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TOWARDS AN EVALUATION MODEL--A SYSTEMS APPROACH.
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        A MODEL FOR EVALUATING INSTRUCTIONAL PROGRAMS AT THE
SCHOOL DISTRICT LEVEL IS DEVELOPED. THE MODEL IS BASICALLY A
DISCUSSION AND AMPLIFICATION OF THE DEFINITION OF
"EVALUATION." IT CONSISTS OF SIX MAIN ELEMENTS--(1) STUDENT
INPUTS, (2) FINANCIAL INPUTS, (3) EXTERNAL SYSTEMS, (4)
MEDIATING FACTORS, (5) STUDENT OUTPUTS, AND (6) NONSTUDENT
OUTPUTS. THESE ELEMENTS ARE DISCUSSED IN A MACRO-SYSTEM. THE
MEDIATING VARIABLES ARE, BY ASSUMPTION, THE ONLY MANIPULABLE
VARIABLES IN THE SYSTEM. (HW)

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TOWARDS AN EVALUATION MODEL:
A SYSTEMS APPROACH

Marvin C. Alkin

Center FOR THE
Study of
Evaluation
OF INSTRUCTIONAL
PROGRAMS

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ABSTRACT

It is the function of this paper to specify, both by verbal and figurative representation (in the form of a model), the nature of what this author feels should be observed and judged in evaluating instructional programs.

Evaluation is defined as "The process of first identifying and quantifying the relationships between student inputs and educational outputs, and determining the combination of mediating factors which maximizes the educational outputs, given a constant financial input and controlling for the effects of external systems." The paper is primarily a discussion and amplification of the above definition.

TOWARDS AN EVALUATION MODEL:

A SYSTEMS APPROACH

Marvin C. Alkin

Evaluation is the process of first identifying and then
quantifying, or measuring, the relationships between student
inputs and educational outputs and determining the combina-
tion of mediating factors which maximizes the educational
outputs, given a constant financial input and controlling for
the effects of external systems. Evaluation is a complex
activity that involves the identification of many factors
that contribute to educational outputs.

In our definition of evaluation, "student inputs" re-
fers to the nature and characteristics of the students enter-
ing the program to be evaluated. By "educational outputs" we
mean two things: 1) cognitive and non-cognitive changes which
take place in students after they are exposed to the instruction-
al program. These changes are assumed to be attributable to the
program. And, 2) the impact of the program upon systems ex-
ternal to it (home, community, other programs, etc.). "Finan-
cial inputs" refers to the financial resources made available
for carrying on the program. "Mediating factors" are the de-
scriptive characteristics (e.g., personnel, school organiza-
tion and programs, and instructional design) of the way in
which financial inputs are utilized within the program in
combination with the student inputs. And, finally, by "external

systems"we mean the framework of social, political, legal, economic, and other systems outside of the school, formal or informal, which encompass the program, have impact upon it, and are, in turn, modified by the outputs of the program.

It should be specifically noted that in the discussion of mediating variables, we act under the assumption that they are the only set of variables which are manipulatable. For the sake of this model we will assume that: 1) external systems are not immediately altered by the outputs of the system; and 2) that the school decision-makers have no control over which external systems are allowed to impinge upon the school. If we were to maintain that feedback immediately changes the system, this would imply a highly dynamic model rather than the static model considered here. The second assumption implies that no attempt will be made to change the nature of the student inputs to the system--that is, we do not usually concern ourselves with the consideration of community changes, which might be made, that would alter the nature of the student inputs. We act, too, under the assumption that student inputs are relatively nonmanipulatable from without the system. Thus, we concern ourselves with the mediating variables within the system that can be changed, manipulated and altered in order to maximize student outputs. We recognize the weakness in this assumption, and that there are some school-related manipulations that could be instituted which would change the nature of the student input. Instances of this are bussing, changing of school boundaries in order to

"juggle" student inputs to specific schools, community educa-
tional resources (such as education resource units in disad-
vantaged areas), and preschool programs (such as Project
Headstart). The assumptions of a static model and of non-
manipulatable external systems seem necessary at this early
stage of the model development.

With our definition of evaluation and some of the limits
we are imposing in mind, it seems appropriate to discuss the
evaluation model[1] and, in more general terms, the principles
of evaluation which follow from the model. However, before
doing this, we will first discuss the general nature and func-
tion of an evaluation model and, second, the importance of the
size of the unit to be evaluated upon the nature of the eval-
uation. These sections will set the background for the
development of the model presented in this paper.

