EDUCATIONAL PLANNING

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The journal prints articles on the theory and practice of educational planning, case histories, and articles from related specialties (economics of education, sociology of education, demography, town planning, institutional research, operations research, educational research, and applied mathematics) which are of interest to educational planners.

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EDUCATIONAL PLANNING

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EDUCATIONAL NEEDS ASSESSMENT:
THE STATE OF THE ART

Introduction

Needs assessment as an activity designed to establish goals and set priorities for educational programs has been a part of the planning process for public education in the United States for the past decade. Recently there has been an upsurge of interest in methods of carrying out needs assessments. The papers which follow are based upon speeches and panel discussions given at a national conference which was held in Oakland, California, April 7-9, 1976. They set forth some of the issues of concern to planners as well as to administrators charged with implementing needs assessment strategies.

In this context a "need" is commonly defined as "the measurable discrepancy between current outcomes and desired outcomes, "or between what is and what should be, or what is required", or between "present conditions and desired conditions". Needs assessment is the systematic procedure for determining important discrepancies in an educational system, setting levels of criticality, and establishing priorities for the allocation of re-sources. Either the needs of the learner or those of the institution may be assessed. This is a specialized use of "need" and is not to be confused with common uses of the term. For example, we say, "What students need is better reading instruction" or "Parents and teachers need to communicate more effectively". In such statements, "need" may be the solution to, or a symptom of, a problem. Other common uses refer to needs in the sense of physiological or psychological requirements of an individual for survival (or for satisfaction), as in Maslow's hierarchy of needs. None of these usages adequately conveys the sense of the term as it has come to be used in educational needs assessment.

Several issues and ambiguities arise from the nature of the assessment to be made. Essentially, the process consists of establishing a set of desired conditions or outcomes for an educational system, gathering data on the current state of affairs regarding these desir-ed outcomes, measuring the discrepancies between the two sets of information, and deciding as to which areas shall receive the most (or the first) attention when planning new programs or modifying programs. There are many problems to be solved at each of these stages. For example. Who should define the desired conditions and by what methods? What kinds of data should be gathered on their current state? How should discrepancies be measured? When is a discrepancy critical? What rules should be used for deciding upon priorities? Should data be gathered about conditions for which the educa-tional system clearly does not have the resources to make changes? Should data be gathered where there is no intention to make changes?

The present interest in assessing needs in education in the United States dates from the passage of the Elementary and Secondary Education Act of 1965. It provided funds for local school districts to institute programs of compensatory education for disadvantaged youth, incentives to develop innovative programs and categorical funds for the handi-

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capped and for bilingual programs, among others. All of these required comprehensive needs assessment, either to justify the request for funds (as in Title III, innovative programs, which are awarded competitively) or to establish program direction and priorities (as in Title I, in which funds are awarded to districts on the basis of their socio-economic status and the numbers of disadvantaged youth enrolled in schools). In addition, ESEA established regional educational centres and laboratories, and provided funds to improve the operation of state educational agencies. Both the labs and the state agencies have developed instruments for assessing educational needs and have contributed to the growing body of knowledge regarding educational priorities in school systems. Instruments and techniques developed within several contexts: a system analysis framework, the accountability movement, management information systems, evaluation, and the design of special projects. Specific procedures for needs assessment appeared first in local or regional educational agencies charged with doing a comprehensive assessment of their schools in order to establish priorities for innovative or remedial programs. Since 1969, state educational agencies have received substantial grants to develop planning models, carry out statewide assessments, and assist local districts in implementing general models. More recently, under Title III of the Higher Education Act, community colleges have received funds to develop models and to conduct comprehensive studies. Many universities have undertaken similar studies.

The studies generally involve at least three constituencies: educators, students, and the community. To the extent that school systems invite their community to express its concerns, values, and needs, the assessment often becomes a powerful political tool – one which may be favourable or unfavourable to the educational establishment. The very fact that parents, for example, are asked to give their views on educational goals and help establish program priorities may arouse expectations which cannot be fulfilled. The process sometimes holds a district up to public scrutiny for the first time. College and university studies look to employer and community expectations rather than student performance for their data base.

Most people who have written about needs assessment agree that a complete discrepancy model should include the following components:

- A set of goals, outcomes, objectives, or conditions which are rated for relative importance. This is the most commonly used method of describing "what should be". The sources for goals are many. Publishers of needs assessment kits generally offer a list. School systems spend considerable time generating their own list, one which fits their student body, the values of parents and of their community.

- Procedures for determining the perceived or actual status of these goals in the system.

- Procedures for identifying, describing, and analyzing the discrepancy between the goals and the present.

- Methods for assigning priorities to these discrepancies for the purpose of program planning. (This step may or may not include decision rules.)

The sources for opinions on the importance of goals and on perceived attainment are teachers, parents, and (sometimes) students; administrators, members of boards of education, the business community and the general public. Data may be gathered through public opinion polls, written surveys or check lists, or various kinds of interactive group processes. In addition, other types of data may be used to describe the present status: achievement tests, self-reports, social indicators, and demographic data. This process may

take as little as 2-4 weeks and incur negligible expenses, or last as long as a year and cost thousands of dollars. In addition to the general discrepancy model, other techniques used are Delphi studies, futuring, fault tree analysis, and critical incident.[1]

The complexity of the management of the assessment depends upon the importance the system ascribes to its findings and intention to act upon its data. Usually committees are appointed to carry out the various functions. Since many school systems in the U.S. have no person or department devoted to planning, the management responsibility for the assessment frequently is assigned to the assistant superintendent for instruction, the director of research, or a small committee of middle management and instructional staff. Where a comprehensive needs assessment is undertaken to establish the priorities for long-range planning, the report generally goes to the board of education. If the board takes its findings seriously, other committees may then be established to delineate the program objectives for high priority areas, and outline the activities and steps for implementation. Unfortunately, many reports are not taken seriously; they merely gather dust on the shelves.

Background of the Conference Papers

In spite of the widespread discussion about educational needs assessment and the proliferation of models, kits, and off-the-shelf instruments, until recently there had been little critical analysis of its procedures, strengths and weaknesses. In 1974 the New Jersey State Department of Education issued a handbook on needs assessment as one in their series of educational planning booklets.[2] In 1972 Kaufman had also placed needs assessment within the context of educational planning, identifying several generic strategies and proposing a model.[3] In 1976 the Florida Educational Research Council compiled an annotated bibliography on the subject,[4] and the analytical study of Witkin has already been referred to. By 1975, therefore, these authors and other planners actively engaged in needs assessment work felt it was time to consider a national conference which would disseminate information on the state of the art, demonstrate a variety of models and techniques, raise issues, and provide an opportunity for educators to consult with needs assessment experts. The Alameda County Schools Office was host and the conference was co-sponsored by it, the National Institute of Education, and the International Society of Educational Planners.

State of the Art

In the past four or five years, there has been considerable development of instruments and procedures and in some cases these have been field tested for utility and acceptability, but there has been almost no research on the technical aspects of needs assessment, and little attempt to evaluate for reliability and validity. Instruments and procedures which follow the general model outlined above borrow heavily from one or two sources and use rather simplistic methods to define priorities. There has been no empirical demonstration of the superiority of one approach over another, and little effort to discover whether the assessment has revealed previously unknown needs or simply reflects some what superficial perceptions of current concerns.

There appears to be an inverse ratio between a model's sophistication and 'completeness' and its widespread acceptance and implementation. Models with complex (and possibly more valid) decision rules are not as popular as simple goal rating surveys or

group card-sort activities. The surveys rely heavily on respondents' global judgments about schools without furnishing the data on which such judgments might be based. Test scores and other types of statistical data are often recommended, but guidelines are seldom given on how the subjective and objective data should be integrated to determine program priorities.

Most models are exclusively oriented to the present. They overlook the emerging or future needs essential for a long-range planning perspective. Many do not show how the educator is expected to use the data on critical needs to improve the system's planning or evaluation capability. Often symptoms, causes, and solutions are confused — especially in the open-ended or non-goal-based models. Sometimes "needs" are confused with wishes, goals and solutions, and the goals of the learners and institutions commingled indiscriminately.

Needs Assessment and Planning

Inspite of such imperfections the use of some type of needs assessment is increasing. They appear to be of two major types:

1. Those which are expected to provide input for the development or modification of a master plan. Many local school districts, and colleges and universities, use some method to attain community consensus on goals. Sometimes the needs assessment goes no further than obtaining agreement from a group of reference persons on broadly stated goals which are intended to guide curriculum development. In other instances, the assessment includes the gathering and analysis of several kinds of performance data, opinions on educational values and perceived attainment, and some analysis of issues as stated by educators, students, and the larger community. In such an effort, committees generally conduct the assessment, analyze the data, write the curricular objectives, and develop a written master plan.

2. Those required to support applications for funds. Although these plans may be called comprehensive generally they differ from those in the first category; they fall under fairly structured regulations, are limited to specific aspects of the school program, and typically restrict themselves to showing the need for basic skills and certain support services. Performance and survey data are gathered for a few specific instructional areas, and the information is used by school committees to set specific program objectives and describe activities which will address themselves to reducing the largest discrepancies between present and desired performance. Thus, the needs assessment becomes an integral part of the program plan, and may be later used to guide the evaluation of the program. Indeed the evaluation of one year's experience may supply data useful to the assessment of the following year.

Needs Assessment and Evaluation

To the extent that a needs assessment uses test data and similar indicators to establish levels of student performance, it is similar to evaluation. Indeed, the evaluation becomes part of the needs assessment data. The Center for the Study of Evaluation of the University of California at Los Angeles views needs assessment as an integral part of the evaluation process rather than evaluation as a part of the needs assessment process. There are basic differences. Needs assessment is forward looking; evaluation usually looks to the past. Needs assessment asks, "How good *should* a program be?" Evaluation asks, "How

good *was* a program?" The decision to continue a program, modify or abandon it may be based upon evaluation data. But needs assessment data are primarily intended to set priorities for programs or program modifications for the future. A needs assessment tends to be broad, evaluation usually is more specific.

There were two general sessions at the conference. Baker's paper (which unfortunately could not be revised in time for inclusion in this issue) set the theme. Drawing upon several years of needs assessment development at the Center for the Study of Evaluation, of which she is director, she pointed out issues of semantics, of style over content, the dangers inherent in applying a new technology without understanding its purposes, and of schools raising expectations they cannot or will not meet. The Hershkowitz paper on critical issues is an expansion on points he made in lighter vein in one of the panel discussions. He sees as a central problem the conversion of management information needs to management data needs and the setting of priorities on identified, critical learner needs. Drawing upon his background in operations research and his experience in conducting large scale regional assessments, he points out that priorities have too often been set by resorting to political, judicial or institutional rules. Instead he proposes an analytical rule by which a *critical function* may be derived.

Included here are brief statements from the other two members of that panel. Bender, from the viewpoint of a university professor who has worked extensively with community groups, discusses why needs assessments are done, and the uses and abuses of their findings. He also challenges the notion that educational goals should be set by consensus. English speaks from the perspective of a school superintendent who has undertaken needs assessments in several school systems, and has written and taught extensively on the subject. He raises political issues dealing with the context in which school boards make decisions. He questions whether we have the right models for actively involving various educational and community groups in this decision making.

Through all these statements there emerges an issue of increasing concern to educational planners in the United States: Is it in the best interests of students and of realizing educational quality to involve the larger community so actively in setting goals and priorities for school program planning? Should not educators take the responsibility for making educational decisions? Is needs assessment just window dressing, or are school authorities serious about using its results?

One final issue which was raised during the conference deserves attention: Often parents and the general public hold school authorities accountable, not for what is presently going on in schools but for what they remember went on twenty years ago, or what they imagine goes on as described in newspapers.

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2. Bernard A. Kaplan, *Needs Assessment in Education.* A Planning Handbook for School Districts. Trenton, New Jersey: Department of Education, Bureau of Planning, February, 1974.

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Martin Hershkowitz*

CRITICAL ISSUES IN EDUCATIONAL NEEDS ASSESSMENT

Introduction

The number of critical issues in educational needs assessment is exceeded only by the number of persons studying the issues. Issues, however, tend to be grouped into two major classes, learner needs and administrator needs. The former are related to educational deficiency, the latter to educational accountability. If the former indicates the discrepancy between 'what is' and 'what should be' or the 'gap between an educational objective and outcome in terms of performance' within the system, then the latter indicates, through 'disclosure' and 'redress', the extent to which the system is reducing the goal-gaps.

On the surface the differences between learner needs and administrator needs, between educational deficiency and educational accountability appear to be clear and operational. However, after extended study they become unclear; areas merge and overlap; one becomes concerned with the difference between outcome accountability and transactional accountability, and with their respective measures of product evaluation and process evaluation. Consider, instead, the possibility that a filter exists which would obscrue these issues of educational philosophy and expose other issues pertinent to needs assessment. Then, the underlying critical issues may be expressed as (1) the need to have definite measures of goal-gap that are indicative of the remedial measures of correction and (2) the need to have priorities among educational and administrative needs.

Articulating Needs

In the United States administrators in education, as in other areas of public service, are oriented towards accountability. It is not sufficient to identify a deficiency. The identification should be so precise as to indicate the program, the implementor and the direction for remediation. For example, merely "identifying the ability to apply knowledge and skills to the solution of real-life problems" as a critical educational need offers no direction for preparing a program to resolve the need. This becomes painfully obvious as the need increases from subject matter goals to complex higher-order goals.

The Maryland study of 1972[1] attempted to gain insight into how to construct an educational program to resolve an assessed need, by obtaining information on school processes surrounding the student-teacher interaction and on educational issues in the school-community milieu. The following are examples from the instrument used to gain the information.

- Teachers of related subjects work together in developing and conducting their courses (always......never)
- The emphasis on learning facts is (too much......too little)
- Discipline problems in the school are (serious......not serious)
- The emphasis placed on the social development of the student is (satisfactory...... unsatisfactory)

Consultant, Maryland Needs Assessment Program.

- Community participation in school planning, setting goals, and making policies and programs should be (greater......less)
- Schools should be opened on a year around basis rather than on a 9-month basis (strongly agree......strongly disagree)
- Schools should provide courses in the methods of effecting political change (strongly agree......strongly disagree)

Unfortunately, there was little direct connection between the goal statement, which yielded the need, and the school process and educational issue statements, which were expected to give guidance on remedying the needs.

The Appalachian Maryland study of 1973[2] gained from the statewide assessment experience. Educational goals were chosen for a community educational television network whose remediation programs were to serve disadvantaged families. The families, by definition, were those whose income was within 125% of the established poverty level income for the area. The examples below are from the most important goals:

- Helping my children do better in school
- Smart food buying
- What am I buying
- Family health

Questions on process involved TV viewing habits, the easiest way of learning ideas and facts, the format preferred for an ETV show, the length of a show, study area interests, and the level of formal education of each member of the family. The information gained from the study yielded considerable knowledge about ETV program content and format which would be useful for resolving the assessed needs.

There is no difficulty in articulating a need at the level of a goal statement, any educator worth his experience and training should be able to do that and the community will be happy to assist. However, as the Maryland programs demonstrate, it is most difficult to articulate needs so that they may be resolved. Thus, a critical issue in educational needs assessment is not so much that of articulating learner needs, but of articulating them in a manner to resolve administrator needs. Administrator needs (with respect to learner needs) are in the realm of accountability. An administrator retains his credibility only when he can convert information about a goal-gap to the specific data which he can use to reduce the gap. In the terms of the information scientist, this can be expressed as a *management information need* and a *management data need*. The former is an information requirement with respect to some problem, the latter relates to the specific information required to examine, understand and resolve the problem.

Consider the management information requirement inherent in the question: "Will our school plant support next year's student-teacher-administrator population?" Converting this to a data need would yield such needed items as:

- Number of classrooms in the system
- Student capacity in each classroom
- Distribution of classrooms among school buildings
- Number of administrative non-classroom spaces among school buildings
- Number of new buildings and/or classrooms to be added into the inventory in the coming years

- Number of buildings and/or classrooms to be removed from the inventory each year hence
- Projection of students by grade each year hence
- Estimated distribution of teachers by grade and discipline each year hence

By applying an appropriate formula to these data the reply to the question is obtained. An affirmative response allows the administrator to go to the next information need; a negative response allows the administrator to examine the data and experiment with selected values (i.e., increasing or decreasing) until an affirmative response is obtained. Then he can establish a program of hiring/firing teachers, adding/deleting rooms in the inventory, etc., in order to achieve an affirmative response in reality.

The example of fitting measurable data on physical plant inventory and estimatable data on the student-teacher-administrator population to a logically constructed mathematical function is pleasant to contemplate. It is neat, manageable and above all solvable. Let us suppose, however, that the data are not obtainable, that there are several totally different procedures for estimating them, that there is no logical mathematical function for combining them into a single, manageable response. How then is the information need resolved?

Let us consider a typical educational information need: "How well are the students in this state performing in reading, mathematics, science, social studies, language arts – what is the gap between their performance and the state goals for such performance – what is the intellectual capacity of the students?" Three categories of data are called for: a model of the statewide performance in each subject area (by grade, by region or by local education authority); a set of instruments for measuring current performance and a procedure for assessing goal-gaps; and an instrument for determining intellectual capacity. Maryland tried to answer these questions by collecting IQ and standardized achievement test scores from each of its 24 school systems. Table 1 displays the distribution of instruments used by these independent school systems. Note that the most common are the Iowa Test of Basic Skills (19 of the 24), the Iowa Test of Educational Development (7 of the 24), the Lorge-Thorndike (11) and the California Aptitude Test (6). Also note that two of the systems gave no standardized achievement test, while twelve systems used 2 instruments, and all twenty-four gave them some IQ test, while three systems used 2 such instruments. Not only was there no common test device, not all systems using the same instrument used all of its sub-tests, some systems employed the test(s) on different grades, some employed them at different times during the school year. And there were other less definable discrepancies. The lack of universal assessment data is astonishing. Maryland since has taken steps to resolve this problem by standardizing selected testing throughout the state.

Faced with similar problems, some state education agencies implement a statewide testing program in advance of their needs assessment study, using existing standardized instruments or constructing their own tests of cognitive skills.[3] However, even with such a centralized testing program disquiet is expressed by the educational research community. Popham[4] raises serious questions about the meaningfulness of standardized tests. Carver[5] agrees with him about psychometric tests, but urges *edumetric* testing through standardizing criterion-referenced tests. Many states, following Maryland's example, are now collecting perceptual data on goal attainment by asking each of the groups involved, "In your opinion, to what extent is this educational goal being attained? (Great degree ...... Not at all)."

Table 1   IQ AND STANDARDIZED ACHIEVEMENT TESTS EMPLOYED BY THE
24 LOCAL EDUCATION AGENCIES

LOCAL SCHOOL SYSTEM	IQ TESTS					ACHIEVEMENT TESTS			
	California Aptitude Test	Cattell Culture Fair	California Test for Mental Maturity	Lorge-Thorndike	Otis-Lennon	Iowa Test of Basic Skills	Iowa Test of Educational Development	Metropolitan Achievement Test	Test of Academic Progress
1	X				X	X			X
2				X		X	X		
3			X			X			
4			X					X	
5				X		X			
6				X		X			
7				X		X	X		
8	X			X		X	X		
9			X			X			
10					X			X	
11	X					X			X
12					X	X			
13				X		X			X
14				X		X	X		
15				X		X			X
16	X			X		X	X		
17				X		X	X		
18				X			X	X	
19			X			X			
20	X					X			X
21	X					X			X
22			X						
23		X							
24					X	X			

Source: G.E. Fox and M. Hershkowitz, "Management Information Systems Development For a State Department of Education", TR No. 01722-01-2, Silver Springs, Md: Vitro Laboratories, 1972.

Arranging the Needs in Priority

Education, like other areas of public service, suffers from constrained resources. There is never enough money, time or space to try *every* approach that might remedy a learner's deficiencies. It is not even possible to try *one* approach to somewhat mitigate every learner deficiency. So, it becomes necessary to allocate available resources to get 'more bang for the buck'. In other words the administrator must establish some rule through which a ranked list can be established for funding and implementing proposed educational programs. Such a list is sometimes referred to as an n-program list, where only the first "n" programs are funded or implemented, and the size of "n" is a function of the budget and other resource constraints.

There may be a number of different rules for establishing an n-program list: political, judicial, intuitional, or analytical. The first three are easy to address. In the political rule the Board of Education, in its infinite wisdom, establishes a set of goals, and the administrators and curriculum specialists prepare sets of programs to achieve them. If the budget cannot support all these programs, other programs are sacrificed. The judicial rule recently has become associated with court-ordered integration, but has been applied both to implement and discontinue specific activities. A judicially-ordered program has budget priority regardless of how critical an educational need it represents. The intuition rule is the least desirable procedure for ranking educational priorities. In this situation a prestigious individual or a local community group, by its lobby, pressures the school system into establishing a particular 'desirable' program regardless of its proven educational importance or its impact on the budget.

The analytical rule is the best one for an educational needs assessment — it is a scientific approach to defining the goal-gap and establishing the priority ranking of critical goal-gaps. Indeed, the procedure developed as an analytical rule should properly be thought of as a criticality function. Typically the criticality function has two components: importance of the goal and extent to which it is currently being attained. Goal importance is usually obtained through a survey where the respondent checks off his or her perceptions of the importance of an item on a scale with finite, uniformly-spaced decision points (five or seven categories including the endpoints). Extent of goal attainment is obtained from a universally applied achievement test. However, because there are so few higher order goals for which a valid and reliable instrument exists and because of controversy surrounding psychometric, criterion-referenced and edumetric testing devices. this is not always possible. Therefore extent of goal attainment is usually obtained by a survey in which the respondent checks off his or her perceptions of goal attainment on a scale. In the event of mixed modes for obtaining goal attainment, the values obtained from an achievement test can be converted (with some loss of precision) into the scale used in the survey.

