.30	1.69	6.12	10.45	0.11	14.98	1.16	51.21	3.69	6.28	15.45	7.12	1.34
Miscellaneous chemicals and allied products	0.07	0.47	14.82	56.39	18.52	2.19	7.54	10.81	0.07	18.90	1.72	41.88	4.04	6.20	17.91	9.28	1.47

Industry	General Education Categories								Special Vocational Preparation Categories								
	1	2	3	4	5	6	7	Avg.	1	2	3	4	5	6	7	8	Avg.
Petroleum and coal products	0.06	0.55	15.25	51.45	21.09	3.86	7.74	10.78	0.06	15.09	2.45	36.73	7.92	6.81	20.69	10.25	1.65
Petroleum refining	0.07	0.53	14.00	51.83	21.29	4.09	8.19	10.87	0.07	13.96	2.50	36.45	8.36	6.94	20.88	10.84	1.70
Miscellaneous petroleum and coal products	-	0.78	27.08	47.83	19.20	1.67	3.44	10.10	-	25.86	2.00	39.40	3.66	5.55	18.87	4.66	1.16
Rubber products	0.24	0.32	8.18	74.66	12.59	1.72	2.29	10.25	0.24	11.06	1.05	63.58	2.54	5.44	12.59	3.50	0.97
Leather and leather products	0.07	0.06	4.25	88.36	6.41	0.56	0.29	10.05	0.07	5.94	0.66	81.21	1.46	3.83	6.24	0.58	0.60
Leather: tanned, curried and finished	0.06	0.25	13.33	75.26	9.66	0.56	0.88	9.88	0.06	13.72	1.45	66.75	2.28	6.01	8.28	1.45	0.79
Footwear except rubber	0.09	0.02	2.71	91.67	4.92	0.42	0.17	10.04	0.10	4.41	0.54	85.00	1.15	3.46	4.98	0.38	0.55
Leather products except footwear	-	0.09	3.83	84.56	10.07	1.12	0.33	10.17	-	6.43	0.61	76.41	2.15	3.68	9.89	0.84	0.72
Not specified manufacturing industries	0.36	0.06	10.78	61.99	21.79	2.27	2.75	10.42	0.36	16.44	1.66	47.74	5.56	3.70	20.03	4.51	1.19
Transportation Communication and Other Public Utilities - Total	0.08	3.02	28.12	36.84	29.07	1.34	1.53	9.75	0.08	21.02	10.73	28.34	10.97	3.46	20.86	4.84	1.23
Transportation-Total	0.06	4.30	35.49	30.10	28.67	0.85	0.83	9.34	0.06	25.42	5.18	31.59	13.10	3.36	16.27	5.02	1.12
Railroads and railway express services	0.06	4.51	24.86	41.09	27.98	0.94	0.56	9.64	0.06	28.10	3.27	27.27	11.39	4.66	15.46	9.79	1.42

Industry	General Education Categories								Special Vocational Preparation Categories								
	1	2	3	4	5	6	7	Avg.	1	2	3	4	5	6	7	8	Avg.
Street railways and bus lines	0.16	1.13	7.09	27.11	63.31	0.69	0.51	11.05	0.16	7.93	13.96	9.91	48.01	1.59	17.54	0.90	1.04
Trucking Service	0.02	0.20	72.73	12.59	13.90	0.40	0.16	8.12	0.02	11.77	1.58	69.32	3.35	1.33	12.42	0.21	0.70
Warehousing and storage	0.12	0.43	34.79	41.19	21.93	0.65	0.89	9.47	0.12	31.61	2.02	34.08	5.40	3.69	21.84	1.24	0.98.
Texicab Service	–	0.18	82.21	4.27	12.97	0.24	0.13	7.82	–	81.27	1.35	3.06	5.93	0.31	7.97	0.11	0.34
Water transportation	0.06	28.29	22.40	22.85	24.92	1.14	0.34	8.22	0.06	35.57	20.39	13.29	4.88	1.38	23.77	0.66	0.91
Air transportation	0.16	–	7.53	28.37	58.97	2.85	2.12	11.28	0.16	9.26	3.17	16.35	18.43	12.82	37.41	2.40	1.69
Petroleum and Gasoli_ne pipe lines	–	4.81	13.08	54.29	18.95	3.46	5.41	10.34	–	14.59	1.85	34.74	19.85	4.51	18.19	6.17	1.33
Services incidental to transportation	–	0.65	27.99	42.86	25.95	1.24	1.31	9.82	–	27.84	5.39	31.05	7.73	2.19	23.47	2.33	1.09
Telecommunications	0.14	0.08	3.05	65.24	27.26	1.54	2.69	10.74	0.14	2.35	44.43	17.62	2.76	1.72	28.14	2.84	1.23
Utilities and sanitary services	0.11	0.64	20.95	39.02	32.01	2.96	4.31	10.48	0.11	19.54	4.27	25.31	8.12	4.67	32.19	5.79	1.61
Electric light and power and electric gas utilities	0.12	0.42	10.28	40.56	39.79	3.48	5.35	11.09	0.12	10.90	5.31	23.59	8.12	4.88	40.64	6.43	1.90
Gas and steam supply systems	0.13	1.76	15.92	45.90	30.35	3.35	2.59	10.42	0.13	17.60	3.67	29.30	10.68	5.00	27.39	6.23	1.54
Water supply	–	0.70	22.83	45.13	24.22	1.99	5.13	10.29	–	21.96	1.49	35.78	5.42	4.72	23.23	7.40	1.47
Sanitary services	0.14	0.26	72.38	17.50	8.16	0.40	1.16	8.08	0.14	56.61	0.87	26.23	3.18	3.49	8.01	1.47	0.54
Other and not specified utilities	0.08	0.77	20.31	42.59	27.25	4.63	4.37	10.51	6.08	21.34	6.17	25.36	7.80	4.20	29.48	5.57	1.51
Wholesale and retail trade	0.10	0.36	18.67	48.93	28.45	3.22	0.27	10.19	0.11	43.44	3.90	12.74	3.66	3.67	32.05	0.53	1.14