It should be noted that in this paper we are not pri-
marily concerned with the methodological consideration per se.
We accept the differentiation by Stake (1967) between the theory
of evaluation which identifies what is to be observed and
judged and the methodology of evaluation which specifies the
manner in which these observations and judgments will be made.
It is the function of this paper merely to specify, both by
figurative and verbal representation (in the form of a model),
the nature of what should be observed and judged.

An evaluation model or, for that matter, any model is a
simplistic statement or representation of sets of complex
interrelationships. Such a representation is intended to help

the modelers in structuring the universe, or that segment of the universe being considered. Of necessity, models must be functions of the frames of reference of their builders. Thus, an evaluation model constructed by one whose background is psychology and the study of tests and measurements will be a quite different model from that constructed by a sociologist looking at evaluation, or of that constructed by a school administrator or an economist. While each model may view the same set of interrelationships, it is inevitable that certain concerns of the model builders will differ. The resultant generation of different perspectives of the problem is beneficial, not only for the model builder who is better able to "get a handle on" his universe, but to others who may be forced for the first time to consider more seriously some of what they previously may have considered to be lesser concerns in their own model.

We cannot claim that the elements of the model presented here are uniquely different from those mentioned by others concerned with evaluation. In fact, most of the variables and kinds of interactions have been mentioned previously by Stake (1967), Scriven (1967), and, we are sure, many others. Moreover, the model is in many ways not significantly different from the total model of evaluation that guides the efforts of the Center for the Study of Evaluation of Instructional Programs at UCLA, as developed by the committee of authors of the proposal for the Center: Chairman M.C. Wittrock and committee members Marvin C. Alkin, John

Bormuth, Reginald Jones, James Liesch, and David Wiley (1965).
That model maintains that evaluation cannot take place with-
out considering the nature of the instructional parameters
in the program being evaluated, without understanding and
quantifying the impact of social and administrative contexts
that impinge upon the program, and without considering a
multiplicity of outcome measures. This author participated
in the development of that model, and the statement presented
here simply represents his own personal modifications of
that model, as well as deviations based on his own frame of
reference.

Units of Aggregation

As a final preliminary, it should be noted that the
nature of an evaluation depends, in part, upon the size of
the unit to be evaluated--and evaluation may involve many
basic units of examination. Where the unit of evaluation is
relatively small and discrete (e.g., individual students),
the nature of the students and of the financial resources
made available, as well as many other variables which medi-
ate in the production of outcomes, can be manipulated by
the method of selection of groups. In this instance, the
task of evaluation becomes the comparison of a single medi-
ating variable to another variable or to several others.
Where more complex units are to be evaluated, other factors
may be more diffuse and uncontrollable. In these instances,
there might be a need for a total systems analysis in which
we attempt to apply statistical controls to many of the

dimensions being examined, because randomness of selection cannot be guaranteed in the same way as when smaller units are the basis of analysis. Furthermore, in order to fully develop an evaluation model, it is fundamental and, therefore, necessary to understand the nature of interrelationships between variables being controlled. It is obvious, then, that the nature and sophistication of the evaluation model to be developed is dependent, in large part, upon the level of aggregation of the unit for evaluation.

Let us examine several possible levels of aggregation for the units which might be considered in an evaluation. For instance, at the first level, it is possible to examine the performance of an individual student in a given classroom in a given school. This is done quite frequently when we give a nationally-standardized test to students and we indicate the percentile score of the student as compared to national norms. In this situation, we are appraising the performance of the student on the basis of national criterion dimensions. However, this is not evaluation unless there is a comparison measure available, such as a pre-test or a test in which comparable groups are treated differently. In other words, it seems that a clear distinction can and must be made between an appraisal that is simply a statement of the present achievement or status of an individual and an "evaluation" that measures the changes in these individuals or other units while attempting to determine the set of mediating factors which is

most directly related to the given changes. The process of evaluation, then, requires a specific identification of the nature of the student units to be evaluated and stricter controls and understanding of the variables which mediate upon those units to produce the educational changes in a range of different kinds of educational outcomes, such as performance, attitudes, and social adjustment. With this specific meaning of the word "evaluation" in mind, let us proceed to examine other aggregated levels of units for evaluation.