The criticality function can then be constructed in a direct and simple manner. A complex, over-sophisticated function is not necessarily an improvement on a simple one. It can fail because the assumptions needed to make it work are not realistic. Perhaps the best test for determining the appropriate complexity of a criticality function is to present it to a group of educators, students and parents. If they cannot understand and appreciate it, do not use it. The following are examples of the criticality function:

● The New Jersey educational needs assessment employed a two component criticality function similar to the one discussed above, but with both parameters measured on a

scale of percent of respondents. The percent of total public who rate each goal 'very important' was selected as the importance measure, and the percent who rate public schools 'excellent' or 'good' on each goal as the attainment measure. By adopting 60% as the threshold between importance and less importance, and 40% between satisfactory and unsatisfactory performance, the criticality function selected New Jersey's critical needs to be those goals where more than 60% of the public agreed on the item's importance and less than 40% that the school's performance was at least 'good'. Figure 1 displays this criticality function as Model A, with brief instructions for its use.

Figure 1   CRITICALITY FUNCTION – MODEL A

Percent of respondents
rating a goal "very important"

GOAL IMPORTANCE
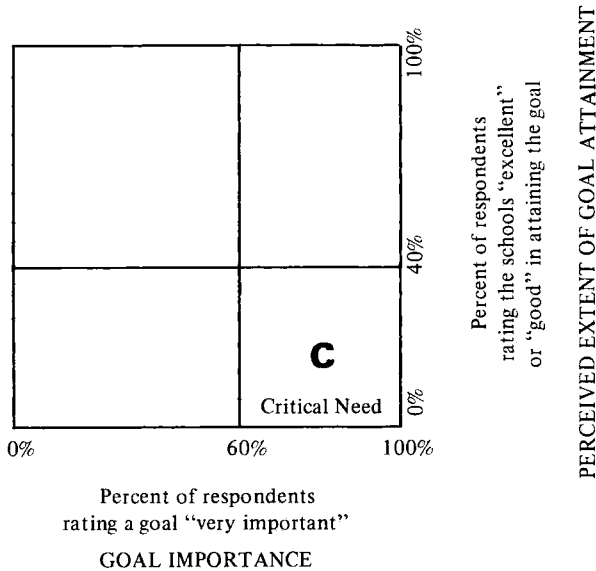
INSTRUCTIONS

- Plot the percent of respondents rating the goal "very important" – percent of respondents rating the schools "excellent" or "good" in attaining the goal coordinates for each goal.
- Repeat the above for each goal.
- Any goal whose importance-attainment coordinates are above 60% on importance and below 40% on attainment (in the critical need quadrant) is a critical need.

● The Maryland educational needs assessment employed a two component criticality function, with importance measured on a five-point scale from 'not at all' to 'very', and attainment measured on a five-point scale from 'not at all' to 'a great degree'. At this point Maryland added a degree of sophistication by recognizing that each identified group (Maryland identified 10 distinct respondent groups) tended to display distinct response patterns (i.e., teachers to rate each goal higher than other respondent groups, business men tend to rate each goal lower than other respondent groups). In order to be able to consider all the responses with equal emphasis it was decided not to use an arbitrary threshold common to all respondents, but to employ a distinct one for each group. By adopting the mean response over all goals as the threshold for each group, Maryland's criticality function selected as the critical needs for each group those goals where the average group

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response on importance was greater than the group's mean importance rating over all the goals; and their average group response on attainment was less than, or equal to, the group's mean attainment rating over all the goals. A second degree of sophistication was added when the critical needs for the individual groups were brought together as Maryland's critical needs. The critical needs for each respondent group had been filtered so that idiosyncratic group rating patterns were no longer a factor. Each group's critical needs were indeed its own. The criticality function selected Maryland's critical needs to be those goals where at least five of the 10 groups agreed on criticality; the most critical needs were those where at least nine of the ten were agreed. Figure 2 displays this criticality function as Model B, with brief instructions.
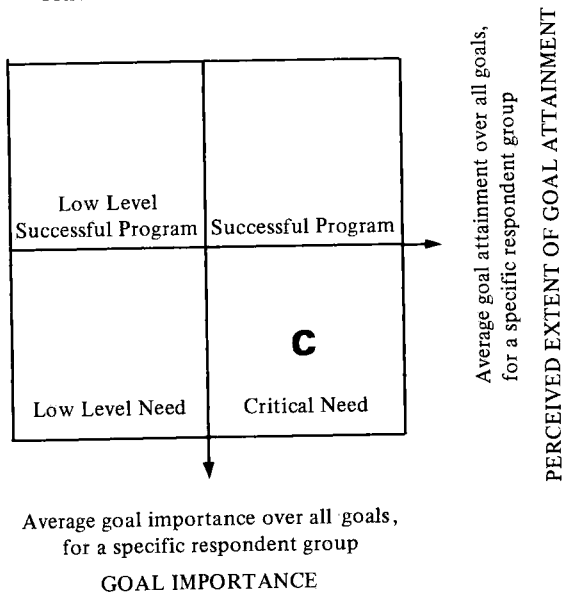
Figure 2   CRITICALITY FUNCTION – MODEL B

Average goal importance over all goals,
for a specific respondent group

GOAL IMPORTANCE

Educational Goals	Respondent Groups					
	A	B	C	. .	.	N
Goal 1	X	X	X	. .	.	X
Goal 2	X			. .	.	
.		.	.		.	.
.		.	.		.	.
.		.	.		.	.
Goal n		X	X	. .	.	X

INSTRUCTIONS
- Plot the respondent group's mean 'goal importance-goal attainment' score coordinates for each goal.
- Enter an X in the table for that respondent group   for each goal whose mean importance-attainment coordinates are above the group overall average on importance and are at, or below, the group overall average on perceived attainment (in the critical need quadrant).
- Repeat both of the above for each respondent group.
- Any goal with an X for at least half of the respondent groups is a critical need for the system. It is a most critical need if 90% of the respondent groups agree that it is a critical need.

● The 'elementary school evaluation kit: needs assessment' of the Center for the Study of Evaluation at the University of California, Los Angeles, employs a three-component criticality function with importance measured on a scale of perception, attainment measured by performance on standardized tests directly related to the goals and then corrected for selected local conditions, and probable increase in utility measured by the utility of improving student performance and probability of improving student perform-ance. CSE calls their criticality function a "priority value" and computes it as follows:

Priority Value = Rated Importance x Probable Increase in Utility.

Figure 3 displays this equation as criticality function Model C. with a brief discussion of its use.

Figure 3   CRITICALITY FUNCTION – MODEL C

Priority Value
= Rated importance x probable increase in utility

(I_o, U_{max}, P_o)

$\downarrow (I_o, U_o, P_o)$ $(I_{max}, U_{max}, P_{max})$ $\downarrow$

Probable increase in utility

$\leftarrow (I_{max}, U_o, P_o)$

Rated importance
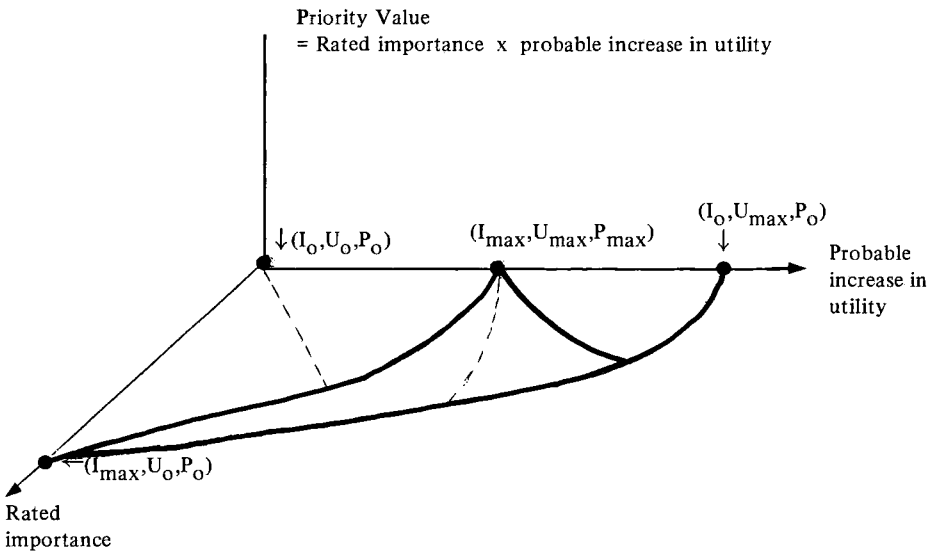
INSTRUCTIONS

    "Probable increase in utility" is some function of "measured performance", "utility of improving performance and "probability of improving performance". It is a complex procedure which does not lend itself to the simplicity of a chart-graph as do the criticality functions of Models A and B. However, since a value can be derived for it by a sequence of operations, the coordinates rated importance-probable increase in utility priority-value (I,U,P) can be plotted for each goal. The goals which are plotted on the surface rising rapidly toward the point $(I_{max}, U_{max}, P_{max})$ are critical needs.

    The surface appears to be one half of Osgood's transfer and retroaction surface.

    Most other models determine criticality of need by relying on a simple mathematical (often purely arithmetical) discrepancy between ratings of importance and attainment. Some improve this by substituting measured performance for rated attainment, by separating respondent groups and accounting for their idiosyncratic rating patterns, by merging separate group needs into a system need through a high level of agreement, or by factoring-in the concept of utility of improvement and probability of improvement. Again, a paradox is encountered: the criticality function must take into account more

than just the simple discrepancy between goal importance and goal attainment, and yet the more complex the function becomes the greater the risk that the underlying assumptions will fail reality. Another critical issue in educational needs assessment, therefore, is how to assign priorities among identified critical learner needs.

Conclusion

Underlying the critical educational issues of educational needs assessment are a number of non-educational technical issues which tend to dominate its potential. Two such issues were identified in this paper: converting an information need into a measurable data need, and assigning the priorities to identified critical learner needs. Overriding these, however, is one other issue which is seldom referred to. It is neither educational nor technical, but it dominates the entire subject of educational needs assessment and educational accountability. It is the question of educational leadership in formulating meaningful *programs* to meet the critical learner needs after they have been agreed upon.

Let us assume that educational needs assessment models can be constructed well, that all aspects of education can be measured and the measures formulated into an information need response, that critical learner needs can be assessed and ranked in agreed priorities. With all this in hand, what will be the response to the traditional question, "Where do we go from here?" This is not an idle question. The Maryland State Educational Needs Assessment study yielded data which led to this very question. Consider the paradox arising from a needs assessment which yielded as a critical need the "Ability to apply knowledge and skills to the solution of real life problems", and which simultaneously assigned least importance to educational subject matter goals. This is a situation calling for the most adroit and persuasive educational leadership if the credibility of the system is to emerge intact. A brief note included in this issue describes the above paradox as it was revealed in the Maryland study.

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Fenwick English*

STATEMENT MADE ON THE PANEL ON CRITICAL ISSUES: NEEDS ASSESSMENT CONFERENCE

For ten or twelve minutes I shall touch on the "why" of needs assessment. I shall assume that you have read about needs assessment and understand what it involves. In that short time I can perhaps deal with some general concerns and raise some issues about needs assessment as a process carried on in a school system. I am basically a practitioner and I speak from that point of view. I've carried out needs assessment in four different states, in four different ways. Each state seems to have had a peculiar set of characteristics which required a different approach. New York state, where I am now, certainly requires a unique approach. It is highly unionized; it presents some difficulties which I did not experience in Florida or Arizona. All of my comments pertain to my field experience. They are grouped into three broad categories: the first includes the practical, political kinds of problem; the second consists of the union phenomena   teacher unions, unions in general. The third is made up of general kinds of comment.

It is *nice* when your system is growing, to have a set of priorities provided from a needs assessment; but it is almost *imperative* to have a set when your system is shrinking — when, for example, you are in a position like that of Westchester: losing state aid, enrollment declining and tax base being seriously eroded. We have had to make staff cuts annually in recent years. This becomes a matter of deciding which programs to cut. During the past three weeks we mailed out our first survey, asking the community to help us rank some educational goals and provide us with some feedback on goal indicators in order to make program priority decisions. One respondent replied, "When I deal with my children, sometimes they ask me what is more important, my heart or my liver. I sort of felt that way in ranking these goals". When a school system is shrinking and cutting programs, the board and the superintendent feel exactly the same. Should cuts be made in art, music, physical education, mathematics or English — and at what grade levels? When you ask such questions you are touching people, particularly kids, in a very direct hands-on way. If we had an agreed set of priorities perhaps we could contract the system more rationally, more logically, using some criteria other than (say) seniority. An uncontroversial, easy way out would certainly be welcome. There is one other difficulty in a shrinking system which is facing a needs assessment: unions are fearful about their members becoming involved in goal ranking. They think the data will be used to whack out teachers or decide which programs are to go. So there will be resistance to participation and a lack of cooperation.

The first general problem that I have encountered is political. It has to do primarily with lack of continuity and the need for continuity in your key group, your board. The Hastings Board experiences a good deal of turnover. Most school boards do today. The problem of continuity also emerges in dealing with the professional staff. They must at least be permanent enough to get into your curriculum and program and make legitimate

changes. There is a need for continuity in your data base, your information system, too. If you have a feedback loop, you will pick up reforms year by year, as you meet some needs and make some successful changes, and as the community sees the goals and priorities change. But you must keep some stability and continuity in your data base; it must not move too rapidly because it will be used as a reference as you revise your curriculum, look at your management structure, etc. As your board changes, new members will come on with different levels of knowledge about education, and also with different commitment to the needs assessment process. So while you are building up a reservoir of experience and excitement about needs assessment as a process, you may well find that you lose half your board; then you have to go back and re-educate. You will find that some people become involved in the process not because they are persuaded of the value of a needs assessment, but because the community has elected them. They feel they already *know* what the needs are. They are all set to begin implementing whatever their particular pet program is.

The process engenders a good deal of hostility. This is the second general problem you will encounter. And the hostility does not necessarily lessen as the needs assessment study progresses. It may increase. Often there is cynicism, particularly on the part of the teaching staff. You must disavow that needs assessment *is* innovation, and argue that it is more a way to determine whether you *should* innovate.

And having spent all this time on the needs assessment, trying to ensure that it will proceed without too much disruption or hostility, what guarantee is there that the board will not just throw it all out anyway? There is a very real difficulty in getting the decision-makers in authority to commit themselves to act upon the information which is gathered by a school system, gathered through surveys or whatever the approach used. One of the ways to cope with that is to get a very broad-based involvement – of staff, students, parents and community. The broader the reference groups the greater the momentum and the harder the board will find it to disregard the results, however they were gathered. I have some concern about simply going out into the community and using the Phi Delta Kappa approach or something similar wherein small groups of citizens do the goal ranking. Board members will be less impressed with small groups than they would be by goals supported by large groups. This is a political problem. And getting a large percentage of the community interests involved has its costs.

How this is done is important. In most fields, and education is no exception – particularly in needs assessment and planning – a good deal of professional jargon is used which the layman does not understand. It merely arouses his irration and hostility. We have found that any survey going to the public must be de-jargonized. We sift it through several citizen groups. Words like "positive self-concept", which educators use a lot, mean nothing to the layman. They have to be translated into something vague and simple like "We want the student to feel good about himself". But when we do that we are criticized because the survey instrument is "too general, too vague". So we're damned if we do and damned if we don't.

The surveying has tremendous logistics problems which I do not believe anyone has resolved really well. There are problems of the stability of the findings, problems about the sample, about the representation of various groups of respondents, about groups which are less articulate, less verbal, less likely to understand what is required, less involved with schools, less likely to return surveys etc.

A needs assessment is both distributive and integrative. It is integrative in the sense that it will bring resources together in different combinations as school systems act upon the information gathered. It is distributive in that it is the basis for policies which will redistribute the resources of the system. Insofar as it is successful in redistribution it will most assuredly lead to conflict with the unions. Conflict is inevitable, I think, and we have not really addressed ourselves to this sufficiently. There is a great deal of resistance to acting upon the information drawn from your needs assessment. To do so you must use the school system to close the identified "gaps". This means that resources must be taken from current programs to serve only certain specified student clients. The groups which will lose are those which have a vested interest in the status quo. If any changes are permitted these groups will try to ensure that the changes are very few and unimportant. The best guardians of the status quo are the unions. All systems, however small, these days are plagued with unions. We have 150 employees in the Hastings School System. It is a very small one. I deal with four unions: a teachers', principals', custodians', and a secretaries'. All have written contracts governing their working conditions etc. All have their own attorneys and can take a grievance to binding arbitration. These represent serious constraints on one's freedom of action.

One of the serious problems educators face after we receive back the survey from the community is that neither staff nor citizens think of schools as *means* to ends. They think of them as ends in themselves. So when you ask the community (even the staff) what the school should do in terms of learner outcomes, you are asking a strange and unexpected question. That is not the way the average citizen thinks about schools. He thinks of schools in a normative sense. Or in terms of activities. He thinks about what should go on in schools, schedules and timetables, lessons and teaching, not what skills and attitudes the youngsters should have by the time they leave school. He cannot easily see the precise relationship between what activities he thinks should occur and what end product he thinks he wants. That is not surprising. We educators also experience some difficulty in describing the relationship between educational "ends and means".

According to the Phi Delta Kappa poll, the problems of U.S. education may be summed up as "discipline, and the three Rs". It is more common to talk about what should be *taught* than what should be *learned*. Even the staff become impatient with detailed discussion of goals and outcomes. They want to plunge immediately into discussion of curriculum and programs.

One last comment: Needs assessment is a process which, in my experience, is too lengthy. To do it properly takes too long. I am aware that we can "cut corners", but I don't think anyone yet knows how to shorten the process well. It will take the Hastings system about two years to go through the process of creating the yardsticks to do the assessment, collecting the data, and working it into the activities which will enable us to revise curriculum, staffing, time schedules, etc., as a means of "closing the gaps". After one year in Hastings I had a board of seven persons, only three of whom were part of the board which brought me to Hastings. At the end of this my second year, there will be only one of the original board left. And yet we have a very stable community. Sometimes I wonder what conditions must be like in other communities which are not so stable politically. Because of the problem of political continuity we tried to compress the process—do two things at a time, instead of one as had been done before. We are trying to get the educational goals ranked and, at the same time, get community feedback on the goal indicators (ask whether respondents agree or disagree with using various means

to assess certain goals). Although we have spent an enormous amount of time on this excercise the citizens are finding it extremely difficult. There must be a way to shorten the process. I just do not believe that many school systems, in their current state, can afford to have two years go by from the initial discussion of goals and priorities to the development of new programs and revised curricula.

Albert E. Bender*

STATEMENT MADE ON THE PANEL ON CRITICAL ISSUES: NEEDS ASSESSMENT CONFERENCE

Why do we do needs assessments? One of the first, and frequently the only, reasons for doing a needs assessment is that it is a government requirement. It often becomes an end in itself. But in fact the needs assessment became a government requirement because of two problems: the need for accountability, and the need for communication. Needs assessment is used to show accountability because it measures. How does one measure a good teacher or administrator? Obviously, one cannot. But a needs assessment does establish some educational objectives which can be used to measure success or lack of success (existence or absence of certain measurable conditions). Generally a needs assessment requires communication between school authorities and a wide referent public — communication about the work of the schools. But here we find some strange results. I once visited a school district that was required by a government grant to do a needs assessment to demonstrate that they were in effective communication with their community, and they had used the delphi technique. Now that technique, to be done purely, guarantees minimal communication! But the government was satisfied. A needs assessment had been done; therefore communication had taken place.

Another reason for a needs assessment, one which many of its promoters ignore, is to correct data. The importance of correcting data should not be underestimated. But it must be conceded that many people fail to use data once they are corrected. Unfortunately, once you have corrected data and proved to government that there has been communication, there is no further requirement to actually *use* the data. In short, if you are forced into doing a needs assessment, I hope not only that you will do it well but also that you do it usefully.

There are two problems which I think are not faced in sufficient fashion in the literature on needs assessment. These are community and goals. If you do a needs assessment, it is quite possible that the communication you had with your community leaves much to be desired. It may be that your institution is not, in fact, part of the community; it sits there like a wart on a nose, apparently part of the nose, but not really. The problems posed by the community are complicated and beyond deep examination here. But let us consider just one communicy factor, size. If you are dealing with a neighbourhood primary school of 500-800 students your problems of communicating with the community are obviously different from those of the administrators of a junior college serving an area the size of a county. In one of the showcase sessions of this conference, Dr Larry J. Morgan presented a report about the 70,000 students in San Diego Community College. No primary neighbourhood school faces such a communication difficulty. In understanding your community it is important to come to a just appreciation of the service you provide to it. In the service sense we must remember that we act as professionals. We are experts and with expertise goes responsibility.

The difficulty of goal formulation is sometimes written off in glib fashion. In preparing a statement of goals you can pull them out of somebody's book or send out a questionnaire asking for people's perceptions of goals. The latter will tell you about the special interests in your community rather than its goals, but more of that later. In my opinion an institution should develop its own goals. The goals should come from the basic principles involved in the educational effort and they should reflect the institution's educational philosophy. Some leading writers on needs assessment doubt that educational objectives, aims, or goals can be derived from principles. They write about philosophy of education as being undemocratic and anti-empirical.[1] Majority is confused with right. Kaufman and English advocate that such "democratic" procedures as brainstorming be used. By democratic procedures they mean vote counting for approval: one person, one vote. This is to deny expertise and values. The writing of an institution's philosophy is an intellectual endeavour. It requires educational leadership. It is not a popularity contest. Nor is the institution's philosophy right or wrong because the majority approves it. We do not establish our roles, goals and priorities by consensus.