Industry	General Education Categories								Special Vocational Preparation Categories								
	1	2	3	4	5	6	7	Avg.	1	2	3	4	5	6	7	8	Avg.
Wholesale Trade	0.03	0.13	18.04	54.07	22.23	4.70	0.80	10.23	0.03	29.70	2.41	32.99	5.69	1.69	26.24	1.25	1.08
Retail Trade	0.12	0.42	18.82	47.71	29.91	2.88	0.14	10.18	0.13	45.54	4.15	9.96	3.12	4.03	32.73	0.34	1.15
Finance, Insurance and Real Estate	1.34	0.03	5.67	50.80	39.06	2.45	0.65	10.67	1.32	9.12	6.04	29.41	31.46	1.25	20.19	1.21	1.07
Business and repair services	0.90	2.32	4.74	21.64	61.21	7.51	1.68	11.44	0.90	8.11	1.30	13.36	7.26	1.36	65.70	2.01	2.24
Advertising	0.05	0.18	3.30	37.34	42.59	11.30	5.24	11.83	0.05	5.39	3.11	28.03	16.65	0.89	25.33	20.55	2.45
Accounting, auditing and bookkeeping services	-	0.03	0.32	24.38	3.32	71.60	0.35	14.38	0.03	0.56	0.26	14.07	9.81	0.09	74.71	0.47	2.40
Miscellaneous business services	5.18	0.05	4.01	45.86	32.38	6.22	6.30	10.88	5.18	10.23	4.46	29.92	9.74	2.70	31.54	6.23	1.62
Automobile repair services and garages	0.02	4.88	6.49	10.84	77.28	0.39	0.10	11.09	0.02	11.20	0.29	6.65	2.99	1.32	74.41	0.12	2.40
Personal services	0.29	11.50	52.52	15.05	20.00	0.55	0.09	8.15	0.30	59.42	5.19	5.33	1.74	15.15	12.69	0.18	0.69
Entertainment and recreation services	0.66	0.06	14.09	38.91	31.22	11.85	3.20	11.10	11.09	17.03	7.00	8.61	8.23	11.75	32.81	3.47	1.52
Professional and related services	0.41	0.53	10.01	22.72	17.77	35.15	13.41	13.16	2.13	14.16	1.25	12.79	2.97	31.09	17.95	17.66	2.32
Public Administration	0.29	0.20	14.65	48.29	25.17	7.98	3.42	10.78	0.30	8.16	13.66	44.44	5.56	2.24	21.56	4.08	1.20
Postal Service	0.23	0.06	42.64	45.44	2.97	8.60	0.06	9.27	0.23	5.51	39.44	42.62	0.76	0.40	10.97	0.07	0.57
Federal public administration	0.29	0.36	6.83	55.79	23.80	6.01	6.92	11.13	0.29	7.49	3.68	47.60	7.52	2.23	24.89	6.30	1.46
State public administration	0.30	0.09	4.38	51.32	28.92	11.45	3.54	11.38	0.30	9.80	3.99	40.58	9.47	2.39	29.15	4.32	1.45
Local public administration	0.33	0.13	11.44	39.26	39.09	7.76	1.99	11.02	0.36	9.99	14.66	42.54	4.69	3.30	20.97	3.49	1.15

Table V - Distribution of the 1940 and 1950 U.S. Labor Force by General Educational Requirements

Scale of general educational development	School grade equivalent [1]	1940 Labor Force		1950 Labor Force	
		Number	Per Cent	Number	Per Cent
1	0	583,240	1.30	119,220	0.22
2	4	3,478,758	7.76	3,118,640	5.67
3	7	8,778,560	19.57	9,067,170	16.48
4	10	19,254,902	42.93	24,584,300	44.69
5	12	9,597,940	21.40	14,019,460	25.49
6	16	2,313,240	5.16	2,775,180	5.05
7	18	844,420	1.88	1,322,510	2.40
Total		44,851,060	100.00	55,006,480	100.00
Average Years of Schooling Required		9.7		10.1	

[1] This translation of the scale of general educational development represents personal judgements. This is obviously a controversial matter and the advice I have had has been conflicting. I do not offer this translation as a definitive one.