At a somewhat more aggregated level, it is possible to evaluate the performance of groups of children. For example, using classrooms as the unit of examination, we might administer a given test in a specific achievement area to students within a school. Then we could proceed to discuss the variation in scores between these units, indicating the range of the scores, the mean, median, interquartile deviation, and other appropriate measures. In this case, while it is true that we are examining the performance of individual students, we are aggregating or combining their performances to represent a larger unit. The evaluation in this instance still conforms to our previously-indicated definition. The student inputs are designated by the series of measures most descriptive of the total classroom as a unit, and the particular set of mediating variables which has been acting upon this class or upon all of the individuals in the class also is indicated by various measures.

In the examination and comparison of several classroom units, if there have been different financial inputs to each of the units, it is necessary to determine the exact nature of the financial input to each of the units. This would be a preliminary step in determining the manner in which these funds have been utilized in initiating environmental changes which mediate upon the student in the production of the educational outcomes. Finally, it is necessary to represent the educational outcomes of each of the classroom units. It would be possible to compute the average of the scores made by students within one classroom and to compare it with the average score of pupils within another classroom or, for that matter, many other classrooms. These comparisons, when considered along with the other factors in the evaluation model, would represent a first-step evaluation of the performance of groups of individuals. In this case, the evaluation would be made between classrooms.

As we have illustrated, there are a number of different kinds of evaluation that might be made. We might wish to evaluate the results on the students of a number of classes using a specific course of study. Or, we might wish to evaluate--in a <u>specific</u> aggregate sense of the words "instructional program"--units which are broader than classroom units. Furthermore, we might wish to consider all of the curricular elements of the instructional program of the school, (mathematics, English, social studies, etc.), as subsets of the total instructional program, namely, the total field of aca-

demic experiences of an individual school. In this sense, we would evaluate the instructional program of the school on a number of output dimensions by using the total aggregated score of all students within the school and statistical measures descriptive of that data.

In an instance where the unit for evaluation is a total school, it would be necessary to examine specific school factors which might have a relationship to the outputs--that is, it would be necessary to ascertain to what extent relevant community characteristics differ between the schools. There are other questions which might be asked: Does each school provide the same amount of financial resources to be utilized in purchasing the important elements within the school system? How much is spent on teachers? On instructional services? What are the unique social characteristics on the school, etc.?

With these somewhat tangential thoughts as a reference point, we will consider more directly the model being presented.

Towards an Evaluation Model

In evaluating instructional programs, the complexities of the interrelationships are so great that we feel that the development of a theoretical model demands a systems approach. For this model, we will consider the school (individual school or school district) as our unit of examination.

There are two categories of input to the school: student

and financial.[2] Moreover, there are a group of mediating
variables within the school. Some of these variables are
"costly" and require the utilization of financial inputs;
others are relatively cost free. Finally, there are a number
of external social, political, and economic systems impinging
upon the school. These factors taken together produce a
number of outputs. Some of these are student outputs (such
as changes in attitudes, skills, etc., of students); others
are incidental or non-student outputs (such as program-caused
or program-related changes in external systems). In suc-
ceeding paragraphs, we will consider each of these elements
individually. For ease of communication, we will hereafter
refer to the school as "the system." The system and its ex-
ternal systems will be called the "macro-system."

One final note must be added: We recognize that there
are great overlaps between individual elements of the macro-
system. However, to avoid confusion in the discussion of the
model, we will think of the elements as being reasonably dis-
crete. Thus, for example, certain aspects of the description
of the student inputs are, to a great extent, a reflection of
external social systems. They will, however, be considered
in one category alone. (See Figure 1, page 12 for a simpli-
fied diagram of the conceptual model.)