When the philosophy for running the United States was being developed, by enunciating the Constitution and the Bill of Rights, our ancestors did not randomly select people in the community and have them write lists of articles in a check list, and rank their preferences in the list of articles which had been drafted by groups of lay people selected without reference to their knowledge of government or the issues of the day. Instead the leaders of the time prepared and debated documents till they formulated one which we have a hell of a time living up to. But it is a good document. The statement of the philosophy of education of an institution should be just such a document. If it is, then the goals, aims, and objectives of the institution can be taken from the document. It will give the institution something to shoot for. Goals are not things which are to be achieved at once. Not all of them will be realized all of the time.

Now, I would like to quickly mention some "wrongs" in needs assessment. I cannot accept "the new truth" syndrome. Here is a quotation from the book I mentioned earlier:

> What happens if a needs assessment is not done?... If some procedure like
> needs assessment is not adopted, the procedure that is impirical and
> public and open to inspection, challenge, and validation, and by which
> school or school system goals and objectives are defined and prioritized,
> we will continue to be plagued by problems.[1]

The claims made by that quotation represent just one more problem. Needs assessment is not a magic solution; it is not even a new truth. By itself it will not solve a single problem; it may even cause additional problems by pretending to do more than it can. If properly used it can be one important piece of the puzzle. But we must keep our expectations in proper perspective. At best a needs assessment is a useful tool, a step in the planning process.

It is evident from much of the literature that the process of needs assessment is being promoted in order to make people feel involved. Involvement becomes an end in itself. But if you involve people in this sort of process, it must be done honestly. Their findings, opinions and reports must be taken seriously and you must be prepared to act upon the information. This is part of respecting people and treating their desires as responsible, whether or not they accord with your notions of pleasant and unpleasant, worthy or unworthy. When you involve people in the governance and policy of the school you must respect them enough to discuss your differences candidly. Dr. Hershkowitz mentioned

a copy of a letter from a Montgomery County newspaper. That was the reaction of a lady who was part of a needs assessment. She charged that the administrators heard precisely what they wanted to hear, and no more. I think the last few words of her letter revealing. They were something like "revise it, rewrite it, reproduce it and shove it".

Another "wrong", a misconception, if you like, which the literature seems to foster, is that goal validity is accomplished by consensus. When I was young I shared that view, but as I have become older, more experienced and more prudent I realize that consensus often means compromise to the least tenable and least desirable position. Consensus often is irresponsible. For the sake of seeming unanimity, groups of people apparently *agree* to something with which they profoundly *disagree* and which their expertise, experience or convictions tell them will not work. I believe we each owe it to the community and ourselves to try to convince our fellow citizens and the school authorities of the correctness of our views. Let me give you a quick example: suppose we are convinced of the importance of "movements and art" in the elementary school curriculum, but the budget must be cut. The choice is given of accommodating to the reduced budget by cutting either "interscholastic athletics" or "elementary movements and art". Consensus derived from a large reference group would probably result in the retention of interscholastic athletics. But many educators would argue that it would be irresponsible to cut "movements and art". If that is their belief, it is their job to help citizens understand that this is the correct decision and why it is the correct decision. It is easy to go along with the majority. It is also easy to allow the authority to become a dictator. It is much more difficult to convince people, to educate them to reject self-interest, to defer short term gratification, to pay special consideration to convictions other than their own.

There is one other "wrong" which must be mentioned – the misuse of data. I do not think that we should survey and interview lay people to get their opinions as to what we educators should do. They do not really *know* what we are actually doing now. One thing such opinion surveys will tell us is what they *think* is going on in the schools. Often they are quite wrong. One use of the findings is to convince us that we urgently need better communication with the public. Then we can proceed to develop some type of communication which will let them know what *really* goes on in the school. The preference survey is also useful to enable us to find out what the public think should go on in the school – not in order to change our school programs (particularly if we disagree with the public's desires) but to show us how great a task it will be to try to change their desires. In the example I have given, if the public feels that all art programs are useless, then we have a problem. It is not the problem of creating new programs which will meet their approval, but that of educating our reference groups as to the importance and value of our existing art programs. Art education is not a "frill", and it is not desirable for school authorities to give the appearance of agreeing with such an opinion just for the sake of contriving consensus. Nor should they set about trying to contrive more "acceptable" art programs unless they are convinced that their existing ones ought to be revised.

I shall close by a brief comment on the Charette system. I think it is ideal because it does, in fact, permit experts to come into a system or an institution and lay some things out for consideration; it permits discussion of the ideas and, from this, the establishment of certain functional goals. Such a system is based on knowledge, rather than on some kind of intuition or public opinion poll. I like that kind of a system. Our needs assessment process should help people to understand the issues so that they can be responsible in the way in which they deal with their schools. If you are from a state where citizens

vote on school tax issues — as I am — public irresponsibility poses serious problems. The voters take notoriously irresponsible actions. The school tax vote is their only chance to vote down taxes. Their negative action may well have educational effects they did not intend, but they take the action anyway. One solution would be to change the law so that school taxes do not need a direct vote of citizen approval, but this is not ideal. A better solution would be to educate the citizens so that they understand the effects of their tax votes and do not shirk their responsibility to provide for the education of each coming generation.

A needs assessment should not be a prescription telling professional educators what to do. It can be used to help us understand our community, communicate with it better and become more accountable to it. It yields much useful data. But, of itself, it will not solve any problem — except that of demonstrating to government that we are meeting their funding requirement.

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Martin Hershkowitz* and Mohammad A.A. Shami**

A NOTE ON THE RELATIVE IMPORTANCE OF SUBJECT MATTER GOALS AND HIGHER ORDER GOALS

Introduction

The statement of the goals of public education has always been of public concern. Such statements usually include generalized goals too vague to be measured and behavioural objectives too specific to be considered goals of the system. The content of the goals varies from subject matter to higher order goals. Few educators distinguish between the different kinds of goals, how they should be identified and what treatment they should be accorded. In the United States the current preoccupation with accountability in education requires that goal statements be measurable across all students in the system and be expressed in such a manner as to satisfy the needs of concerned public groups.

The State of Maryland in 1972 conducted a major goals validation and needs assessment study whose results provide direction for stating statewide and local system goals, the allocation of program funds and the establishment of a system for educational accountability. The study also sheds light on public concern over the *content* of educational goals. This paper presents data on the relative importance, to the reference groups, of subject matter and higher order goals.

In order to validate thirty-seven specific educational goals, the Department of Education decided to solicit public perceptions of the importance of each. A random sample of the general public and representative samples of special interest groups (students, teachers, parents) were selected, a questionnaire developed, and public school students, educators and community representatives were used to gather the data. Table 1 shows the mean importance scores for each of the respondent groups, for each of the selected goals.

Findings on Subject Matter Goals and Higher Order Goals

The purpose of the study was to establish the validity of the selected goals, determine the perceived hierarchy of importance among the goals, and thereby assess the educational needs of Maryland public school students. However, the findings so clearly indicate a polarity of perceived importance between subject matter goals and higher order goals that that in itself warrants discussion. The survey showed a limited number of distinct mean goal importance scores by each respondent group, over the thirty-seven specific goals. Because the spread of mean goal importance scores differs for several respondent groups, a direct cardinal ranking is not very informative. Therefore the "most important" goals were ranked directly (i.e., first = 1) and the "least important" goals in reverse (i.e., least = n, next to least = n-1, where n is the number of distinct mean goal importance scores for a particular respondent group). Maryland's thirty-seven goals cover the entire

TABLE 1   MEAN GOAL IMPORTANCE FOR EACH RESPONDENT GROUP FOR EACH GOAL

Goals	Mean Goal Importance									
	Students	School Staff	Central Staff	Parents	Board of Education	Business/Industry	General Public	Elected and Appointed Officials	MSDE Staff	Postsecondary Educators
Ability to arrive at independent decisions	4.5	4.7	4.8	4.6	4.7	4.3	4.7	4.4	4.6	4.6
Understanding of how members of a family function under different family patterns	3.5	3.8	3.8	3.7	3.6	3.2	3.7	3.4	3.4	3.2
Knowledge of language concepts	3.6	4.3	4.1	3.8	4.0	3.2	3.6	3.8	3.9	4.1
Knowledge of social studies concepts	3.7	4.0	3.9	3.8	3.9	3.2	3.8	3.6	3.7	3.7
Knowledge of the personal and social consequences of critical health problems, (such as smoking, drug abuse, alcohol, work hazards)	4.4	4.5	4.4	4.5	4.5	4.3	4.5	4.3	4.3	4.2
Qualifications required for acceptance of students planning to continue their studies into the college(s) of their choice	4.2	3.9	3.8	4.4	4.3	4.1	4.3	4.0	3.7	4.0
Knowledge of environmental sciences	3.8	4.0	3.8	3.9	3.9	3.3	3.9	3.6	3.8	3.8
Knowledge of mathematical concepts	4.1	4.1	3.9	4.3	4.2	3.8	4.0	4.0	3.8	4.0
Concern for the use and abuse of environmental resources	4.2	4.3	4.1	4.2	4.0	3.7	4.2	3.9	4.0	4.0
Development of self-respect	4.6	4.8	4.8	4.7	4.6	4.6	4.7	4.6	4.6	4.5
Ability to use leisure time in const. activities	3.8	4.2	4.0	4.0	3.6	3.6	4.0	3.7	3.8	3.6
Ability to use leisure time in a personally satisfying manner	3.9	4.1	4.0	3.9	3.5	3.4	3.9	3.4	3.7	3.6
Knowledge of opposing value systems and their influence on the individual and society (such as ecology versus exploitation of resources, individual freedom vs. group interest)	3.9	4.1	4.2	3.9	4.0	3.7	3.9	4.0	4.2	4.1
Ability to apply knowledge and skills to the solution of real life problems	4.6	4.8	4.7	4.6	4.7	4.4	4.7	4.6	4.7	4.5
Knowledge of scientific concepts	3.5	3.7	3.6	3.7	3.8	3.2	3.6	3.6	3.5	3.9
Skills required for employment in their selected occupations by students planning to enter the job market	4.4	4.6	4.4	4.5	4.6	4.4	4.5	4.4	4.4	4.3
Knowledge of varied resources for ind. study	3.9	4.0	3.9	4.0	3.9	3.3	3.9	3.6	4.0	4.1
Mastery of reading skills	4.5	4.8	4.7	4.8	4.8	4.7	4.8	4.8	4.7	4.8
Knowledge of child dev. & skill in child care	3.8	3.8	3.8	3.7	3.5	3.3	3.8	3.1	3.6	3.3
Skills for managing personal and family finances	4.2	4.0	4.1	4.1	4.1	4.1	4.2	3.8	4.0	3.6
Development of desire for continued learning	4.2	4.4	4.2	4.5	4.4	4.1	4.4	4.1	4.1	4.4
Mastery of computational skills	3.6	3.9	3.9	3.7	3.8	3.4	3.6	3.4	3.7	3.7
Knowledge of fine arts concepts	3.0	3.3	3.3	3.1	3.0	2.6	3.1	3.0	3.1	3.5
Ability to understand the pros and cons of issues	4.1	4.3	4.2	4.3	4.3	4.1	4.3	4.3	4.4	4.4
Ability to practice sound personal health habits	4.2	4.5	4.3	4.4	4.3	4.2	4.4	4.1	4.3	3.9
Understanding of and concern for problems of society (such as community improvements, crime prevention)	4.3	4.4	4.3	4.3	4.1	4.1	4.4	4.1	4.3	4.1
Mastery of mechanical skills of writing	3.5	3.9	3.7	3.8	3.8	3.7	3.7	3.6	3.7	3.9
Mastery of skills in listening, to comprehend the ideas of others	4.2	4.6	4.4	4.4	4.4	4.3	4.4	4.2	4.4	4.5
Knowledge of personal, phys. & mental health	4.4	4.3	4.2	4.3	4.1	3.9	4.3	4.0	4.1	3.8
Ability to develop a personal value system	4.1	4.6	4.5	4.4	4.2	4.1	4.4	4.2	4.4	4.2
Development of concern for others	4.3	4.6	4.5	4.4	4.3	4.2	4.4	4.3	4.5	4.2
Ability to effectively plan the use of time	3.9	4.4	4.2	4.3	4.2	4.1	4.2	4.1	4.1	4.0
Ability to study independently	4.3	4.4	4.1	4.4	4.3	3.9	4.4	4.2	4.2	4.4
Knowledge of job requirements of major occupational fields	4.3	4.0	3.8	4.2	3.9	3.7	4.1	3.8	3.9	3.5
Mastery of skills in oral expression	4.0	4.3	4.2	4.3	4.3	4.1	4.2	4.1	4.3	4.4
Mastery of skills in the written expression of ones views and those of others	3.9	4.1	3.9	4.2	4.2	3.8	4.1	4.0	4.1	4.4
Knowledge of the educational preparation req'd for major occupational field	4.3	4.0	4.0	4.2	4.1	3.9	4.2	4.0	4.0	3.8

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TABLE 2   CARDINAL RANKING OF SUBJECT MATTER GOALS FOR EACH RESPONDENT GROUP BY THE MEAN GOAL IMPORTANCE SCORE, INCLUDING MAXIMUM, MINIMUM AND NUMBER OF DISTINCT SCORES

Subject Matter Goals	Students	School Staffs	Central Staffs	Parents	Boards of Education	Business/Industry	General Public	Elected & Appointed Officials	MSDE Staff	Postsecondary Educators
Maximum mean goal importance score	4.6	4.8	4.8	4.8	4.8	4.7	4.8	4.8	4.7	4.8
Minimum mean goal importance score	3.0	3.3	3.3	3.1	3.0	2.6	3.1	3.0	3.1	3.2
Number of distinct mean goal importance scores	n=13	n=13	n=13	n=13	n=14	n=14	n=13	n=14	n=15	n=15
Mastery of reading skills	2	1	2	1	1	1	1	1	1	1
Skills required for employment in their selected occupations by students planning to enter the job market	3	3	4	4	3	3	3	3	4	5
Knowledge of mathematical concepts	n-7	n-5	n-4	n-7	n-7	n-6	n-5	n-7	n-5	n-7
Knowledge of language concepts	n-2	n-7	n-6	n-2	n-5	n-1	n-1	n-5	n-6	n-8
Knowledge of environmental sciences	n-4	n-4	n-3	n-3	n-4	n-2	n-4	n-3	n-5	n-5
Knowledge of social studies concepts	n-3	n-4	n-4	n-2	n-4	n-1	n-3	n-3	n-4	n-4
Mastery of mechanical skills of writing	n-1	n-3	n-2	n-2	n-3	n-5	n-2	n-3	n-4	n-6
Mastery of computation skills	n-2	n-3	n-4	n-1	n-3	n-3	n-1	n-2	n-4	n-4
Knowledge of scientific concepts	n-1	n-1	n-1	n-1	n-3	n-1	n-1	n-3	n-2	n-6
Knowledge of fine arts concepts	n	n	n	n	n	n	n	n	n	n-2

TABLE 3 CARDINAL RANKING OF HIGHER ORDER GOALS FOR EACH RESPONDENT GROUP BY THE MEAN GOAL IMPORTANCE SCORE, INCLUDING MAXIMUM, MINIMUM AND NUMBER OF DISTINCT SCORES

Higher Order Goals	Students	School Staffs	Central Staffs	Parents	Boards of Education	Business/Industry	General Public	Elected and Appointed Officials	MSDE Staff	Postsecondary Educators
Maximum mean goal importance score	4.6	4.8	4.8	4.8	4.8	4.7	4.8	4.8	4.7	4.8
Minimum mean goal importance score	3.0	3.3	3.3	3.1	3.0	2.6	3.1	3.0	3.1	3.2
Number of distinct mean goal importance scores	13	13	13	13	14	14	13	14	15	15
Development of self-respect	1	1	1	2	3	2	2	2	2	3
Ability to apply knowledge and skills to the solution of real life problems	1	1	2	3	2	3	2	2	1	3
Ability to arrive at independent decisions	2	2	1	3	2	4	2	3	2	2
Knowledge of the personal and social consequences of critical health problems (such as smoking, drug abuse, alcohol, work hazards)	3	4	4	4	4	4	3	4	5	6
Mastery of skills in listening to comprehend the ideas of others	5	3	4	5	5	4	4	5	4	3
Development of concern for others	4	3	3	5	6	5	4	4	3	6
Ability to develop a personal value system	6	3	3	5	7	6	4	5	4	6
Development of desire for continued learning	5	5	6	4	5	6	4	6	7	4
Ability to understand the pros and cons of issues	6	6	6	6	6	6	5	4	4	4

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range from clearly subject matter to clearly higher order. Nineteen of them can be identified as either subject matter (ten) or higher order goals (nine). The remaining eighteen are sufficiently mixed-mode to prevent a clear dichotomous separation.

Table 2 shows the cardinal ranking of the subject matter goals. The maximum, minimum and number of distinct mean goal importance scores for each respondent group is presented for comparison purposes. These data reveal that only the goals "reading skills" and "skills for employment" were rated highly by the respondent groups (first and third highest ranks, respectively). The goal "mathematical concepts" rates about the seventh lowest rank, and "language concepts" and "environmental sciences" about the fifth lowest (but the large spread of respondent group rankings for "language concepts" raises questions as to the meaningfulness of the specific rating). The goals "social studies concepts", "skills of writing" and "computational skills" rate about the fourth lowest rank, but the spread of respondent group rankings for "skills of writing" raises questions about the meaningfulness of its specific rating. "Scientific concepts" rates about the third lowest rank, but here again the spread of respondent group rankings for the goal raises questions as to the meaningfulness of the specific rating. The goal "fine arts concepts" clearly rates *lowest*, with the spread of respondent group rankings being smallest for this goal, as also was the case with the "reading skills" goal which was the *highest* rated goal. Even taking into account the large spread of respondent group rankings for some subject matter goals it is clear that respondents agree: with the exception of the highly rated goals "reading skills" and "skills for employment", subject matter goals are considered of low importance.

Table 3 presents a cardinal ranking of the higher order goals. The goals "self-respect", "solution of real life problems" and 'independent decisions" rate about second highest. Those of "consequences of critical health problems", "listening to comprehend the ideas of others" and "concern for others" rate about fourth highest. "Personal value system", "desire for continued learning" and "pros and cons of issues" rated about fifth highest, but the moderate spread of respondent group rankings for the goal "personal value systems" raises questions as to the meaningfulness of its specific rating. Clearly for all respondent groups, higher order goals are of very high importance.

Comment

This study was not specifically designed to investigate the relative ranking of goals by different public reference groups. If this had been the case it would have been possible to make specific statements and interpretations of the finding that subject matter goals were held in low esteem as compared to higher order goals. However, as a by-product of another investigation, we found that the referent groups' goal preferences are clearly dichotomous. This raises some questions of educational policy. What do these dichotomous results mean? Why are subject matter goals rated at the low end of the importance scale rather than interspersed among the ranks assigned to higher order goals? Why are the goals "reading skills" and "skills for employment" rated first and third respectively, instead of being grouped with the other subject matter goals? Would similar results be found in a similar study in another state? How might an educator use such findings?

We classified "reading skills" and "skills for employment" as subject matter goals, but they are of a special nature. The other subject matter goals are educational (i.e., mathematics, language concepts, environmental sciences, social studies, science and fine arts), but it may be argued that reading and employment skills may be considered as basic training. Certainly, reading skills are basic to the entire educational process and to almost

all types of employment. Employment skills have a directly observable "pay-off". Therefore the reason why "reading skills" and "skills for employment" were not ranked with the other subject matter goals may be less related to their category than to the potential reward which they represent. If this is the case, however, why are writing skills not viewed in the same way?

The dichotomous results seem to suggest that, while higher order goals are perceived as very important by all respondent groups, the subject matter goals appear to be of little importance. Yet it is evident that the ability to attain the higher order goals presumes the attainment of the skills and concepts associated with the subject matter goals. We must assume either that the respondents do not recognize this dependent relationship or that their ranking is not intended to convey a lack of perceived importance. We feel that the ranking expresses the students', educators', parents' and other respondent groups' very real concern over the departmentalized practice of teaching subject matter for its own sake — that the results should be interpreted as a demand for curricula directed to attaining high order goals *by means of* subject matter goals.

The findings from this study appear to be valid. Scientific sampling principles were observed, and the large number of respondents (11,015 persons) and high level of consistency of goal ranking within and between respondent groups indicate that the findings are generalizable. A similar study in another state or a local school system should yield similar results. However, the interpretation of the policy implications of the results is more a matter of philosophy than of statistics.

Frank W. Banghart, Pacharee Kraprayoon and Geoffrey A. Tully*

A MODEL FOR SETTING REALISTIC NUMERICAL GOALS FOR HIRING MINORITIES AND WOMEN IN A STATE UNIVERSITY SYSTEM

Background

The equal employment opportunity provisions of the United States 1964 Civil Rights Act have stimulated an abundance of rhetoric, threats, law suits, promises, good intentions, hope and discouragement. Nevertheless Churchill and Shank recently noted, "We know of no major company, regardless of its intentions or accomplishments, which is not in violation of the equal employment opportunities provisions of the 1964 Civil Rights Act."[1]

The 1964 Civil Rights Act was expected to affect all segments of American society, including governmental and private agencies, business, industry and the universities. The sense of the law, of course, was honourable, and for the most part persons responsible for its enforcement have good intentions. The problem seems to be that a law which requires "specific goals" is, in practice, unenforceable because of the apparent lack of good information regarding what is an attainable "reasonable mix" of employees.