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Table VI - <u>Specific Vocational Training Requirements for the U.S. Labor Force in 1940 and 1950</u>

Specific Vocational Preparation Range	1940 Labor Force		1950 Labor Force	
	Number	Per Cent	Number	Per Cent
1 Short demonstration only	644875	1.44	256980	0.47
2 Anything beyond short demonstration up to and including 30 days	7488960	16.70	11544540	20.95
3 Over 30 days up to and including 3 months	5931798	13.23	4249320	7.71
4 Over 3 months up to and including 6 months	10271960	22.90	13055320	23.71
5 Over 6 months up to and including 1 year	1941740	4.33	2785080	5.06
6 Over 1 year up to and including 2 years	7865902	17.54	7919520	14.37
7 Over 2 years up to and including 4 years	9210585	20.53	12957350	23.52
8 Over 4 years	1495240	3.33	2318370	4.21
Totals	44851060	100.00	55086480	100.00

Average Years of Training Required   1.26   1.35

These comparisons of "requirements" with "actuals" should not be taken as implying that any surplus of the latter over the former implies that there is "too much" high school education, for example. Even to create the productive inputs alone a certain amount of "wastage" is necessary as mentioned above. More importantly, it was also pointed out that there are many valid reasons for education at all levels in addition to preparation for production. The calculations above are not in any way meant to demean these reasons.

The estimates also provide the basis for computing the total costs of educating a labor force with the specified skills. This could be done by applying the appropriate unit costs to the different types and levels of education. The estimate would include vocational education costs, as it should, and exclude education primarily for the purposes of consumption. That part of education which might be warranted to give flexibility and mobility to the labor force, just as excess capacity and flexibility is sometimes built into capital equipment, is also excluded, however. Also no allowance would be for the necessary "wastage" requirements in education, i.e. for that which performs the necessary screening functions. Even apart from these omissions the calculated total would not correspond to human "capital" for that would be giving a zero value to the inevitable, and desired, joint-products.

There are inadequacies in the census data and in the job description data. But the approach gives information which would otherwise be unavail able about the labor force and its desirable educational background, I believe, and it points the way to detailed methods of educational planning.

IV. Education and Manpower Planning

In planning education for productive purposes as in most other kinds of planning it is necessary to give details of "how much" and "what kind", if plans are to be useful. This can be and has been done by following an approach similar to that outlined above. The steps are: (1) to project future occupational levels and (2) to deduce from these the necessary

educational requirements.

For example, if the assumption were made that the "marginal" educational requirements were equal to the average, then data such as that of Table IV could be used in the U.S. to project educational needs based on industry projections. If the "marginal" requirements are not equal to the average then further information on the margins, organized as outlined above would provide the necessary information. For other countries, with some reason to believe that their development may follow U.S. patterns, Table IV would provide a basis for estimating what their future educational patterns might become. Similar studies for other countries could add to the range of experience which would provide a basis for forecasting.

Though nowhere is there fully adequate data one virtue of the approach is that the studies which would be required to create a good empirical basis are straightforward. They avoid such intrinsically difficult problems as those of estimating shadow prices for resources for which there are no valid market prices. A good occupational census is necessary and, for projections, information on the occupational distribution of industries to be expanded in the future. Occupational censuses are either already made and could be easily improved in many countries or quite within the scope of census development. In the U.S. the occupational census should be made a part of the industrial census, wherever possible, and job classifications used which are compatible with other job information. The information on job descriptions needs to be improved. The Worker Trait Requirements for 4000 Jobs was not intended for the purpose to which it was put here but a study for such a purpose is quite likely to be successful. Additional information on wastage and the benefits of education for occupational mobility should also be developed. The attempt to estimate labor and education requirements directly has the virtue of suggesting a research design which would produce empirical material of immediate use in setting criteria for education.

Having set forth the criticisms of the use of "market criteria" in educational planning, it does not follow that "prices", i.e. wages, have no relation at all to "investment" in education. The relation is not obvious, however, and it too should be investigated. Certainly one criteria for educational planning is that the returns to educated labor should be reasonably consistent with the investment in education. But what constitutes reasonable consistency has to be explored and cannot be assumed.