Student Inputs

We will consider the student input as a description or
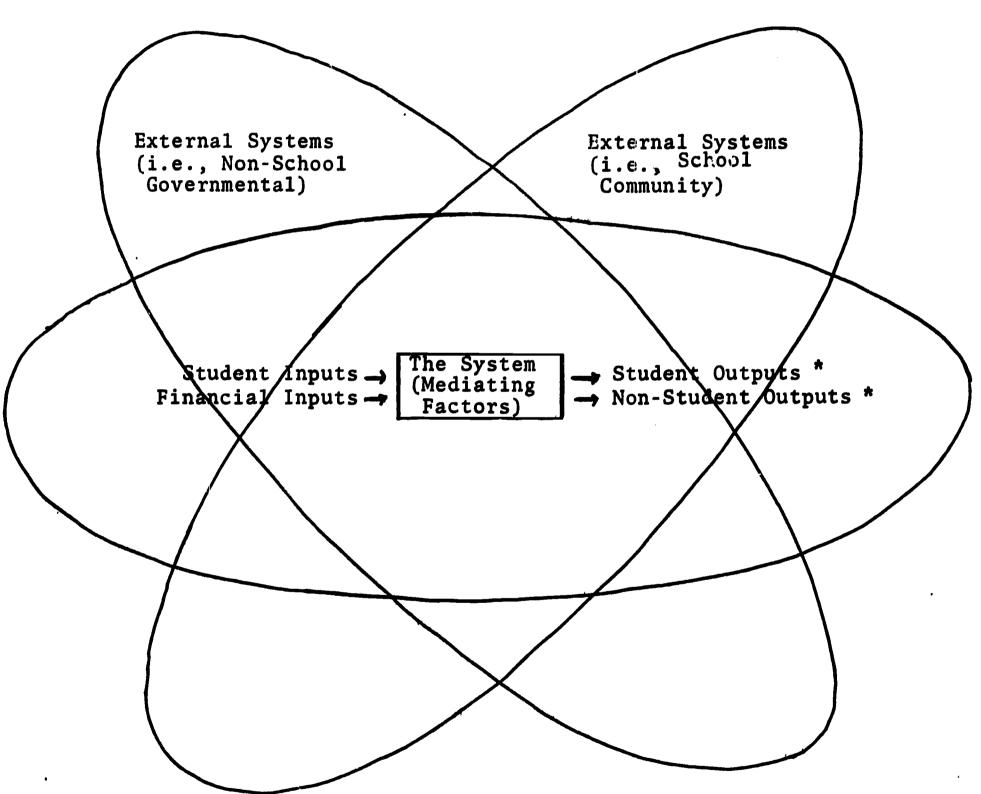measure of the student being introduced into the system or,

in the case of a larger unit of instructional program, as an aggregated, statistical description of the students being introduced into the system. In the ideal world, when students enter the system, they are given a complete battery of all the traditional kinds of achievement, intelligence, and personality tests, as well as questionnaires and other documentary data describing their homes, status in the community, family background, family memberships in other social systems, and the like. Unfortunately, the ideal world does not exist. We must, therefore, develop a series of proxy measures of student inputs. Very frequently, intelligence scores are available for entering students; there is usually, also, some small amount of family data available in the cumulative record folder. Occasionally, achievement tests given in the preceding year or two have been transferred and are available as a measure of the achievement starting-point of the students in the system. A considerable amount of additional desired data must, in consequence, either be collected in the school or more often be inferred from other, more accessible measures. As a result, we often look at the community and the characteristics of the community as an indication of the kind of student input that is being introduced into the system. For example, from the works of McClelland (1953) and others, we know that certain family characteristics bear a strong relationship to achievement motivation in children. And, while we would undoubtedly prefer individual achievement-motivation-test scores for each student entering the system, when such

FIGURE 1

The Macro-System of an Evaluation Model

External Systems
(i.e., Non-School
Governmental)

External Systems
(i.e., School
Community)

Student Inputs → | The System (Mediating Factors) | → Student Outputs *
Financial Inputs → | | → Non-Student Outputs *

*As student and non-student outputs enter the macro-system, they alter to some extent the nature of the external systems and thus by extension the inputs in succeeding stages.

information is unavailable, certain implications can, nonetheless, be drawn from certain data items descriptive of family characteristics.

Financial Inputs

There is a second class of inputs to the system--financial inputs. If we think of a district as a system, then not only do students enter the system, but finances are provided from local, state, and federal sources and are, in part, a means of implementing different sets of mediating factors within the system. Perhaps it is relevant to determine the portion of the total resources, derived from each of the governmental levels. Perhaps, also, it is important to designate the specific authorizations from federal funds or special state programs in order to be aware "of the strings attached" and consequent implications for resource utilization within the system.