In 1974, the authors began a project entitled "Development of a Model for Establishing Realistic Numerical Goals for Hiring More women and Minorities in the State University System". The purpose of the model was to furnish a realistic data based procedure for staff planning in a state university system.

The project has four relatively distinct phases: Phase I consists of two independent models whose input data can be provided from the terminal. The first is a simple interactive computer model for setting staff mix "target objectives". The second deals with a transition matrix of staff tenure from the base year into future years. This phase of the work has been completed. Phase II is an extension of the first phase. It involves a more complex model based on six data files: a system definition file, historical student data, staff data, a candidate availability file, a transitional statistics file, and the probability of hiring file. This phase of the work should be complete by June, 1976. Figure 1 maps the key features of the second phase model.

Phase III extends the first two phases to include a career progression feature thereby enabling the planner to alter such internal dynamics as tenure, promotions and salaries, which will then have an impact upon turnover rates. In this model, hiring rates and personnel policies contribute to enhance the attainment of desirable staff "mixes". It is expected that this work will be complete by June, 1977. Figure 2 maps the third phase model.

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Figure 1   PHASE II MODEL

```
┌─────────────────┐
│   PAST YEAR     │
│  STUDENT FTE    │
└────────┬────────┘
         │
         ▼
┌─────────────────┐
│  PRODUCTIVITY   │
│   GENERATOR     │
└────────┬────────┘
         │
         ▼
┌─────────────────┐      ┌─────────────────┐
│  GROSS STAFF    │◄─────│    FORECAST     │
│   FORECAST      │      │  STUDENT FTE    │
└────────┬────────┘      └─────────────────┘
         │
         ▼
┌─────────────────┐      ┌─────────────────┐      ┌─────────────────┐
│     NEW         │◄─────│   TURNOVER      │◄─────│   STAFF FLOW    │
│   VACANCIES     │      │    RATES        │      │ CHARACTERISTICS │
└────────┬────────┘      └─────────────────┘      └─────────────────┘
         │
         ▼
┌─────────────────┐      ┌─────────────────┐      ┌─────────────────┐
│     NEW         │◄─────│    HIRING       │◄─────│   CANDIDATE     │
│   HIRINGS       │      │  PROBABILITY    │      │  AVAILABILITY   │
│                 │      │                 │      │     POOLS       │
└────────┬────────┘      └─────────────────┘      └─────────────────┘
         │
         ▼
┌─────────────────┐      ┌─────────────────┐
│    TARGET       │◄─────│    HIRING       │
│     MIX         │      │     MIX         │
└─────────────────┘      └─────────────────┘
```

Figure 2   PHASE III MODEL

```
┌─────────────────┐                              ┌─────────────────┐
│   PAST YEAR     │                              │   AUTHORIZED    │
│   STUDENT       │                              │   POSITION      │
│     FTE         │                              │     FILE        │
└────────┬────────┘                              └────────┬────────┘
         │                        ┌───────────────────────┼───────────────────────┐
         ▼                        ▼                       ▼                       ▼
┌─────────────────┐      ┌─────────────────┐    ┌─────────────────┐    ┌─────────────────┐
│  PRODUCTIVITY   │      │    SALARY       │    │    TENURE       │    │   POSITION      │
│   GENERATOR     │      │    LEVELS       │    │    DIST         │    │    LEVELS       │
└────────┬────────┘      └─────────────────┘    └─────────────────┘    └─────────────────┘
         │
         ▼
┌─────────────────┐  ┌─────────────────┐  ┌─────────────────┐  ┌─────────────────┐
│  GROSS STAFF    │◄─│    STUDENT      │  │    EQUITY       │◄─│    CURRENT      │
│   FORECAST      │  │     FTE         │  │    ADJUST       │  │  STAFF FLOW     │
│                 │  │   FORECAST      │  │                 │  │ CHARACTERISTICS │
└────────┬────────┘  └─────────────────┘  └────────┬────────┘  └─────────────────┘
         │                                          │
         ▼                                          ▼
┌─────────────────┐      ┌─────────────────┐    ┌─────────────────┐
│     NEW         │◄─────│   TURNOVER      │◄───│   STAFF FLOW    │
│   VACANCIES     │      │    RATES        │    │ CHARACTERISTICS │
└────────┬────────┘      └─────────────────┘    └─────────────────┘
         │
         ▼
┌─────────────────┐      ┌─────────────────┐    ┌─────────────────┐
│     NEW         │◄─────│    HIRING       │◄───│   CANDIDATE     │
│   HIRING        │      │  PROBABILITIES  │    │  AVAILABILITY   │
│                 │      │                 │    │     POOLS       │
└────────┬────────┘      └─────────────────┘    └─────────────────┘
         │
         ▼
┌─────────────────┐      ┌─────────────────┐
│    TARGET       │◄─────│    HIRING       │
│     MIX         │      │     MIX         │
└─────────────────┘      └─────────────────┘
```

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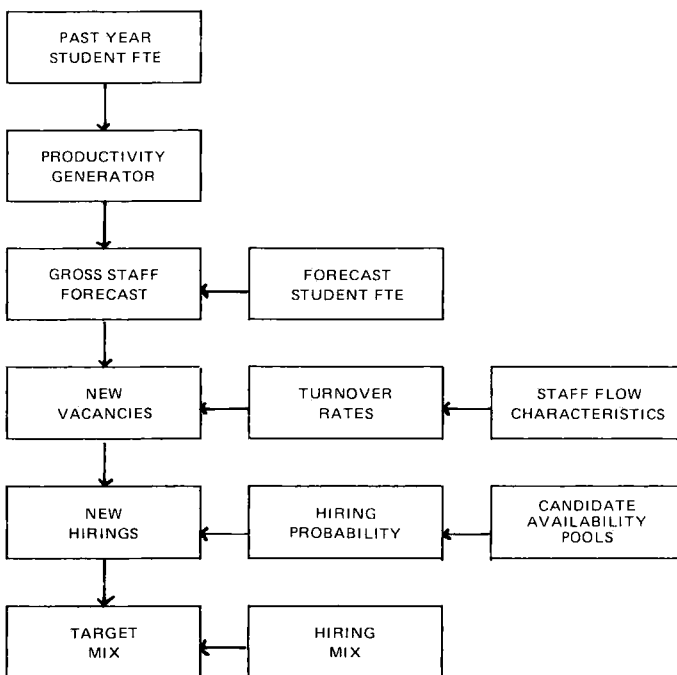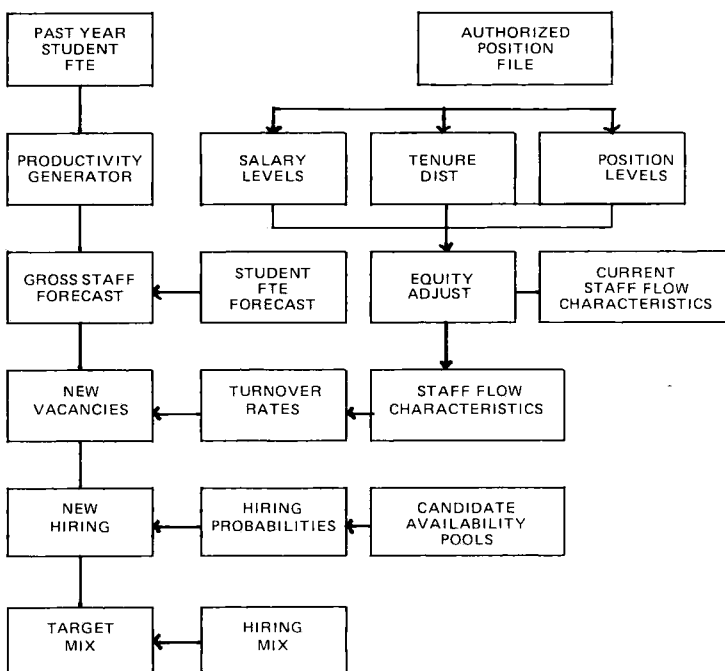
Phase IV is an extension of Phases I, II, and III, designed to alter such exogenous variables as recruitment and placement so that there is an impact upon equitable employment opportunities. It will add information regarding requirements in human resources, programs, and other resources (i.e., people, dollars, space and materials). Its expected completion date is June, 1978.

In this article we shall describe the Phase I model and demonstrate its operational output. The reader should note that the authors stress "progress" towards goal attainment rather than "goal" *per se*. Indeed, the major contribution of the model rests with its capability to simulate various employment hiring rates and thereby study the effect which such rates will have on employment mixes. It has been a common experience that good intentions quickly go awry when turnover rates and overall growth rates are integrated into the process of attaining desirable "mixes" of staff.

The Model for Setting Target Objectives

The primary purpose of this model is to permit the decision maker to set realistic numerical hiring rates based upon projected gross staff requirements, net vacancies calculated from gross needs and turnover rates, growth rates and a mix of target goals.

Figure 3 illustrates its details. The flow chart shows the step by step procedures which are analogous to the operational aspects of the system, and Tables 1 and 2 the data elements and table structure.

Table 1   DATA ELEMENTS

Element	Value in Sample Data
Number of population groups	3
Label for each group	minority white female white male
Initial population for each group	50 250 700
Target proportion for each group*	.2 .4 .4
Overall population growth rate*	.10
Separation rate for each group*	.15 .10 .05
Base year date	1973
Number of years to cycle	10
Output format options*: 1) Full summary table 2) Hiring proportions 3) Employment numbers 4) Employment proportions	Full summary
Hiring options*: 1) Program calculated rates 2) Fixed rates	Program calculated rates

*data values which can be changed via the 'change data' program option.

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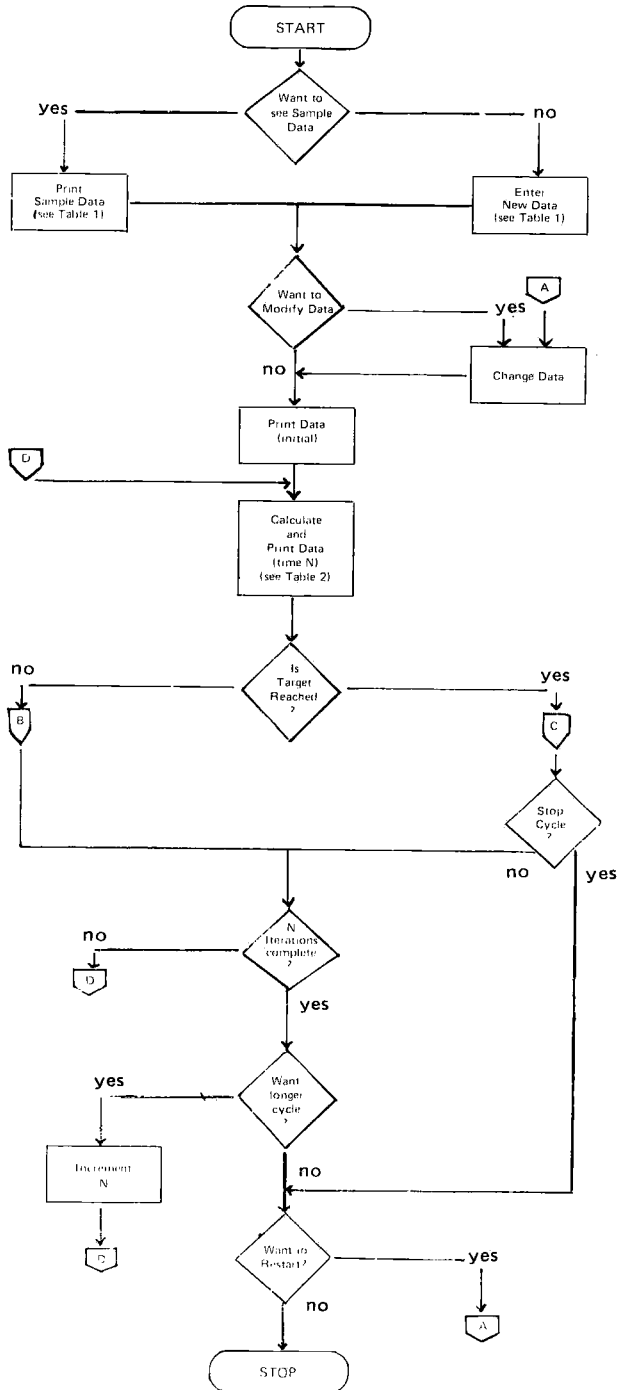Figure 3   PHASE I PROGRAM FLOW CHART

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Table 2   YEARLY OUTPUT DATA TABLE STRUCTURE
1. Header line indicates date.
2. Number and percentage separation by groups. (optional)
3. Number and percentage hirings by groups. (optional)
4. Percentage only for hirings by groups. (optional)
5. Number and percentage population in each group after separation and hirings. (optional)
6. Percentage population in each group after separation and hirings. (optional)

NOTE: Selection of full summary table will use options 1, 2, 3, and 5. If full table is not selected, program will query user for desired options (option 1 is included with all annual output).

The following printout demonstrates the interactive nature of the model:

FACULTY FLOW MODEL – PHASE 1 PROGRAM
WOULD YOU LIKE TO SEE THE SAMPLE DATA TABLEAU
? NO
ENTER INITIALIZATION DATA AS REQUESTED
HOW MANY POPULATION GROUPS
? 3
ENTER IDENTIFYING LABEL FOR
GROUP 1
? MINORITY
GROUP 2
? FEMALE
GROUP 3
? MALE
ENTER STARTING POPULATION FOR
MINORITY
? 480
FEMALE
? 317
MALE
? 4200
ENTER OVERALL EMPLOYMENT GROWTH RATE
? 04
ENTER SEPARATION RATE FOR MINORITY
? .04
FEMALE
? .03
MALE
? .03
ENTER TARGET PROPORTION FOR MINORITY
? .10
FEMALE
? .20
MALE
? .70
NOTE: TO MAINTAIN INITIAL MIX, USE
STASIS HIRING MIX*   .908565   .146795   .754639
TO MAINTAIN TARGET (WHEN REACHED), USE
STASIS HIRING MIX*   .112676   .197183   .690141
    *Number to maintain equilibrium
DO YOU WANT FIXED HIRING RATES
? NO
DO YOU WANT PROGRAM CALCULATED OPTIMAL HIRING RATES
? YES
DO YOU WISH TO ENTER MALE HIRING RATES EACH YEAR
? NO
ENTER MALE HIRING RATE
? .60
TIME INDICES: A = 5.8444   B = .1711
WHAT YEAR IS THE BASE DATA FROM
? 1976
HOW MANY YEARS DO YOU WANT FORECASTED
? 10
SELECT DESIRED OUTPUT OPTIONS
DO YOU WANT OUTPUT EACH YEAR
? YES
DO YOU WANT SEPARATION AND HIRING SUMMARY
? YES
DO YOU WANT TO STOP WHEN TARGET IS REACHED
? YES
WITHIN WHAT TOLERANCE
? .05   34

The following is an example of the information which is furnished for the projected time span: Base year information 1976

FORECAST FOR 10 YEARS
PRINT SUMMARY TABLE – EACH YEAR
INDICATE WHEN TARGET IS REACHED WITHIN TOLERANCE = .0500
TOTAL EMPLOYMENT – ANNUAL GROWTH RATE = .0400

	MINORITY	FEMALE	MALE	TOTAL
– PARAMETERS –				
SEPARATION RATES	.040000	.030000	.030000	
INITIAL EMPLOYMENT	480.00	817.00	4200.00	5497.00
EMPLOYMENT MIX	.087320	.148627	.764053	
– POLICY VARIABLES –				
TARGET MIX	.100000	.200000	.700000	
STASIS HIRING MIX	.112676	.197183	.690141	

CALCULATE OPTIMAL HIRING MIX, GIVEN THAT MALE HIRING RATE IS FIXED AT .6000

1977 ——				
NUMBER LOST (.03)	19.20	24.51	126.00	169.71
PERCENTAGE LOST	.113134	.144423	.742443	
NUMBER HIRED (.07)	50.33	105.51	233.75	389.59
PERCENTAGE HIRED	.129177	.270823	.600000	
EMPLOYMENT (1.04)	511.13	898.00	4307.75	5716.88
EMPLOYMENT MIX	.089406	.157079	.753515	
1978 ——				
NUMBER LOST (.03)	20.45	26.94	129.23	176.62
PERCENTAGE LOST	.115759	.152533	.731708	
NUMBER HIRED (.07)	52.44	109.67	243.18	405.29
PERCENTAGE HIRED	.129398	.270602	.600000	
EMPLOYMENT (1.04)	543.13	980.73	4421.70	5945.56
EMPLOYMENT MIX	.091350	.164952	.743698	
1979 ——				
NUMBER LOST (.03)	21.73	29.42	132.65	183.80
PERCENTAGE LOST	.118200	.160078	.721722	
NUMBER HIRED (.07)	54.64	114.00	252.97	421.62
PERCENTAGE HIRED	.129604	.270396	.600000	
EMPLOYMENT (1.04)	576.04	1065.32	4542.02	6183.38
EMPLOYMENT MIX	.093160	.172287	.734553	

SOME GROUPS WITHIN RANGE OF TARGET IN 1979

EMPLOYMENT (0.)	576.04	1065.32	4542.02	6183.38
EMPLOYMENT MIX	.093160	.172287	.434553	
			IN RANGE	

DO YOU WANT TO PROCEED WITH MORE YEARS
? YES

1980 ——				
NUMBER LOST (.03)	23.04	31.96	136.26	191.26
PERCENTAGE LOST	.120472	.167098	.712430	
NUMBER HIRED (.07)	56.93	118.51	263.16	438.60
PERCENTAGE HIRED	.129796	.270204	.600000	
EMPLOYMENT (1.04)	609.93	1151.87	4668.92	6430.71
EMPLOYMENT MIX	.094846	.179120	4668.92	6430.71

SOME GROUPS WITHIN RANGE OF TARGET IN 1980

EMPLOYMENT (0.)	609.93	1151.87	.726034	
1981			IN RANGE	
NUMBER LOST (.03)	24.40	34.56	140.07	199.02
PERCENTAGE LOST	.122586	.173630	.703084	
NUMBER HIRED (.07)	59.30	123.20	273.75	456.25
PERCENTAGE HIRED	.129975	.270025	.600000	
EMPLOYMENT (1.04)	644.83	1240.51	4802.60	6687.94
EMPLOYMENT MIX	.096417	.185484	.718098	

SOME GROUPS WITHIN RANGE OF TARGET IN 1981

EMPLOYMENT (0.)	644.83	1240.51	4802.60	6687.94
EMPLOYMENT MIX	.096417	.185484	.718098	
	IN RANGE		IN RANGE	

Figure 4   TRANSITION MODEL FLOWCHART

START

Input Data

Base Population	Proportion with Tenure
Separation Rates	Promotion Rate
Growth Rate	Number of Iterations
Proportion of Hiring with Tenure	

Print Summary
Report Statistics for
Base Year

Calculate and Print:

Staff Levels (Tenure/Non-tenure)
Hirings
Overall Separation Rate
Proportion with Tenure After
Next Iteration

N
Iterations
Yet?

no

yes

Update N

Want
More
Iterations
?

yes

no

Want
to Restart
?

yes

no

STOP

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The output follows automatically, immediately after the on-line data input:

BASE PERIOD DATA

	NON-TENURED	TENURED	SEPARATED
NON-TEN	600.0	0.	0.
	.700	.200	.100
TENURED		400.0	0.
		.920	.080
HIRED	0.	0.	
TOTAL	600.0 (.600)	400.0 (.400)	0. (*) = 1000.0

PERIOD 1

	NON-TENURED	TENURED	SEPARATED
NON-TEN	420.0	120.0	60.0
	.700	.200	.100
TENURED		368.0	32.0
		.920	.080
HIRED	82.0	0.	
TOTAL	502.0 (.507)	488.0 (.493)	92.0 (.092) = 990.0
NEXT T = .561			

PERIOD 2

	NON-TENURED	TENURED	SEPARATED
NON-TEN	351.4	100.4	50.2
	.700	.200	.100
TENURED		449.0	39.0
		.920	.080
HIRED	79.3	0.	
TOTAL	430.7 (.439)	549.4 (.561)	89.2 (.090) = 980.1
NEXT T = .610			

```
WANT MORE ITERATIONS
? NO
DO YOU WANT TO RESTART
? NO
        STOP

CP          3.251 SECS.
RUN COMPLETE
```

Conclusion

What is the contribution of a model such as the Phase I model? Probably its real value is that it represents a response to the new demands placed upon senior administration. It is now evident that policy must be data based. However the model also makes other con-tributions: (a) it is a "working model" in an actual system, (b) it has a wide range of applications, (c) it is transferable to business, industrial and governmental applications, (d) its operational simplicity allows a clerk to use it, (e) it is flexible enough to be used in various aspects of staff planning and (f) it is a simulation vehicle for studying alterna-tive policy decisions with variations of grouping and timing "mixes".

The model's chief limitations are that it is (a) non-file based, (b) that there are no files showing the availability of staff, and (c) that the turnover rates which are inputted at the terminal are not calculated ones.

All of these limitations are being eliminated in Phase II.

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James K. Martin and Susan Padro*

COST-IMPACT: A FRAMEWORK FOR THE ANALYSIS OF COMMUNITY COLLEGE PROGRAMS

Introduction

This paper presents a framework for analyzing community college programs which can be used for decision-making at the level of the Province or State. Such a framework should not only improve the efficiency and effectiveness of analysis for this level of decision making, but also provide useful information for senior administrators of the colleges themselves.

Community colleges can be described as a set of interlocking subsystems. For any given program in a college there are three sub-systems: the state or province level, the college level and the program level. The upper level policy-setting bodies operate for the entire college system. They include the equivalent of the provincial department of colleges and universities and related accrediting organizations. Three types of decision are made by such agencies: what programs are to be funded; what guidance or controls will ensure that such programs are to be funded; what guidance or controls will ensure that such programs are effective; and the level of resources to be given to all programs. Each major type of decision consists of several subdecisions.

The group in charge of programs (the administrators of each college) operate them. They choose what equipment to buy with the limited funds available, the appropriate level of enrolment, the mix of programs and their general orientation.

At the level of the individual college program decisions are much more specific. They include the daily allocation of resources, the sequencing of the course content, evaluation of students, etc. From this level we are only interested in the outputs.

Figure 1 illustrates the interconnections between the levels of the system, showing some of the major interactions among the different levels of decision makers. It also demonstrates that the outputs of decision makers in levels (1) and (2) are primarily of an intermediate nature.

Most of the outputs of one subsystem are the inputs to another. From the view of the entire system such relationships, although important to the functioning of the system, do not have to be considered for an assessment of the total system; only the *net* inputs and outputs need be measured. Since level 1 decision makers are the primary targets of this paper and their interest focuses upon the entire system, our area of concern will be the level of the entire system.

To break down the most important input variables that affect the educational process is difficult. There are virtually hundreds of factors which have been identified as being of importance to educational outcomes.[1] To obtain effective evaluation, description or even discussion one must reduce them to a manageable number. The output (or outcome)

variables are affected by the same problem. Many researchers have attempted to measure outcomes directly,[2] but this is expensive and of dubious value given the system interactions. However, instead of focusing upon outputs, it is possible to assess them indirectly, by estimating the *impact* on the socio-economic system where interaction effects are not eliminated.

Figure 1   SYSTEM DESCRIPTION OF COLLEGE PROGRAMS
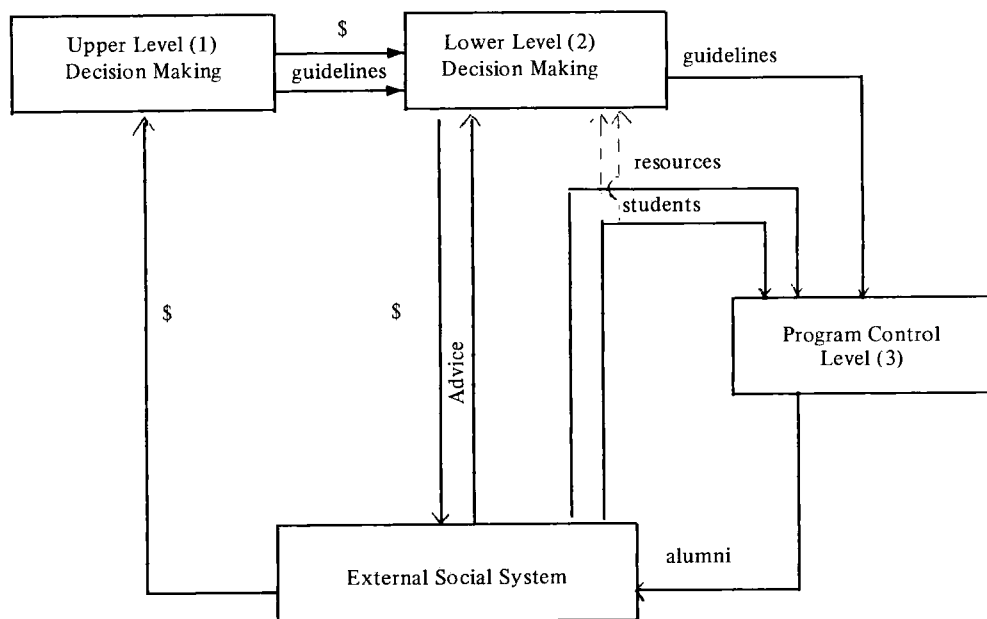
We will define the impact of system A on another system, B, as the change in the characteristics of the underlying entities of system B which result from the introduction of the outputs of system A into B. Let us consider the post-secondary educational system as an example: Graduates take employment which should provide them with more income and more satisfying work than they would have obtained without the education; the overall economy should function more smoothly since there is no skill shortage; the increase in the average educational status of adults should lead to fewer problems in educating the next generation. (Since the achievement of pupils is so closely linked to the education of their parents.) All these might be measured as impacts of the higher educational system on society at large.

The Cost-Impact Framework

Evaluation studies of primary and secondary schools frequently attempt to measure outputs, without even mentioning costs. In the classic, *Educational Evaluation and Decision Making*, there are only two references to cost data.[3] Such studies restrict themselves to examining only part of the inputs (ignoring resources) and part of the outcomes (ignoring resource depreciation or depletion). More comprehensive in scope are the cost-effectiveness studies,[4] which relate inputs and associated resource depletion, to positive outcomes

and associated production targets. Similar to such studies are the cost-benefit ones[5] which do not measure outputs but estimate how well the entities perform in the econmic system. Generally they assign a dollar value to the impacts; this value is then compared to the costs (depletion of resources) so that conclusions can be drawn about the efficiency of the system.

Many studies have attempted to measure the value of educational outcomes to both society and the individual. Kotz summarizes the variables which most decision-makers would consider as important.[6] Few studies attempt to measure the less tangible variables on his list, factors such as 'mobility' or 'better citizenship'. Bowlby and Schriver, when considering non-wage benefits, stressed only employability and mobility, because meaningful proxies are more easily developed for these than some of the others.[7] Where studies have tried to measure variables such as these, they have encountered substantial interpretation problems.[8] Since norms are required, either arbitrary standards must be set (the targets required for true effectiveness) or programs must be compared to interpret the meaning of the observations. Evaluations of social systems are always confounded by the overriding major problem that the time span between the measurement of the inputs and the outputs is substantial, with the result that much unobserved interaction takes place between the entities of the system under study and other systems. For example: students leave their colleges every night; they interact with people other than those who are part of the system, are exposed to various pressures and influences, etc. When one attempts to evaluate the college system, the influences of the external systems are included but not measured. This can distort the analysis to a large degree.

There is one alternative means of analysis which can be termed cost-impact analysis. It is characterized by the attempt to measure impact, not in dollar terms, but with measures which are different for different types of impact. For example: students who have learned a skill might well be more flexible or employable, in the sense of being better able to find good or meaningful jobs. 'Flexibility' might be measured by measuring mobility, analysing the reasons for job changes, the perceptions of flexibility, and job satisfaction. In a cost-impact study the product of community colleges is assessed primarily in terms of its effect upon the context. The findings of cost-impact analysis would not be a single index of a system's "worth", as in cost-effectiveness or cost-benefit analysis, but a matrix of measures of the impacts of the outputs of the system related to its costs on the same dimensions.

Applying the cost-impact framework

Level 1 decision makers are concerned with the impact of their graduates upon society at large; their orientation is to the macro system which includes both their colleges and society. Their decisions produce the policy guidelines and resources which are inputs to the institutional level of their system—inputs which they expect will lead to products which will have a desirable impact on society. The type of analysis described in this paper provides these decision makers with information about the impact (and related costs) of college programs according to a number of relevant critical dimensions. Rather than attempting to provide a single index of worth, as has been frequently attempted through cost-benefit analysis, the impact variables remain segregated, so that information is provided in a form usable for the type of decisions made at this level. The analysis is divided into three major sections:

- measure of the positive impacts of the program
- measure of the costs of the program
- study of impacts relative to costs

These should assist level 1 administrators of the system to make decisions about changes of levels of support and changes in program guidelines.

Because of the similarity of many programs offered in different colleges, often it is beneficial to cluster them for the purpose of analysis. Each cluster should be truly similar — i.e. appeal to the same types of students, involve the same types of skill, place graduates in the same types of employment. Such clustering not only reduces the cost of program analysis but also makes program comparisons feasible, since data on similar programs are more comparable than those on dissimilar programs.

Impact Variables

The first stage in the analysis is to define the impact variables, develop a general classification scheme for them and then refine it to include actual measurable variables (or proxy variables). To provide a useful framework for analysis, impact variables might be classified according to the dimensions: social *vs.* economic, individual *vs.* society, and direct *vs.* indirect. Table 1 suggests a taxonomy based on the two-way classification: economic *vs.* social variables and effects on individuals *vs.* effects on society. Each of the four possible classes then is broken down into types of variables.

Table 1 CATEGORIZATION OF IMPACT VARIABLES

Class	Direct Impact – Type of Variable	Example
(A) ECONOMY		
(1)	individual	
	(a) employment	length of time in a meaningful job
	(b) certification	special vs. general certificate
	(c) flexibility	mobility
	(d) benefits	monetary returns
	(e) other	
(2)	societal	
	(a) structural needs	needs for certain skills
	(b) certification process	shift in meaning of certificates
	(c) flexibility	substitutability of alumni
	(d) benefits to society	tax returns
	(e) other	
(B) SOCIAL		
(1)	individual	
	(a) satisfaction	satisfaction with job
	(b) social functioning	satisfaction with one's life situation
	(c) SES changes	status change
	(d) educational experience	plans for more education
	(e) other	
(2)	societal	
	(a) general satisfaction	desirability of modified educational mix
	(b) social functioning	crime reduction
	(c) educational aspirations	change in demands for certain types
	(d) other	

The 'type of variable' represents some real but unobservable entity, e.g., 'structural need of the economy' is a multi-dimensional concept which would be measured by several specific variables. However, the economy is also conceived of as a whole, which makes it reasonable to talk about the degree to which structural needs (as an entire set) are fulfilled.

The class economy-individual contains the variables which are normally considered to be the primary targets of the college system: of these, employment is the most important type. Monetary benefits, which are related to employment, form the basis for most cost-benefit studies of vocational-technical education and are accepted as good indicators of how much the student outputs are valued. Although 'labour force or job flexibility' is frequently mentioned as a desirable characteristic, studies seldom try to measure it in terms of geographic or job mobility. Underlying all of these economic impacts is the way in which employers treat college graduates, whether they consider a diploma to represent general or specific skills, and what they assume the skills to be.

The economy-societal class contains variables which represent the direct effect college alumni have upon the economy. For example: there may be a structural need for a level of personnel with certain skills; by supplying graduates with such skills the colleges would have a major positive effect upon production and employment. Conversely, if there were specific gaps in the manpower pool, then the program emphasis should be altered to accommodate these specific skill areas. By increasing the number of certified people of all types, as well as the specified group, the college system will affect the views of employers and students concerning the importance of diplomas. Other variables in this class might be changes in the tax base, or increased flexibility in the economy due to greater substitutability among skilled employees.

Usually, impact variables in the social-individual or social-societal classes have not been included in cost-benefit studies because of the difficulty of assigning dollar values. Perhaps the most obvious measurable variable in the social-individual class is the satisfaction which the person gains from obtaining well paid work of a meaningful nature. But, in addition, attitudes toward the value of work and social skills might well be changed as a result of college experience, so that the person is able to perform better as a member of society. One such change is increased political awareness. Here we are referring to awareness engendered by experiences at college as distinct from that which would be the product of maturation anyway. Meeting a person's expectations in terms of job prestige, pay, etc., generally leads to greater satisfaction. To some extent the process of college 'standardizes' or 'normalizes' expectations. But alumni are not the only ones directly affected by colleges. The general level of satisfaction in the populace might increase because of the contribution of alumni to society. This has been included in the variables of the social-societal class, but it must be admitted that it is very difficult to develop measures for this class of variables.

Indirect impact variables are those normally called 'spillover effects' or 'external (dys)economies'. They can be very important in many instances, but the difficulties of developing reasonable measures for this class of variables are so well known that it is not necessary to elaborate them here.

We shall now examine in some detail the four classes of impact variables in order to suggest appropriate proxy variables.

We define a proxy variable as one which takes the place of another target variable and which can be employed as if it were the target variable. When considering a measure of a proxy variable, it is necessary to ascertain

- its *validity*. The degree to which it measures what was intended
- its *reliability*. How often the measure is the same in similar situations
- its *utility*. How such data would be employed in decision making and
- possible *suppressor variables.* Ones which could counteract the undesirable features of the proxy variables (to increase their validity).

Economic (Individual) Impact Variables

These are variables dealing with the effect on the individual as he functions in the labour market. Four primary dimensions are employability, certification, flexibllity and material benefits. The variables might provide information on such questions as: (1) Whether the program is turning out graduates with skills that are in demand. If not, why do employers not respond as desired? (2) Whether the program is helping individuals obtain employ-met. If not, why not? (3) Whether the program has given individuals the flexibility needed to change their long-term aspirations to some degree and to readily transfer to other employment. Table 2 provides a sample of the types of variables which provide the basis for answering such questions as these. In this table the main dimensions have been broken down into discrete variables. As proxies for the dimensions, some of these variables leave much to be desired – this also is indicated.

Table 2   ECONOMIC (INDIVIDUAL) IMPACT VARIABLES

Impact Variable	Sample Proxy Variables	Problems as a proxy
A. Employability	length of time unemployed (not voluntarily) since leaving college	'relevance' needs to be accounted for
	relevance of training	quantity measure of employment required
	reasons for hiring	quantity measure of employment required
	number of job changes since leaving college	includes both forced and unforced changes
	satisfaction with present job	positive bias
	income	quality missing, short term
	perceived underemployment	perhaps expectations too high
B. Certification	college vs. other institutions	perhaps inexperienced with college alumni or perhaps generalizing from limited experience
	amount of 'on the job training' since leaving	purpose required in order to interpret
C. Flexibility	move required to take job	possibly a problem of aggregate demand
	perception of place in hierarchy	possible overestimation plus lack of knowledge of hierarchy
	perception of upward mobility in the hierarchy	over-expectations, might not be desirable (level of incompetence)
	ability to switch job hierarchies	over-expectations, might not be desirable
D. Material Benefits	income	as in A
	pay differentials from others	short term measure
	security	may not imply higher expected lifetime earnings ($ may be reduced)
	perceived capability for independence	bias towards positive response not necessarily limited to higher income

Employability. The general variable is a single index of the capability of the graduate to obtain work for which he is (and feels he is) most suited, both upon leaving college and at a later time. Each of the suggested variables measures some facet of this condition. By combining them in different ways it should be possible to determine the effect of a college program better than if each were treated separately.

Certification. Certification is one of the purposes of all educational systems. Usually it is implicit rather than explicit. Here we are not discussing whether the function exists but whether it is of a general or specific nature, and what skill level the certification is presumed to represent. The curriculum of a program specifically designed to enable people to function in the economy must depend upon what functions the graduates are expected to perform, most of the variables listed in table 2 under certification are directly related to level and type of skill.

Flexibility. A major economic impact of a program on a person is the change in his ability to switch jobs and/or the location of jobs. The freedom to choose is one of the primary facets of a person's economic well-being, the wider job market increases his access to opportunities. Flexibility has two components: geographic mobility and job mobility. The latter in turn consists of two types: upward (vertical) mobility within a given job hierarchy and lateral (horizontal) mobility from one hierarchy to another.

Material Benefits. All the variables in this category measure the tangible, material benefits which a person enjoys as the direct result of having graduated from a specific program. They correspond to the variables generally used in cost-benefit or cost-effectiveness studies. Some of these have concentrated on lifetime earnings,[9] while others have been concerned with starting salaries and present income.[10] In addition to the strictly monetary benefits there are others which can increase expected lifetime earnings, including security and increased independence.

Economic (Societal) Impact Variables

This category consists of impact variables which measure the effect alumni have on the economy. The variables are closely related to the measurement of the effects of programs on individuals; if the alumni do not fulfill a need in the economy, then the impact of the program on the students is deemed to have been essentially negative in nature. Analysis of the economic (societal) impact variables should help to answer such questions as: (1) Whether the alumni of the program fulfill a real need in the economy (2) How the program affects the certification process. Are instabilities (positive feedback) introduced? (3) Whether the economy is better suited to respond to new challenges because of the skills of the college alumni. (4) Whether the average person is economically better off because of the college program. Four types of impact are defined within this class. The effect on the structural needs for labour in the economy, on the certification process as a whole, on the economy's ability to adjust to changing circumstances and on the material benefits accruing to the society at large (not just the alumni). Table 3 shows a sample list of variables which should be investigated in order to assess these impacts.

Structural Needs of the Economy. In this set of variables, two measures of interest are listed, an overall measure of alumni employability and the perceived effect on the growth potential of the industry if there were no more alumni. The first measure indicates how well the alumni fit into the economy; the second assesses how the termination of a program could affect an industry (according to the employers' perceptions).

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Table 3   ECONOMIC (SOCIETAL) IMPACT VARIABLES

Impact Variable	Proxy Variable	Problems as a Proxy
E. Structural Need	overall measure of individual employability	external economies should be assessed
	effect on growth potential of indicators if not more alumni	substantial error responses not well thought out
F. Certification	effect of alumni on hirings (qualifications considered)	depends on sample of employers and differs from students
	reasons for taking the program	could differ from employers and non-students
	demand for enrolment in the program (as participation ratio)	other reasons for increasing demand
G. Flexibility	substitutability of alumni	depends on certification type
	flexibility of resources of industries to the environment	status quo technology might be assumed
H. Societal Benefits (material)	structural need as measured as in E and flexibility as in G	basically these have assumed a Leontief* model of economy

*By a Leontief model we mean one in which the output is a function of different types of labour, say $F(L_1, L_2, L_3)$ and the output is dependent upon min (aL_1, bL_2, cL_3). Hence labour shortages of one type of labour completely restrict the use of the other types.

Certification Process. Some indication of how the college's diplomas are perceived could indicate the level of effect that the programs have had on employers. To be precise: Has a certificate become necessary for employment in various jobs? Many variables measuring the characteristics of alumni should be used to determine this. Probably *all* such variables can help determine whether or not, the enrollment of a program should be increased. The interpretation of the responses to each type of question will require comparisons within the clusters of programs as well as between clusters.

Economic Flexibility. This estimate is used to assess whether the economy can respond to unexpected changes. If we make the assumption that a reduction in the structural needs of the economy implies flexibility, then one indicator of high flexibility is the ability to fill the economy's current structural needs. In addition we can obtain employers' perceptions of the substitution possibilities represented by the skills of alumni, e.g. where para-professionals like technicians can replace professional engineers. Another indicator would be the employers' estimates of their companies' capability of reacting to changes in product demand. Has this capability increased or decreased? It must be recognized that such measures are highly subjective and so this part of the analysis will not generate conclusive results. Perceived flexibility should be interpreted only in the light of other general variables (such as general or specific certification of individuals), particularly if the information is being used to develop new program guidelines.

Benefits to Society. Increased flexibility and the elimination of economic bottlenecks can be of general benefit to society but it is difficult to assign precise monetary values to these impacts of the college programs, and this should not be attempted. Instead a qualitative assessment of overall benefits should be made in order to arrive at some conclusion on the total worth of a program as a vehicle for promoting economic well-being. A quantitative assessment could only be attempted if there already exists a sophisticated model of the provincial economy.

Social (Individual) Impact Variables

Although variables in the social impact class are not of primary concern for evaluation of college programs, it is important to demonstrate that programs do not have a negative social effect. Such data might well be important in decisions on marginal programs or to identify program weaknesses. The data should throw light on the follcwing types of question: (1) Has participation in a program improved the life situation of the alumnus? (2) Has it prepared the person to function better as a member of society? Has it actually hindered this function? (3) Has it promoted the upward social mobility of the student? (4) Has it led to new educational opportunities for the student?

There are four major types of variable included in this class, relating to the degree of satisfaction of the alumni, their ability to function as members of society, the effect on their social mobility, and on their subsequent educational experiences. Table 4 gives a sample of the variables which might be used to indicate positive or negative effects in each area.

Table 4   SOCIAL (INDIVIDUAL) IMPACT VARIABLES

Impact Variable	Proxy Variable	Problems as a Proxy
I. Satisfaction	expressed satisfaction with the educational process	may not adequately reflect outcomes
	level of willingness to pay fees	as a monetary expression, may reflect primarily material consideration
J. Social Functioning	goals clarified by experience in program	goals perhaps unrealistic goal isn't equivalent to knowing how to get there
	perception of program's contribution to understanding of self understanding of one's life context	generally, these variables are desirable but not to a great degree
	ability to fit in with the other workers	could be carried too far
K. SES Changes	parental income	only one component of SES
	parental job mobility *vs.* own experience	assumes a medium degree of mobility associated with being a professional
	present family income	only one component of SES
L. Educational experience	educational experience (regular) since graduation – reasons for	presumably consumer education implies relative satisfaction – only if opened up by program taken.

The impact variable representing a total measure of alumni satisfaction with the effects of a program, can be tapped by several specific variables. Student fees might be taken as a proxy of willingness to pay, degrees of satisfaction with the educational process might be another indicator. The second set of variables reflects a general measure of the alumni's capability of functioning in the society. One of these obtains the view of employers, the others deliberately seek the subjective views of the students. Such variables all have a heavy bias towards the cognitive aspect of psychological impact. The third set of variables gives some indication of the effect of the program on the social *position* of the alumnus, but they measure only a part of social status. The fourth set assumes that education is intrinsically good and completing a college program will likely increase the person's accessibility to additional education.

Social (Societal) Impact Variables

Variables in this class reflect the impact which the college programs have generally upon society. This analysis produces the least satisfactory data because much of it is subjective and one must leap from partial micro data to total macro judgements. This section is included primarily for closure of the concept. Social (societal) impact variables are used to consider the following types of question: (1) Has the program led to a more stable society — in the sense that people interact better? (2) Has it functioned to promote social mobility? Table 5 illustrates the variables under two categories, social functioning and educational aspirations. No new variables have been included but rather a different interpretation is placed upon variables which have been previously used.