If we were concerned with evaluating a part of the system, such as the mathematics program or the guidance program, it would be necessary to determine the nature and amount of the financial input to that portion of the system. Unfortunately, present accounting practices in all states provide data only on functions of expenditures rather than on programs of expenditures--i.e., data are available on a number of factors such as the amount spent for administration, maintenance, operation, instruction, and fixed charges, but these data are not available on a program basis. What is needed, therefore, is a budgeting system that will allow ready

aggregation and disaggregation of funds to provide specific
and total cost data on individual instructional programs. In
short, we need a system of program budgeting.

External Systems

The school is placed within the framework of numerous
social systems (external social contexts). For example, in
the case of the individual school some of the contexts are:
the community, the district, the nature of the district or-
ganization, other governmental systems such as the city, the
county, the patterns of community organizations and of commun-
ity participation. Each of these external systems, by the
nature of the differentiated functions it serves, places sets
of demands and restrictions both upon the educational system
(school) and upon the individuals within the system. Each of
these systems serves specific integrative, adaptive, goal-
attaining, and pattern-maintaining functions in the macro-
system. Consequently, it is necessary to identify and quantify
these external systems characteristics and relationships which
are relevant in terms of the contribution they make towards
producing the educational outputs of the system.

In actuality, the external systems interact with the
educational system. While each of them may be conceived as
having their own inputs, particular sets of mediating vari-
ables, and outputs, they are, in turn, external systems to the
educational system and vice versa. Thus, each system external
to education may, in effect, be considered as both a source
of inputs and a receiver of outputs. In this model, we are

concerned specifically with only two of the inputs to education, financial and student, and will consider the "inputs" from other external systems as control variables. The outputs of the system to external systems are considered as non-student outputs.

Mediating Factors

A fourth group of elements of the evaluation model is what we call the mediating factors. The financial input to a system can be utilized in a great number of ways. We could decrease the student-to-teacher ratio, establish standards which insure the hiring of teachers with specified characteristics, develop different administrative arrangements within the school, provide more library books, provide more textbooks, introduce different curricula, use different instructional procedures, or provide additional supplies.

Thus the variables that we call "mediating" are highly manipulatable--that is, they are subject to change or manipulation by educational decision-makers at all levels. We have no definitive evidence, however, as to which combination of mediating variables is most effective in achieving the objectives of the school (i.e., in producing desired educational outputs).

At this point, it is only fair to indicate that we do not mean to imply that all mediating factors which have impact on educational outputs are related to financial input. Indeed, some mediating factors are "free." For example, the cost of

implementing certain alterations in the school environment or
in the attitudes of teachers may be relatively cost free.
Frequently, the instructional procedure used by the teacher
in the classroom (the substitution of one procedure for an-
other) has little or no additional cost attached to it. How-
ever, some changes in the system are extremely costly (such
as some of the administrative or organizational arrangements
and many instructional procedures which are technologically
based). As a consequence, the potential output achieved by
the change must be examined in terms of the costs involved.

It is a relatively easy position to maintain that
more money should be provided for teacher salaries and that
in this way, in all likelihood, the educational program will
be improved. There is evidence that a relationship exists
between higher teacher salaries and educational quality.
The real question, however, is to what extent a given
dollar input, if utilized in an alternate manner, would
increase the nature of the educational outputs. This is a
cost-effectiveness question and is, after all, one of the
elements at the heart of evaluation or, at the very least,
one of the reasons why we evaluate.

We have noted that the selection of different sets of
mediating factors may lead to the maximization of educational
outputs in a system. There is, though, another point to be
made: not only are there different sets of mediating vari-
ables most applicable for producing given educational outputs,
but, significantly, these sets of mediating variables may

produce quite different levels of change in the educational
outputs in different systems or for different student input
groups. James Coleman observed this point in a study for
the Civil Rights Commission entitled Equality of Educational
Opportunity. He noted that the "inference might then be made
that improving the school of a minority pupil may increase
his achievement more than would improving the school of a
white child increase his. Similarly, the average minority
pupil's achievement may suffer more in a school of low
quality than might the average white pupil's." He concluded
that "this indicates that it is for the most disadvantaged
children that improvements in school quality will make the
most difference in achievement." (Coleman, 1966). Appro-
priate mediating factors, therefore, are a function not
only of the desired educational outputs, but of the nature
of the student inputs and of the given system as well.