Table 5   SOCIAL (SOCIETAL) IMPACT VARIABLES

Impact Variable	Proxy Variable	Problems as a Proxy
M. Social Functioning	score on I, J, and K variables	a good impact of the alumnus is not necessarily good for everyone
N. Educational Aspirations	expectations of future education all variables in F	doesn't directly measure effect on non-alumni as above

If general conclusions on social functioning are to be derived from the data, then scores should be developed for variables I, J and K. The difficulty with this type of analysis is that it is based on the assumption that what is good for college students will be good for society. But this is not self-evident. By helping some people to improve their life prospects, the goals of others might well be blocked, e.g., a rush to achieve certification, in the long run, probably will decrease the returns to college education. A second general variable would be a measure of the impact which a college program has upon the educational aspirations of the populace. Such a measure would be important to assess the volume of services required and determine the resulting shifts in the functions the college system performs for society.

Treatment of Impact Variables

The methodology suggested here is to perform separate analyses at the level of each impact variable. Since the data are not based on some common unit of measurement (such as dollars) we cannot arrive at an impact index which encompasses all the variables described above. It should be more useful to provide decision-makers with the estimated impact of each variable separately. Table 6 summarizes the proposed treatment. The following briefly describes the treatment for each class of variable.

Economic (Individual) Impact Variables. We do not suggest that an overall scale be constructed to measure the economic benefits accruing to the individual. Instead the analysis should identify problem programs by the use of scales of the lower level impact variables and scores on the individual proxy variables. If a cluster of programs is dealt with then problem identification should be easier. Scales to measure the impact variables can be used, in conjunction with identified problems, to make judgements on the desirability of contracting, expanding or terminating programs.

Economic (Societal) Impact Variables. The analysis is likely to be less convincing than that used for the first set of impact variables, because macro level implications are being drawn from micro level data. Such data would be difficult to use to interpret single programs or program clusters. However, they might prove to be beneficial for evaluation of an entire system. It would be useful to collect special data (through survey or interview) to try to determine the economic impact on society generally.

Table 6   SUMMARY OF SUGGESTED TREATMENT OF IMPACT DATA

Impact Variable	Treatment of Data
Economic (Individual)	No aggregate index Analyze each impact variable separately.
A. Employability	Overall index possible
B. Certification	Qualitative statement
C. Flexibility	Qualitative statement
D. Material Benefits	Overall index possible
Economic (Societal)	Qualitative statement
E. Structural Needs	Overall index; individual variable scores to discriminate among programs
F. Certification	Overall index
G. Economic Flexibility	Qualitative statement
H. Benefits to Society	Qualitative assessment of program worth
Social (Individual)	Integration of scores on each impact variable may provide useful information on impact of entire system over time.
I. Satisfaction	Overall index
J. Social Functioning	Overall index
K. SES Changes	Overall index
L. Educational Experience	Overall index
Social (Societal)	Intuitive, judgemental approach
M. Social Functioning	Aggregate index possible but not likely to be useful for specific program assessment
N. Educational Aspirations	Scores meaningful only on long-term, macro basis

Social (Individual) Impact Variables. It should be easy to calculate an overall score on each of the four general variables in this class. Although this is not necessary for evaluating the college programs, the individual proxy variables will be useful in identifying problems and might provide the data base for studying measures of impact of the outputs of the college system over time.

Social (Societal) Impact Variables. At this time, no formal analyses are suggested for these impact variables. Once we have gained experience in the development of such data it may be possible to move beyond an intuitive, judgemental approach.

Cost Data

Costs can be categorized on the same basis as the impact variables, e.g., into economic (individual), social (individual), social (societal) and economic (societal). Data for the first two need not be collected separately if impacts are defined as net impacts. It is expected that individuals take into account their opportunity costs when assessing possible program impact and their willingness to pay fees. Data for social (societal) cost variables present difficulties. Since the impact variables in this category are formed from previous net measures, social (societal) cost variables are implicitly included in the measures of impact. The economic (societal) cost variables include many components, the largest of which is the direct cost of programs to the taxpayer. Therefore analysis based on these data should be quite manageable. Moreover, these costs correspond to the funds entrusted to the upper level college system decision makers and thus are most meaningful for this analysis. Generally cost data are available through the institutions themselves. In Ontario they are provided for all the provincial Colleges of Applied Arts and Technology through the CAMPUS System.* Similar packages are used by many colleges in the U.S.

At the aggregate level, cost per FTE (or cost per student contact hour) is available for each program. For the analyses, all cost data must be put into constant dollars. If a cluster of programs is to be evaluated, then data on the individual programs must be weighted by enrollment to provide data for the cluster. The total cost per FTE can easily be broken down to provide a cost distribution among academic salaries, support staff salaries, EDP, equipment, and so forth. This type of data can be used to identify problem programs and to discuss efficiency problems. For the overall analyses of programs, the analysis by disaggregated data *per se* is unnecessary. Once the distinction has been made between high and low impact programs, cost problems can be identified by submitting costs to statistical tests, to determine (1) significant differences in total costs; (2) significant differences in single cost items; and (3) significant differences in the whole pattern of costs. Many programs would have to be evaluated before such analyses could be performed with confidence.

Cost-Impact Analysis

When scores have been calculated for the impact variables and dollar costs have been determined on the same dimensions, a matrix of impacts *versus* costs can be compiled, as follows:

*For a detailed description of CAMPUS, see *CAMPUS VIII Planning Model: General description.* Toronto: Systems Research Group Inc., 1972.

Impact Variables	Scores	Costs
Economic-Individual		
A		
B		
C		
D		
Economic-Societal		
E		
F		
G		
H		
Social-Individual		
I		
J		
K		
L		
Social-Societal		
M		
N		

The ratio of impacts to costs can then be calculated, and programs grouped according to high impact per dollar cost and low impact per dollar cost. Such a ratio could also be calculated for each item, or for the scores on each impact variable—either method gives multi-dimensional results. Over time the analysts will become aware of, and can discard, those variables which do not serve as adequate discriminators. It must be stressed, however, that it is not necessary to develop all ratio measures. Far more important is the presentation of the array of costs and impacts on which decisions can be based. For some types of decision, the ratio of costs to impacts will be meaningful, for others not.

There are essentially three ways that decisions can be made, for which the cost-impact framework, which we have described, should prove useful.

● Targets can be set for the goals; a program is good if it fulfills these objectives.

● Programs can be compared; a program is good if it has, *relative* to other programs, high impact scores per dollar cost. (This is the only feasible approach in a situation devoid of targets. The primary problem with such ranking is that this is merely a relative evaluation and, since there must always be a program ranked at the bottom, the conclusion is misleading.)

● Outputs can be assessed as satisfactory (or not), given the level of expenditures. This is known as "satisficing behaviour".

It is the third style of decision making which is the most prevalent among administrators at the level with which this paper is concerned. For them the cost-impact framework of analysis can be most useful, since they need information relating impacts to costs in a multi-dimensional array (as opposed to single cost-benefit indices).

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William Evanco*

MULTINOMIAL LOGISTIC ENROLLMENT MODELS: APPLICATION TO IRAQI PRIMARY EDUCATION

Introduction

One important activity in the planning of educational systems is the forecasting of student enrollment. If, at some future time, sufficient places are to be provided for students and adequate educational resources made available for their programs, then the policy-makers must have some idea of the numbers to be expected. Over the past two decades, techniques for enrollment forecasting have become highly developed, the most sophisticated methodology to date being based on educational flow models.[1] In any given year, the numbers of students are identified by grade level; transition rates, measuring the propensity of students to advance the following year to a subsequent grade, to repeat the grade, to drop out or to graduate, permit estimates to be made of the numbers in each grade the subsequent year. The number of new students entering the system may be estimated using demographic techniques, or otherwise projected exogenously. This process, iterated for as many years as desired into the future, will yield the enrollment estimates on which policy can be based.

The transition rates which characterize the flows of students remain relatively stable over time; so for a first approximation the enrollment forecast can be made with constant transition rates. However, these rates do change slowly over time and for long term estimates more sophisticated forecasting requires that the time trends be identified. If sufficient empirical data are available then the rates *vs.* time may be plotted and a straight line fit through the points with the aid of linear regression analysis. However, there are a number of objections to this approach. The values of transition rates are restricted between zero and one, whereas a straight line extrapolated to future times may violate these bounds. For such cases it may be necessary to establish arbitrary cutoffs. In addition, as we shall see in the next section, the sums of certain transition rates must equal one; performing independent regressions will not necessarily yield predicted transition rates satisfying this restriction. This problem may be overcome by normalizing the rates, but such an approach will lead to a poorer fit between the empirical points and the normalized rates. Alternatively the least squares regression analysis may be carried out with the constraints brought into play from the start; using Lagrange multipliers the squared errors can be minimized subject to the constraints, but then many of the desirable features of regression analysis, concerning the analysis of errors, would be forfeited. Moreover Meulepas raises theoretical objections to the use of least squares techniques for estimating transition rates.[2] The empirical transition rates are computed by taking the ratio of two random variables which produces complications (for example, the repeater rate for the second grade is the number of students repeating that grade between two consecutive years divided by the total stock of second grade students in the initial year). Even if the stocks are regarded as deterministic the variance associated with a transition

rate will depend on time, resulting in a correlation between the explanatory variable, time, and the residual. Thus a generalized least squares approach should be used to avoid biased estimators.

To overcome some of these problems we suggest the use of multinomial logistic enrollment models, as described in this paper. Logistic curves are restricted between zero and one, and, properly chosen, the sums of transition rates will satisfy the necessary constraints. Moreover, the use of a maximal likelihood principle to estimate the model parameters will eliminate theoretical objections connected with regression analyses. First the definitions and concepts necessary for understanding the problem are developed, then the multinomial logistic model is discussed, the model is applied to the primary education system in Iraq, and a conclusion discusses the results and suggests directions for future research.

Notations and Relationships

For concreteness consider a primary educational system consisting of six grades whereby entrance into any grade (beyond the first) is conditional upon the successful completion of the previous grade. Under certain conditions a student in any grade during one year may, the following year, repeat that grade, advance to the subsequent grade, or drop out. Consider N_j^T students enrolled in grade j at time T such that the numbers of students who repeat, advance, or drop out, respectively, are R_j^T, A_j^T, D_j^T. For the sixth grade assume that $A_{j=6}^T$ is the number of students who successfully complete this grade and graduate to the next level of schooling. An identity relating these numbers is

$$R_j^T + A_j^T + D_j^T = N_j^T \qquad (j = 1, \ldots, 6) \qquad (1)$$

and for the primary system the numbers can be represented in the student flow table in Figure 1. Note that the jth column adds to N_j^T; in addition, the seventh column represents the number of new entrants in each of the grades at the start of T+1 where we assumed that the numbers of students reentering grades two through six are sufficiently small to be ignored. Column eight represents the row totals such that

$$R_1^T + NE_1^T = N_1^{T+1} \qquad (2)$$

$$A_{j-1}^T + R_j^T = N_j^{T+1} \qquad (j = 2, \ldots, 6) \qquad (3)$$

The interpretation of equation (2) is that the number of students in grade one at T+1 equals the numbers of students repeating grade one from the previous year plus the number of new entrants to grade one. Equation (3) indicates that the number of students in grade j (j = 2, ..., 6) at T+1 equals the number advancing from j-1 plus the number repeating j.

We further define the fractions of students in grade j at time T who repeat, advance or drop out at T+1, respectively, as r_j^T, a_j^T, and d_j^T. These fractions are called transition ratios and are formally defined for j = 1, ..., 6 by

$$r_j^T = R_j^T / N_j^T \qquad (4)$$

$$a_j^T = A_j^T / N_j^T \qquad (5)$$

$$d_j^T = D_j^T / N_j^T \qquad (6)$$

Figure 1   STUDENT FLOW TABLE

Grade During Time $T+1$	1	2	3	4	5	6	New Entrants	Row Totals
1	R_1^T	0	0	0	0	0	NE_1^T	N_1^{T+1}
2	A_1^T	R_2^T	0	0	0	0	0	N_2^{T+1}
3	0	A_2^T	R_3^T	0	0	0	0	N_3^{T+1}
4	0	0	A_3^T	R_4^T	0	0	0	N_4^{T+1}
5	0	0	0	A_4^T	R_5^T	0	0	N_5^{T+1}
6	0	0	0	0	A_5^T	R_6^T	0	N_6^{T+1}
Graduates	0	0	0	0	0	A_6^T	0	
Dropouts	D_1^T	D_2^T	D_3^T	D_4^T	D_5^T	D_6^T		
Column Totals	N_1^T	N_2^T	N_3^T	N_4^T	N_5^T	N_6^T		

Figure 2   MATRIX OF TRANSITION RATIOS

$$
\begin{array}{cccccc}
r_1^T & 0 & 0 & 0 & 0 & 0 \\
a_1^T & r_2^T & 0 & 0 & 0 & 0 \\
0 & a_2^T & r_3^T & 0 & 0 & 0 \\
0 & 0 & a_3^T & r_4^T & 0 & 0 \\
0 & 0 & 0 & a_4^T & r_5^T & 0 \\
0 & 0 & 0 & 0 & a_5^T & r_6^T \\
0 & 0 & 0 & 0 & 0 & a_6^T \\
d_1^T & d_2^T & d_3^T & d_4^T & d_5^T & d_6^T
\end{array}
$$

Figure 2 shows a matrix of ratios analogous to the flows of Figure 1, and by the definitions (4) to (6) they satisfy the identity

$$r_j^T + a_j^T + d_j^T = 1 \qquad\qquad (j = 1, ..., 6) \qquad\qquad (7)$$

Thus all students are accounted for in terms of repeating, advancing, or dropping out.

These transition coefficients represent the proclivities of students to repeat, advance, or dropout; for example, r_2^T can be interpreted as the probability that a student enrolled in grade 2 at time T will repeat that grade at $T+1$ so that the number of students repeating that grade is $R_2^T = r_2^T \cdot N_2^T$ consistent with equation (4). This proclivity will depend upon the types of students enrolled in grade 2, the resources applied to them, and the administrative regulations regarding promotion. If these factors remain relatively un-

changed over a given period of time, then we might expect the transition probabilities to be approximately constant over the period. In this case, for any times T and T+1 within the period

$$N_1^{T+1} = r_1 N_1^T + NE_1^T \tag{8}$$

$$N_j^{T+1} = a_{j-1} N_{j-1}^T + r_j N_j^T \qquad (j = 2, ..., 6) \tag{9}$$

where because of constancy the time index on the transition coefficients was suppressed. From equation (8) the number of students enrolled in grade one at T+1 is the number of students in grade one at T multiplied by the probability of repeating that grade, plus the number of new entrants into the grade at T+1. Similarly equation (8) gives the number of students enrolled in j at T+1 in terms of the number of students advancing from j-1 i.e., the probability of advancing from j-1 multiplied by the number of students in j-1 at T) plus the number of students repeating j-1 (i.e., the probability of repeating j multiplied by the number of students in j at T).

Equations (8) and (9) can be conveniently written in matrix form as

$$\begin{pmatrix} N_1^{T+1} \\ N_2^{T+1} \\ N_3^{T+1} \\ N_4^{T+1} \\ N_5^{T+1} \\ N_6^{T+1} \end{pmatrix} = \begin{pmatrix} r_{11} & 0 & 0 & 0 & 0 & 0 \\ a_{21} & r_{22} & 0 & 0 & 0 & 0 \\ 0 & a_{32} & r_{33} & 0 & 0 & 0 \\ 0 & 0 & a_{43} & r_{44} & 0 & 0 \\ 0 & 0 & 0 & a_{54} & r_{55} & 0 \\ 0 & 0 & 0 & 0 & a_{65} & r_{66} \end{pmatrix} \cdot \begin{pmatrix} N_1^T \\ N_2^T \\ N_3^T \\ N_4^T \\ N_5^T \\ N_6^T \end{pmatrix} + \begin{pmatrix} NE_1^T \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} \tag{10}$$

Given the student flow table as in Figure 1 for some base year, T=0, the transition ratios as shown in Figure 2 can be calculated, and if these ratios are assumed to be constant over a given time period then equations (8) and (9), or (10) may be used iteratively to obtain enrollments by grade during the time period, provided that independent estimates are obtained for the NE_1^T.

Such a calculation provides a first approximation to enrollment forecasting. In reality the factors influencing the transition coefficients do change over time thus generating systematic changes in these coefficients. Moreover targets may be set by policy-makers for various transition coefficients; it may be desired to reduce repeater and dropout rates to a certain level within a certain time period. In what follows, however, we restrict ourselves to the projection of historical time trends in transition coefficients to estimate their effects on enrollments. To this end it is necessary to introduce a stochastic formulation for student flows.

Stochastic Formulation

Henceforth we assume a time dependence for the transition coefficients, as in Figure 2, and we interpret these coefficients as transition probabilities. Given the number of students in grade j at time T, N_j^T, and the transition probabilities, we can express the probability of observing the numbers R_j^T, A_j^T, and D_j^T as:

$$P(R_j^T, A_j^T, D_j^T / N_j^T) = (N_j^T!/R_j^T!A_j^T!D_j^T!)(r_j^T)^{R_j^T}(a_j^T)^{A_j^T}(d_j^T)^{D_j^T} \qquad (11)$$

where identity (1) still holds. Equation (11) is a multinomial probability distribution, and the motivation for its use is as follows: From the ensemble of N_j^T students, the probability of drawing R_j^T students who repeat, A_j^T students who advance and D_j^T students who drop out *in some particular order* is just the product of the last three terms on the right of equation (11), because the probability of independent events is multiplicative. However, when the order of outcome is ignored, the probability is the sum of the probabilities for the ordered outcomes, since the possible orders are mutually exclusive. But the ordered outcome probabilities are constant, and the number of ordered outcomes is $N_j^T!/R_j^T!A_j^T!D_j^T!$ by the general law of permutations, so that the summation of ordered outcomes is given by (11)

Taking the expectation value of R_j^T, A_j^T, and D_j^T with respect to the probability given in equation (11) yields respectively $r_j^T N_j^T$, $a_j^T N_j^T$, and $d_j^T N_j^T$. Thus from identities (2) and (3) it follows that the expectation values (denoted by the symbol "E") of N_j^{T+1} (J=1, ..., 6) are given by:

$$E(N_1^{T+1}) = r_1^T E(N_1^T) + E(NE_1^T) \qquad (8a)$$

$$E(N_j^{T+1}) = a_{j-1}^T E(N_{j-1}^T) + r_j E(N_j^T) \qquad (j = 2, ..., 6) \qquad (9a)$$

which are equivalent to (8) and (9).

In order to statistically estimate the time dependence of the transition probabilities on the basis of historical data, it is necessary to assume a functional form for these probabilities. We are constrained by identity (7) and the fact that these probabilities can only have values between zero and one. Multinomial logistics functions[3] of the form

$$r_j^T = \exp(Z_{1j}^T)/(1 + \exp(Z_{1j}^T) + \exp(Z_{2j}^T)) \qquad (12)$$

$$a_j^T = \exp(Z_{2j}^T)/(1 + \exp(Z_{1j}^T) + \exp(Z_{2j}^T)) \qquad (13)$$

$$d_j^T = 1/(1 + \exp(Z_{1j}^T) + \exp(Z_{2j}^T)) \qquad (14)$$

for j = 1, ..., 6 satisfy the constraints (7) where

$$Z_{1j}^T = \alpha_{1j} + \beta_{1j}T \qquad (15)$$

$$(j = 1, ..., 6)$$

$$Z_{2j}^T = \alpha_{2j} + \beta_{2j}T \qquad (16)$$

The mathematical properties of logistics functions are given in the appendix to this paper on page 63.