As mentioned at the beginning of this paper, the
mediating variables, as we have defined them, are assumed to
be the only set of variables which can be manipulated. (See
page 2.) This is a simplifying assumption, in part, because
it allows us to deal with a static instead of a more complex
dynamic model. Also, it should be noted that the bias implied
by this assumption follows from the basic intent of the model
we are seeking to construct--that is, a decision-making model
or, more specifically, a model designed to aid school admin-
istrators in their day-to-day operations.

Student Outputs

Another set of elements of the evaluation model is the student outputs. Changes take place in students from the time they enter the system to the time they leave, and many of these changes are produced by the nature of the mediating factors within the system. Here, again, there is a problem, for the outputs of a school or of a district cannot simply be measured by the scores of students on academic achievement tests.[3] What are the noncognitive aspects of output? How has the behavior of students changed? What is the relationship between the activities that take place in a district or a school and the eventual success of students in their vocational or future educational endeavors? How does the student's educational experience aid him in dealing with political problems and activities as well as cultural affairs? To what extent does the social situation present in the school, as well as what is learned in classes, affect the student? These are only some of the unanswered questions related to the identification of educational outputs, and, of course, they can be solved only through further research and investigation.

While there are two prime inputs into the system (student and financial), we will consider that there are no direct, financial outputs except as a portion of the student outputs--there are no financial outputs except as we are willing to place financial value on certain behavioral changes or except as student outputs yield financial or economic returns, either individual or societal.[4]

Non-Student Outputs

The final set of elements of the model is the non-student outputs. The two groups of outcome measures (student and non-student) may be thought of as feedback loops in which each modifies, to some extent, the nature of future inputs to the system. The changes in students, for example, have social, political, and economic implications--that is, the very nature of the external systems is altered by changes in student outputs. There are, however, other outputs of the school--the impact of educational decisions made as a part of the "mediating factors" has repercussions in the external systems. Frequently, these outputs are only tangentially related to individual students or to student outputs. For example, the nature of many of the decisions as to the proper utilization of resources may produce innumerable educational outputs not directly student-related. That is, decisions which influence the number and salaries of teachers, as well as the number and salaries of classified personnel, could, in many ways, modify the nature of some external systems, especially if these employees were to reside in the district. To what extent do teachers paid at different salary levels have the economic ability to forego other earnings and instead participate in community activities and organizations? And, how is the nature of these external systems modified by the educational decision that determined the particular combination of mediating factors which allowed greater salaries for the

teachers? Also, how does the type and quality of teachers selected affect the changing nature of the community? Other examples might be the impact upon the economy of the community brought about by the selection of mediating factors which include large capital investment or a large amount of supplies and materials locally purchased. How do the educational decisions related to whether school transportation will be provided, or the hours of school, or the scheduling of student time, in terms not only of regular session classes but with respect to recreational and summer use of school facilities, have implications for parental employment patterns or avocational participation? And, to what extent does the school, as a merchant of facts, knowledge, and ideas, influence community attitudes on political, social, and cultural issues? Finally, although the list could be extended greatly, how does the impact of selection of mediating factors upon the social patterns within the school relate to breaking down or reinforcing patterns within the systems external to the school?

Conclusion

We recognize that it is not possible to isolate every conceivable element of the total system and to determine its value or its individual, contributory relationship to the educational outputs of the system. Nevertheless, it is requisite in any evaluation scheme to identify and control

for as many of the factors as possible thought to be significant. It is true that in discussing each of the sections of this paper, we have asked many questions and, undoubtedly, could have asked countless more; but few answers have been given. This is in keeping with the general intent of the paper. We are primarily attempting to set forth the skeleton of a model that will guide our thinking and research in the years to come, and will probably become vastly expanded in the process. In this case, we are describing what we choose to call a systems approach to evaluation, which has considered within it the full range of systemic problems including those related to input utilization.

FOOTNOTES

1. More specifically, this is a mathematical model which will be used in evaluating instructional programs.

2. Economists would classify inputs to the system in a somewhat different manner: In addition to the above mentioned inputs, they would include teacher resources (including time) and student time. This kind of classification implies a concern for total manpower utilization. On the other hand, while we are concerned with such things as student time, we are taking as a prime consideration the decisional requirements of individual educational administrators at the local level. Thus, the model discussed is more an education-decision model than a total manpower model.

3. We would readily admit, however, and to the chagrin of many reluctant school administrators, that at least this measure would be a feasible starting point.

4. There is evidence that this is a reasonable approach. See: Becker (1962), Miller (1962), and Schultz (1961).

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