Given M years of empirical data, say from T = –M to T = –1, regarding the values of R_j^T, A_j^T, and D_j^T, the maximal likelihood principle can be applied to estimate the parameters $\alpha_1, \beta_1', \alpha_2$ and β_2. Thus we want to maximize the function

$$\prod_{T=-m}^{-1} P(R_j^T, A_j^T, D_j^T \mid N_j^T)$$

with respect to the parameters where π refers to the product operator. It is however more convenient to take the natural logarithm of this function (since the logarithm is a monotonically increasing transformation, its maximum will occur for the same parameter values as that of the original function) and obtain

$$\sum_{T=-M}^{-1} (\ln(N_j^T!/R_j^T!A_j^T!D_j^T!) + R_j^T \ln r_j^T + A_j^T \ln a_j^T + D_j^T \ln d_j^T)$$

Then differentiating this function with respect to $\alpha_1, \alpha_2, \beta_1$, and β_2, using the identities (A.3) through (A.5) as established in the appendix, and identity (1) will yield the following first order conditions (all summations from $T=-M$ to $T=-1$):

$$\alpha_1: \quad \Sigma N_j^T r_j^T = \Sigma R_j^T \tag{17}$$

$$\alpha_2: \quad \Sigma N_j^T a_j^T = \Sigma A_j^T \tag{18}$$

$$\beta_1: \quad \Sigma T N_j^T r_j^T = \Sigma T \cdot R_j^T \tag{19}$$

$$\beta_2: \quad \Sigma T N_j^T r_j^T = \Sigma T \cdot R_j^T \tag{20}$$

We want to find those values of the parameters $\alpha_1, \alpha_2, \beta_1$ and β_2 for which equations (17) through (20) will hold. Since these equations are acutely non-linear, in the parameters we employ the Newton-Raphson technique (see Bock for an exposition of this approach) to iteratively approximate the parameter values. For the $(i+1)$th iteration the first order conditions, (17) through (20), are Taylor expanded about the parameter values estimated in the ith iteration. Keeping only two terms of this expansion, and setting the expansion equal to zero will yield four inhomogenous linear simultaneous equations in the differences between the $(i+1)$th iteration and the ith iteration estimates of the parameters as shown below in equation 1h(21). The differences may now be solved by matrix inversion. To start the iterative process the parameters are initially set equal to zero. The Newton-Raphson process usually converges to finite values of the parameters in five or six iterations.

$$(W)_i \begin{pmatrix} \alpha_1^{i+1} - \alpha_1^i \\ \alpha_2^{i+1} - \alpha_2^i \\ \beta_1^{i+1} - \beta_1^i \\ \beta_2^{i+1} - \beta_2^i \end{pmatrix} = \begin{pmatrix} \Sigma (N_j^T r_j^T - R_j^T) \\ \Sigma (N_j^T a_j^T - A_j^T) \\ \Sigma T (N_j^T r_j^T - R_j^T) \\ \Sigma T (N_j^T a_j^T - A_j^T) \end{pmatrix}_i \tag{21}$$

where W is the matrix of coefficients in the second order condition and is given by

$$
W = \begin{array}{c|cccc}
 & \alpha_1 & \alpha_2 & \beta_1 & \beta_2 \\
\hline
\alpha_1 & \Sigma N_j^T r_j^T (1-r_j^T) & -\Sigma N_j^T r_j^T a_j^T & \Sigma T N_j^T r_j^T (1-r_j^T) & -\Sigma T N_j^T r_j^T a_j^T \\
\alpha_2 & \Sigma N_j^T a_j^T r_j^T & \Sigma N_j^T a_j^T (1-a_j^T) & -\Sigma T N_j^T a_j^T r_j^T & \Sigma T N_j^T a_j^T (1-a_j^T) \\
\beta_1 & \Sigma T N_j^T r_j^T (1-r_j^T) & -\Sigma T N_j^T r_j^T a_j^T & \Sigma T^2 N_j^T r_j^T (1-r_j^T) & -\Sigma T^2 N_j^T r_j^T a_j^T \\
\beta_2 & -\Sigma T N_j^T a_j^T r_j^T & \Sigma T N_j^T a_j^T (1-a_j^T) & -\Sigma T^2 N_j^T a_j^T r_j^T & \Sigma T^2 N_j^T a_j^T (1-a_j^T)
\end{array}
\qquad (22)
$$

Application to Iraqi Primary Education

The model will now be applied to the primary educational system of Iraq. The system consists of six consecutive grades and data are available for the school years 1965-66 through 1972-73 on the total enrollment, the numbers of students advancing to a subsequent grade (or in the case of the sixth grade graduating), the numbers repeating each of the six grades and the number of new entrants to grade 1. These data are shown in Table 1. New entrants to other grades are assumed to be zero. These numbers are substituted into equations (21) and the values of the α and β parameters are approximated using the Newton-Raphson technique. On the basis of these parameter values, the promotion and repeater rates for each grade are plotted (see Figures 3a-f) as a function of time, T, for the years 1965-66 through 1989-90. Also shown are the empirically derived transition rates between 1965-66 through 1972-73, calculated using equations (4), (5) and (7) and the values from Table 1. In addition, for comparison purposes, in Figure 3-f the results are plotted for the transition ratios when they are assumed to be linear functions of T and linear regression analysis is applied to estimate the parameters. By the school year 1982-83 both the promotion and repeater rates for the 6th grade have violated the contraints, thus requiring that an arbitrary cutoff be applied. Moreover, linear regressions tend to overestimate the promotion rates, and underestimate the repeater rates beyond the school year 1973-74.

Using the values calculated for the α and β parameters in equations (12) and (13) and substituting them into the flow model given in equation (10), will yield projections of student enrollment by grade. The NE_1^T of equation (10) was estimated for future years from the geometric growth equation

$$NE_1^T = (1+r)^T NE_B$$

where r is the annual rate of growth and NE_B is the number of new entrants for some base

TABLE 1   NUMBER OF STUDENTS ENROLLED (N), PROMOTED (A), REPEATING (R), BY GRADE AND YEAR; AND NEW ENTRANTS INTO GRADE ONE BY YEAR

		YEAR							
		65-66	66-67	67-68	68-69	69-70	70-71	71-72	72-73
1	N_1^T	192709	198442	198958	208255	235787	271158	301245	323454
	A_1^T	127238	136974	138461	142058	166397	192482	214115	233086
	R_1^T	40495	40644	38888	44362	45372	55228	62448	69802
	NE_1^T	157979	158314	169367	191425	225785	246018	247010	274858
2	N_2^T	163424	164048	168784	170982	178288	198440	225487	251527
	A_2^T	119015	124303	131428	130834	138015	155706	182068	201954
	R_2^T	33232	30713	29557	32490	31267	32647	36262	42047
3	N_3^T	142874	149174	150933	156908	154636	167681	181574	209735
	A_3^T	107832	115060	118973	122740	121739	135892	149665	176660
	R_3^T	26854	26138	24619	26472	24507	24408	26529	29046
4	N_4^T	147055	146865	151691	155804	156114	163534	170926	188106
	A_4^T	101479	100717	107667	11553	110143	124703	129683	140947
	R_4^T	36140	36566	34146	33094	35891	33888	34771	37038
5	N_5^T	169154	166299	163363	171747	172385	176593	181657	194046
	A_5^T	86143	86457	88826	96371	97184	101467	104675	112736
	R_5^T	64049	62003	56698	56761	56150	63609	64568	66420
6	N_6^T	128264	132075	133244	127555	126222	127474	134641	134870
	A_6^T	67993	67735	78851	83363	79533	82573	90754	99907
	R_6^T	44542	47787	32256	30251	30290	31951	28615	24951

Source: *Educational Statistics Annual Reports*, Ministry of Education, Baghdad, Iraq.
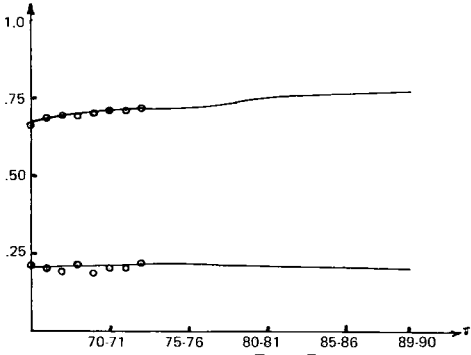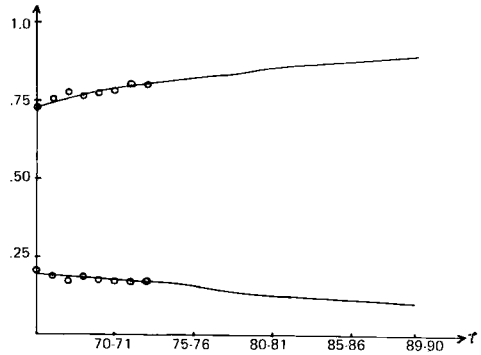
Figure 3a: a_1^T, and r_1^T vs. T
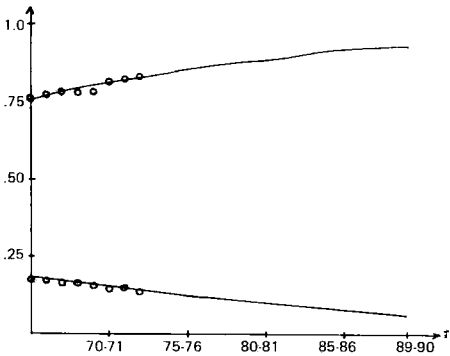
Figure 3b: a_2^T and r_2^T vs. T

Figure 3c: a_3^T and r_3^T vs. T
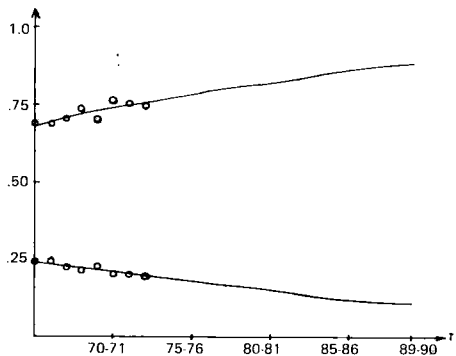
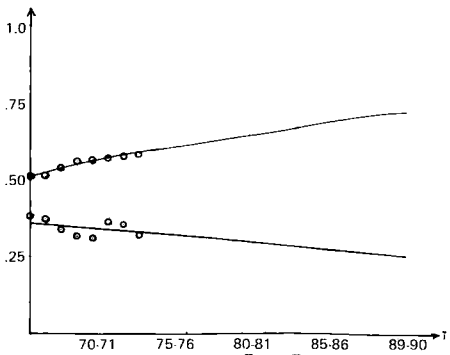**Figure 3d:** a_4^T and r_4^T vs. T

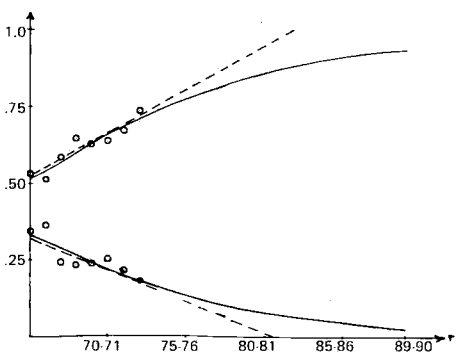**Figure 3e:** a_5^T and r_5^T vs. T

Figure 3f: a_6^T and r_6^T vs. T

year. The rate of growth was estimated using linear regression and was found to be about 6%. The total primary enrollment is shown in Figure 4 as a function of time through 1989-90, and is compared with the total obtained by using linear regression to estimate transition rates, i.e., the transition rates were assumed of the form $a+b \cdot T$; independent regressions were run and the sum of promotion, repeater, and dropout rates were then normalized to unity. Whenever necessary, a cutoff of unity was applied to a projection of a transition rate exceeding one, and for projected transition rates less than zero a cut-off of zero was applied. Beyond 1980-81 the linear estimation overestimates enrollment by more than 300,000 students per year.

Figure 4   TOTAL PRIMARY ENROLLMENT VS. TIME
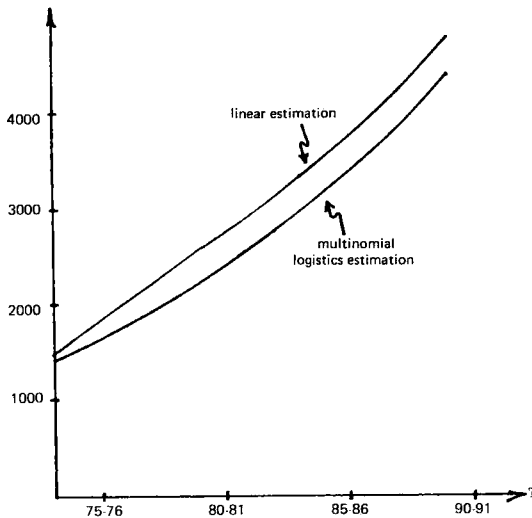
Conclusion

The enrollment model presented in this paper has a number of advantages over previous models:

● The logistic functional forms used to represent the transition rates automatically incorporate the constraints on these rates. Expressions (12), (13) and (14) can never exceed one and may never be less than zero; moreover, the sum of these expressions equals one for all values of time, T, thus satisfying identity (7). Previous attempts to characterize transition rates by logistic functions did not have the desirable property of satisfying identity (7)[4] which results from the use of binomial rather than multinomial logistic curves to fit each transition rate *independently*. Thus it was required to determine one residual transition rate by subtracting the sum of the other rates from one. Moreover, the independent fitting of non-residual rates to binomial logistics may in some instances result in their sum exceeding one. The method described in this paper avoids such problems by *simultaneously* fitting the transition rates to multinomial logistic curves.

● The stochastic multinomial model permits the use of a maximal likelihood approach to arrive at paramter estimates, thus eliminating the theoretical objections raised to estimating transition rates by linear regression techniques.

● Logistic relationships depict the time evolution of transition rates more realistically than linear forms. As a rate approaches its asymptotic limit it increases/decreases at a diminishing rate, reflecting the difficulty of changing a transition rate near its limit. We are assuming, of course, that changes take place by other means than fiat, that there are underlying factors which affect the rates and that changes in such factors are leading to changes in rates. Near the asymptotic limit the factor changes act with diminishing effects.)

There are a number of modifications which might be made in the methodology we have outlined. The functional forms selected imply either monotonically decreasing or increasing transition rates. If, for example, the empirical points lie along a "bowl-shaped" curve and it is believed that this effect is due to underlying factors rather than statistical aberrations, then a good fit might be obtained by treating equations (15) and (16) as quadratic rather than linear in time. The methodology might be modified by introducing additional parameters. Or if sufficient empirical data are available, it might be possible to express the Z's in equations (15) and (16) in terms of the factors believed to cause the changes in the transition rates. In so far as some of these factors can be controlled by policy-makers, the influence of policy alternatives on future enrollments might then be traced.

Appendix

In this appendix the properties of multinomial logistic functions are developed. Consider the general form

$$f(T; \beta_1, \beta_2) = \exp(Z_{1T}) / (1 + \exp(Z_{1T}) + \exp(Z_{2T})) \tag{A.1}$$

The asymptotic limits of this function as $T \rightarrow \infty$ are

$$\lim_{T \rightarrow \infty} f(T; \beta_1, \beta_2) = 1$$

if $0 < \beta_2 < \beta_1$ or $\beta_1 > 0$ and $\beta_2 < 0$, while

$$\lim_{T \rightarrow \infty} f(T; \beta_1, \beta_2) = 0$$

if $\beta_1 < 0$ and $\beta_2 > 0$, or $\beta_1, \beta_2 < 0$, or $0 < \beta_1 < \beta_2$

Desirable asymptotic properties of the transition probabilities are that $a_j^T \rightarrow 1$ while $r_j^T, d_j^T \rightarrow 0$ as $T \rightarrow \infty$. The only parameter values yielding these properties are $0 < \beta_1 < \beta_2$ or $\beta_1 < 0$ and $\beta_2 < 0$. In these cases, the a_j^T is a monotonically increasing function while the r_j^T and d_j^T are decreasing functions in T. The "S-shaped" character of a_j^T is depicted in Figure 5 approaching unity as $T \rightarrow \infty$, while the curves for r_j^T and d_j^T will be similarly shaped but will asymptotically approach the abscissa.

Finally, differentiating equations (12), (13), and (14) with respect to $\alpha_1, \alpha_2, \beta_1$, and β_2 respectively yield:

$$\partial r_j^T / \partial \alpha_1 \;=\; r_j^T(1-r_j^T) \qquad\qquad \partial r_j^T / \partial \alpha_2 \;=\; -a_j^T r_j^T$$

$$\partial a_j^T / \partial \alpha_1 \;=\; -r_j^T a_j^T \qquad\qquad \partial a_j^T / \partial \alpha_2 \;=\; a_j^T(1-a_j^T) \qquad (A.2)$$

$$\partial d_j^T / \partial \alpha_1 \;=\; -r_j^T d_j^T \qquad\qquad \partial d_j^T / \partial \alpha_2 \;=\; -1_j^T d_j^T$$

and for i=1,2

$$\partial r_j^T / \partial \beta_1 \;=\; T \partial r_j^T / \partial \alpha_i \qquad\qquad\qquad (A.3)$$

$$\partial a_j^T / \partial \beta_i \;=\; T \partial a_j^T / \partial \alpha_i \qquad\qquad\qquad (A.4)$$

$$\partial d_j^T / \partial \beta_i \;=\; T \partial d_j^T / \partial \alpha_i \qquad\qquad\qquad (A.5)$$

Figure 5 a_j^T, r_j^T and d_j^T as functions of time, T
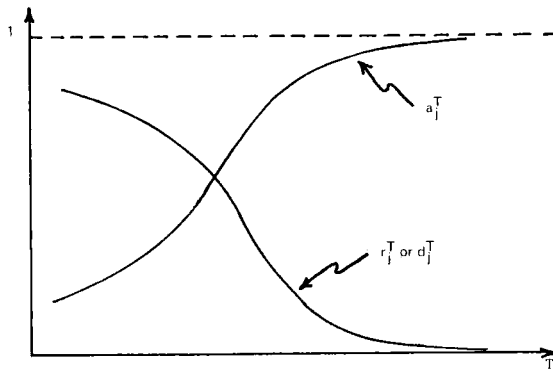
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PROJECT SIMU-SCHOOL COMPONENT
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Background

In the past decade educational planners have been concerned with problems of system growth as they affect programs, personnel and buildings. However, today many find themselves dealing with system problems arising from no growth or very slow growth. This does not mean that shifts in population are not (and will not in the future) cause some school districts to expand. This situation is especially evident in metropolitan areas. But such growth is taking place under different economic conditions. Current austerity programs in education and the reluctance of taxpayers to vote increased education taxes, make the need for effective educational planning more evident. One of the obstacles to planning has been the dearth of accurate data and the inability to use such data as we have in such a manner as to illustrate the alternatives available for decision makers' choice. In other words, all too often we cannot simulate various alternatives through the manipulation of selected data.

Over the past five years, with the Project SIMU-School network, a most promising vehicle has been developed which furnishes such data and planning processes.

This article will describe one of the operational components of the SIMU-School network, which has been developed over the past year at Washington State University to serve educational planners across the state.

The SIMU-School Project was originally funded in 1972 under Title III, Section 306 of the ESEA (Elementary and Secondary Education Act). Since that time ten components have become operational across the country. SIMU-School, essentially, is a simulation technique enlarged to include such common aspects of educational planning as finance, enrollment, staffing and land use. Until recently simulation techniques were seldom used in school planning and most attempts were neither very successful nor widely copied. In contrast, the implementation plan of SIMU-School has been to make the components entirely field based.

The first component was developed in Chicago in 1973. It was quickly followed by those of Santa Clara County, California, and Dallas, Texas. Most of the components perform different functions, but it is hoped that in the future they will comprise a comprehensive planning network, and that a national centre for educational planning will be created to act as the clearinghouse for the various components which are located across the country. The services which might well be offered by such a centre would include the entire planning process. It could

- Store education knowledge
- Function as a multi-communication centre
- Coordinate research and development
- Provide a model for planning
- Enhance community involvement in planning

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- Assist in training future educational planners
- Become a research fellowship centre
- Stimulate components
- Develop planning packages
- Serve as a contracting and coordinating centre
- Evaluate research and product development
- Provide a source of planning talent
- Supply mobile versions of SIMU-School components
- Secure funds for continuing program.[1]

The general purpose of the Washington State Universtiy component was to develop, demonstrate, and disseminate computer-driven models of various aspects of the operation of school systems which, when incorporated into the school planning process, would assist school planning units in deciding upon policies, priorities and programs.

Specifically, the component attempts to facilitate planning by furnishing models which which: (1) manage cumbersome and complex data; (2) supply an objectivity which identifies all relationships between elements of the model; (3) provide a quantitative model with descriptors allowing for various forecasting techniques which describe the long-range impact of decisions. It actually includes three models designed for the needs of administrators in local school districts, and closely linked with such functional administrative departments as personnel, budgeting, planning and instructional services.

The Component Models

1. The enrollment and facilities projection model estimates enrollment at, and for, each district, and then determines the number of school rooms required of each of four room types, compares the estimated room requirements with existing space, and reports surpluses or deficiencies. The administrator may play with various assumptions about enrollment trends and is allowed to increase or decrease space at a school. The model reports the projected results of each decision and can print reports which analyze the differences among various decisions.

The inputs to the model consist of statistics showing births, enrollment history, projected average teacher salaries, class loading by subject and a facilities inventory for each school in the district. Once the basic set of input data has been prepared, the model can be used to examine the effect on the school district of variables which will affect enrollment and the availability of facilities. The projections for this model are derived by using one of several cohort survival techniques. Three techniques are available within the SIMU-School project.[2]

Means of the ratios – the cohort survival is calculated for each grade for each year of data. The mean and variance of these ratios are then calculated and reported.

Ratio of the averages – the average number of pupils in a given grade is divided by the average number of pupils a year later in the following grade to determine the cohort survival ratio. The variance in the ratio of these averages is then calculated and reported.

Log normal cohort survival ratio – the cohort survival ratio is first calculated as in "means of the ratios". The logarithm of each ratio is determined and the mean of the logarithms and the variance in the mean are calculated. The antilog of the mean is then determined and results of these calculations are reported. The cohort survival ratios calculated are

used to forecast future enrollment by grade, or the ratio can be modified by adding or subtracting some fraction of a standard deviation to reflect future growth or decline not accounted for by the historical data. The modified ratio can then be used to forecast future enrollment.

The last year of data is used with the survival ratios to calculate the enrollment in the first year of projection. The same ratios are applied (using the first year of projection) to project a series of years in sequence until the final year of the projection is reached. Enrollment is distributed among schools on the basis of the ratio of the enrollment by grade per school to the total enrollment for that grade in that particular building or district. These ratios are applied year by year in order to calculate the enrollment in a given school.

In addition to forecasting directly from the cohort survival ratios, the program makes provision for reporting the inward and outward migration of students. Migration can be applied to the district as a whole, representing growth or decline in total population, or it can be applied to an individual school and grade.

When the enrollment by school has been calculated, projections of teacher requirement can be computed and reported. For example, elementary school teacher requirements are calculated on the basis of pupil/teacher ratios by grade. The number of teachers required for a given grade is calculated by multiplying the enrollment per grade by the reciprocal of the pupil/teacher ratio. For secondary schools, the number of teachers is calculated for each subject using the same process. Ratios that reflect the fraction of the pupils in a given school or district are calculated. This is accomplished by multiplying a given subject by the reciprocal of the number of pupils per teacher per subject per week. The matrix of ratios is multiplied by the total enrollment in the school to derive the number of teachers required to teach a specific subject in a specific school or district.

Salary is calculated on the basis of an average teacher's salary per year. The estimated salary budget of a school is obtained by multiplying the total number of teachers at that school by the average salary to be paid per year. The figure is recorded as the amount of teacher salary for that year.

The facilities forecasting computations are based on the teacher forecasts. The program assigns rooms on the basis of one room per teacher. The type of room is determined by the subject taught. The number of rooms required is increased by a fraction which reflects the room utilization during teaching periods. For example, if the room is available seven periods a day but only occupied by a teacher for six, then six-sevenths of the total number of rooms is actually required. The facilities portion of the program can report changing inventories of classroom space for any or all given school(s) for any year of the projection, and carry the change forward to any future year.

2. The faculty projection model predicts on a year to year basis the number and cost of teachers starting, terminating or remaining, and the number of new hirings needed. Teachers may be grouped by one or more variables such as race, sex, salary group, subject area or professional status. The model moves teachers through the salary schedule and terminates them according to frequencies established by the historical data. The number of teachers required is determined from enrollment data, previous years' curriculum data and alternatives introduced externally by the user. Prediction mathematics in this model is a probabilistic process. Starting with the complement of teachers for the current year,

the process predicts the status of the group for the following year using transition probabilities calculated from the data base. It anticipates status changes by calculating transition probabilities for each possible event. These probabilities are organized into a transition probability matrix. Multiplication of the starting teacher complement by the matrix will predict the status of a group one year later. This will include the number and status of those who remain and the number of terminating teachers. A "new" teacher complement is calculated from the remaining and newly hired teachers, and starting with the complement, the entire process is repeated, on and on, for up to nine years. One type of report that can be retrieved shows the projected count and cost of starting teachers per subject area, for a given school.

3. The financial projection model estimates the number of personnel by type, forecasts salaries, applies state funding formulae, projects revenue, projects expenditure and provides related financial data.

The model produces a project budget in the format required by the state and provides a financial analysis of the school district by simulating the formula of the state in question. Historical and current data and various user-selected forecast methods to derive the number of pupils, instructional personnel, amount of state support, district support, and federal support are used first to describe the situation quantitatively, and then to project a budget based on these data. Pupils are described by level and type of program. Personnel are described by years of experience, degree attainment and personnel category. The projection of operating fund revenue and expenditure includes calculation of the required local tax rate and assessment level.

This model enables the administrator to address himself to such school finance questions as:
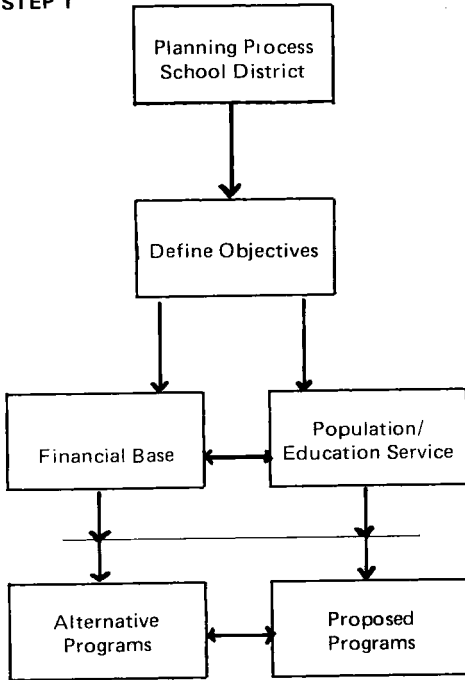
- What short and long-range impact will shifting student enrollment have on state receipts and operating expenditures?
- What are the alternative financial pictures implied by the professional personnel salary schedules under consideration?
- What local tax support can be expected in the next decade?
- What local tax effort will be required in the next decade?
- What controllable variables exist for district financing?

The financial projection model enables the educational planner to vary inputs and predict the associated impact of virtually any number of policy factors which can influence a school budget. An example of this is illustrated where there has been a change in the assessed value of taxable property and a new budget has to be calculated. This model may draw upon data generated by the other two models. The planner may decide to increase or decrease the enrollment projections, or may wish to predict the impact of salary variations upon the district's cash flow.
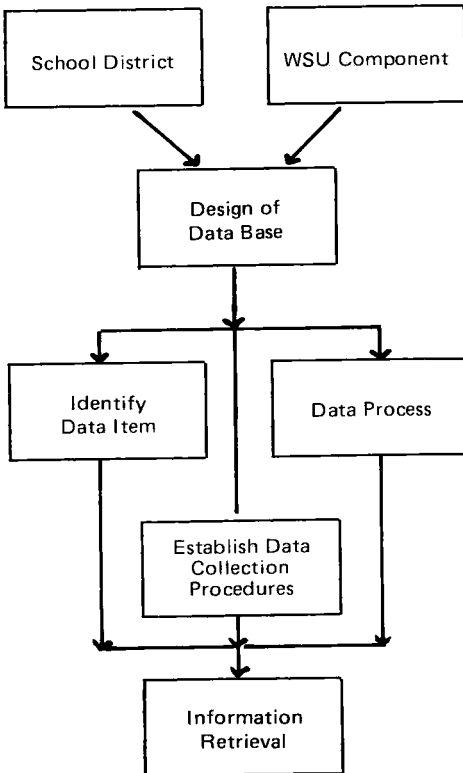
The financial projection model uses a wide variety of historical trend analyses on which to base the projection over time. The effects of varying any component of the budget can be systematically predicted. For example, the assessed value of taxable property can be altered to reflect changes within the school district. The model enables educational decision makers to manage vast quantities of data and assess accurately a wide variety of program alternatives. Other planning variables in the data file that can be treated are analysis of tax assessments, bonded indebtedness, debt service charges and investment revenues.
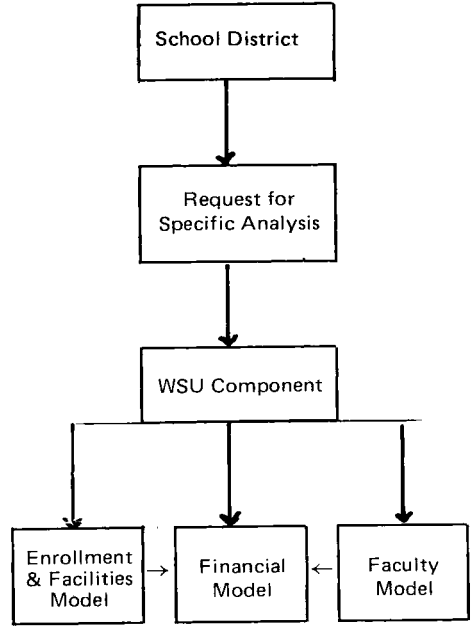
Thomas E. Glass

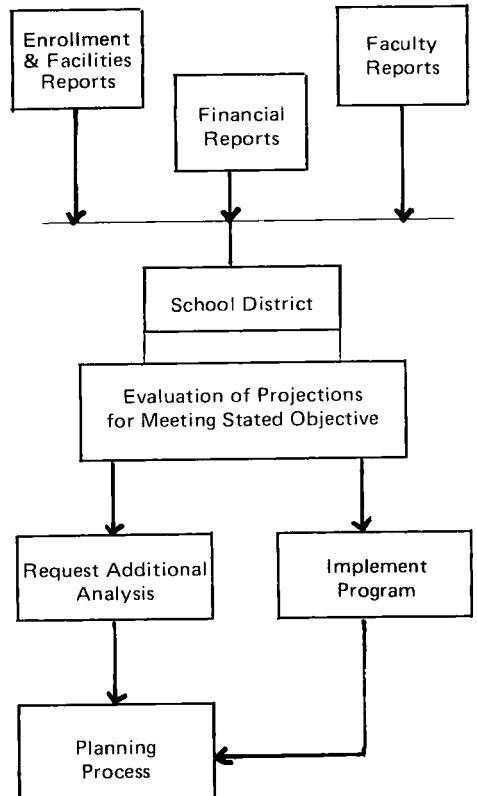## SYSTEM DIAGRAM
STEP 1

```
┌─────────────────────┐
│  Planning Process   │
│   School District   │
└─────────────────────┘
          │
          ▼
┌─────────────────────┐
│  Define Objectives  │
└─────────────────────┘
     │           │
     ▼           ▼
┌──────────┐  ┌──────────────┐
│          │  │ Population/   │
│ Financial│◄─►│ Education     │
│ Base     │  │ Service       │
└──────────┘  └──────────────┘
     │              │
     ▼              ▼
┌──────────┐  ┌──────────┐
│Alternative│  │ Proposed │
│ Programs  │◄─►│ Programs │
└──────────┘  └──────────┘
```

STEP 2

```
┌─────────────────┐   ┌─────────────────┐
│ School District │   │  WSU Component  │
└─────────────────┘   └─────────────────┘
           │                 │
           ▼                 ▼
        ┌──────────────────────┐
        │     Design of        │
        │     Data Base        │
        └──────────────────────┘
                  │
     ┌────────────┼────────────┐
     ▼            │            ▼
┌──────────┐      │      ┌──────────────┐
│ Identify │      │      │ Data Process │
│ Data Item│      │      └──────────────┘
└──────────┘      │
     │      ┌──────────────┐
     │      │ Establish Data│
     │      │ Collection   │
     │      │ Procedures   │
     │      └──────────────┘
     │            │
     ▼            ▼
        ┌──────────────────┐
        │   Information    │
        │    Retrieval     │
        └──────────────────┘
```

STEP 3

```
┌─────────────────┐
│ School District │
└─────────────────┘
          │
          ▼
┌─────────────────┐
│  Request for    │
│ Specific Analysis│
└─────────────────┘
          │
          ▼
┌─────────────────┐
│  WSU Component  │
└─────────────────┘
     │      │      │
     ▼      ▼      ▼
┌────────┐┌────────┐┌────────┐
│Enrollment││Financial││ Faculty│
│& Facilities│→│ Model │←│ Model │
│ Model  ││        ││        │
└────────┘└────────┘└────────┘
```

STEP 4

```
┌────────────┐  ┌──────────┐  ┌──────────┐
│ Enrollment │  │ Financial│  │ Faculty  │
│ & Facilities│  │ Reports  │  │ Reports  │
│ Reports    │  │          │  │          │
└────────────┘  └──────────┘  └──────────┘
      │              │              │
      ▼              ▼              ▼
           ┌──────────────────┐
           │ School District  │
           └──────────────────┘
                    │
           ┌──────────────────────┐
           │ Evaluation of        │
           │ Projections for      │
           │ Meeting Stated       │
           │ Objective            │
           └──────────────────────┘
              │              │
              ▼              ▼
    ┌──────────────────┐ ┌──────────┐
    │ Request Additional│ │ Implement│
    │ Analysis         │ │ Program  │
    └──────────────────┘ └──────────┘
              │              │
              ▼              │
    ┌──────────┐            │
    │ Planning │◄───────────┘
    │ Process  │
    └──────────┘
```

The Sequence of the SIMU-School Projection Tasks

SIMU-School is a system of computerized data files, and programs that can provide a quantitative basis for planning and decision-making. Variables that include pupil service activities, personnel reporting, instructional activities, support services, and special projects are identified and stored in specific data files.

Figure 1 illustrates the interaction between the school district and the SIMU-School project.

Step 1 — describes the systematic processes a school district follows to establish program needs and alternatives. Accurate forecasting is an essential activity of this process.

Step 2 — defines the collection procedures to develop an integrated data base.

Step 3 — shows the relationship of the three models, within the SIMU-School project, to provide standard statistical analyses and projections.

Step 4 — interprets results, and submits additional data to the computer analyst to help evaluate alternative solutions.

Conclusion

The projection models can function either independently or as subfiles of the financial projection model. All three may be integrated into one district-wide simulation which will yield accurate data predicting the needs and impact of various input alternatives. When these activities are incorporated into the planning process, management and policy decisions are facilitated.

The three models which have been described are now in use. The initial district of implementation was Clover Park, Washington, where they were operationalized through use of baseline data collected by the district. These models are an outgrowth of the SIMU-School component of Dallas, Texas. In the near future, it is anticipated that we shall operationalize the enrollment projection model Simu-School component of Santa Clara, California which includes in-migration/out-migration, population shift, and "futuring".

The prime purpose of the WSU Simu-School component is to provide public school administrators the opportunity to simulate the effects of future policy. Its benefits are readily apparent if we consider the development of a planning system for an entire state. The use of the SIMU-School programs should promote accurate projections of the need for, cost of, and effects of proposed programs.

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William Gattis and William Dunklau, "Enrollment and Facilities Projection Program: General Description and Users Guide". Project SIMU-School, Dallas Component, Dallas Schools, 1975.

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Gayle Davis Thornton and C. Kenneth Tanner*

DECISION THEORY: AN APPLICATION TO EDUCATIONAL MANAGEMENT

Educational administrators are continually being confronted with decisions which involve matters of direct observation containing concealed variables. In such circumstances, projections of possible intervening events must be made and the final recommendation is said to be made under conditions of uncertainty. By using decision theory they are more likely to select the course of action which will prove to be the 'best' outcome in the long run, one which will achieve the purpose with savings in time, money or human effort.

Decision principles yield mathematical tools which enable one to follow rational behaviour in conditions of uncertainty. They provide for analysing a set of alternatives given any possible number of 'states of nature' which may occur. Assuming that such conditions are stochastic, decision theory does not provide for the ultimate solution, but it assists the development of postulates for dealing with possible future events.[1] A decision problem essentially entails three components:

● A set of possible alternative actions which might be chosen (e.g., whether to hire X, Y or Z new teachers for the coming year; whether to retain last year's flat rate of $0.50 per plate lunch or set cost on a per item basis).

● A set of possible *future* occurrences ('states of nature') relating to possible actions, one of which will be true but which one not being known (e.g., enrollment will be down by 200, up by 100, up by 500; food costs will increase by 10%, stabilize at present rates, or certain ones will decrease by 5%).

● The consequences of each decision alternative given the possibility of any one of the future occurrences.[2]

Decision rationale provides the administrator with the possible consequences (item 3 above) of each decision (d_j) given any one of the possible states of nature (q_i). Concurrent with possible future circumstances are the probabilities that each of these conditions will occur. If historical data on past occurrences of the same states of nature exist, the decision maker may assign objective probabilities to the happenings. Generally, the lack of historical information leaves the administrator the task of assigning subjective probabilities, i.e., optimal guesses with respect to unknowns. The subjective probabilities should parallel the administrator's feelings about possible future consequences so that consistency in belief and action will emerge as a product of the decision making process.[3]

Using decision theory the final analysis may be made in terms of expected payoffs (monetary value), expected opportunity losses (relative loss weighted by the probability of a set of events occurring), or utility. Although educational institutions have in the past prided themselves upon being non-profit organizations, their current stable or decreasing budgets are bringing about some change in that philosophy. This paper will deal with decision-making in the light of monetary values, with emphasis upon minimizing educational losses. A set of well-defined principles will be used to simulate the behaviour

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of an educational administrator when faced with a problem involving uncertainty; and the actual decision criterion, upon which the final action is based, will be demonstrated.

Decision Criteria

In principle, the final action in a decision scheme is based upon a single criterion. However, the choice of the criterion to be used is left to the administrator. We shall explore the use of five possible decision criteria, examine the differences which result from their adoption and discuss the advantages and disadvantages of each criterion as the basis for the final decision. A hypothetical problem should provide insight relevant to the criteria which seem most reasonable and effective for varying situations. One assumption used in these decision criteria is that monetary value has a continuing (linear) relationship to utility. Therefore, $200 is more beneficial than $100 to the decision maker with respect to reinvestment in his institution.

Each of the following criteria will be used as possible determinants in the final decision act of the problem simulation:

1. *Maximax* — chooses the alternative which maximizes the possible monetary value regardless of losses, the probability of creating a debt or of not creating a debt.

2. *Equally likely* — assumes that the probabilities of all conditions are equal. Therefore, by adding the possible "states of nature", the optimum act is that which maximizes expected payoffs.

3. *Minimax* — chooses the act which minimizes maximum losses, or the act with the smallest loss with respect to maximizing payoffs.

4. *Maximum Liklihood* — emphasizes that act which, given the state of nature, has the highest probability. It chooses the case which is most likely to occur and the best act for that state according to conditional payoffs.

5. *Bayes' Decision Rule* — combines the conditional profit of each alternative action with the historical probability of each state of nature, and chooses the act which yields the highest expected monetary value or the lowest expected opportunity loss given a certain state of nature.[4]

Simulation of the Problem

Let us suppose that the director of continuing education of a community college has received a request from a representative of a reputable consulting firm to conduct a workshop. The firm has suggested activities for a one-day workshop applicable to education, business, and industry entitled "The Future Economy: Effective Ways of Dealing With It". Since meeting the needs of local business and industry is one of the major objectives of continuing education, the director considers the possibilities for such a workshop. The firm is willing to contract on one of two bases: a flat grant of $650 for the day, with any money generated above that amount going to the college, or a fee of $40 per person, with $30 going to the consulting firm and $10 to the college. Whatever the contract decision made by the director, the cost to each perspective participant will be $40 for the day.

The director is faced with three alternatives: (1) to reject the offer altogether and have no workshop, (2) to contract for the flat grant of $650 for the day, or (3) to contract on a $40 per person basis, knowing that the college will reap only 25% of the fee paid. Looking through his files on non-credit study activities for business and industry for the ten

years history of the college, he gathers historical data regarding the demand for such workshops. Demand is the "state of nature" or the stochastic variable in the problem. Table 1 shows the demand (rounded to the nearest ten persons) for twenty previous one-day workshops.

The director finds himself unable to make a valid decision based on raw historical statistics, but he is able to calculate the probabilities with respect to future demand from these data — $\frac{1}{n} \Sigma$ number of workshops recorded at a specific demand level.

His next step is to construct a table of conditional profits, which will display the monetary payoffs of each action he might take, given a certain level of demand or "state of nature". Table 2 summarizes these values. If the director contracted for the flat grant of $650, and 40 persons attended a workshop, the college would make $950 which possibly may be used for expanding the continuing education program (40 x $40 = $1,600; $1,600 – $650 = $950). If he contracted on a per capita basis, and 40 persons attended, the profits to the college would be only $400 (40 x $10 = $400). If he contracted on the flat grant basis of $650 and no people took the workshop, he would have a loss of $650; whereas, on the per person basis with zero attendants, he would neither have gained nor lost money as a result of his decision.

The director then decides to study the conditional opportunity losses for each possible action given a certain level of demand. These are illustrated in Table 3. Opportunity loss is the relative loss due to not choosing the optimum action for a given state of nature. If the director decided not to hold the workshop, but there were firms in the area which would have sent participants (let us assume 30), the optimum decision would have been to contract on a flat grant basis of $650 for the workshop. The college then has foregone a possible profit of $550. On the other hand, if the director chose to contract on a per capita basis, and 40 attended the conference, he would have foregone a profit of $550 by not choosing the optimum decision to contract on a flat grant basis (40 people x $40 = $1,600 – $650 = $950 possible profit; 40 people x $10 = $400 actual profit; $950 – $400 = $550 conditional loss).

Up to this point the probabilities of the uncertainty of demand have been disregarded. By applying the historical probabilities (from Table 1) as weights to the conditional profits (from Table 2) of each "state of nature" and summing the products, the expected monetary value of each possible action can be determined. These are given in Table 4. Using this procedure, applying the historical probabilities of demand to the conditional opportunity losses, the director can calculate the total expected opportunity losses (EOL) for each possible action. These are shown in Table 5. Note that the act which yields the highest expected monetary value should also reflect the lowest expected opportunity losses. With his data complete, the director can make his final decision based on his chosen criterion.

If the director decides to use maximax as his decision criterion, he need only to refer to Table 2. His decision would be to contract on a flat grant of $650 for the day, because that action has potentiality for yielding the highest profit ($950) disregarding any probability of demand. But consider the irrationality of a decision based on the maximax criterion given a probability of 40 persons attending being .001. The director who would choose maximax as the decision criterion is likely to be a gambler.

Table 1   PREVIOUS DEMAND

Total Demand (qi): Workshop Attendance	Number of Workshops	Probability of Demand
0	1	.05
10	5	.25
20	6	.30
30	4	.20
40	4	.20
	n = 20	1.00

Table 2   CONDITIONAL VALUES

State of Nature (qi):	Possible Actions (di)		
Demand	Reject Offer	Flat Grant of $650	Contract Per Capita
0	$0	($650)	$ 0
10	$0	($250)	$100
20	$0	$150	$200
30	$0	$550	$300
40	$0	$950	$400

Parentheses indicate losses

Table 3   CONDITIONAL OPPORTUNITY LOSSES

State of Nature (qi):	Possible Actions (di)		
Demand	Reject Offer	Flat Grant of $650	Contract Per Capita
0	$ 0	$650	$ 0
10	$100	$250	$ 0
20	$200	$ 50	$ 0
30	$550	$ 0	$250
40	$950	$ 0	$550

Table 4   EXPECTED MONETARY VALUES

State of Nature: Demand (qi)	Probability of Demand	Possible Actions (di)					
		Reject Offer		Flat Grant of $650		Contract Per Capita	
		Cond. Value	Expected Value P(qi)(CV)	Cond. Value	Expected Value P(qi)(CV)	Cond. Value	Expected Value (P(qi)(CV)
0	.05	0	0	(650)	(32.5)	0	0
10	.25	0	0	(250)	(62.5)	100	25
20	.30	0	0	150	45	200	60
30	.20	0	0	550	110	300	60
40	.20	0	0	950	190	400	80
Expected Monetary Value			$0		$250		$225

Parentheses indicate losses

Table 5   EXPECTED OPPORTUNITY LOSSES

State of Nature: Demand (qi)	Probability of Demand	Possible Actions (di)					
		Reject Offer		Flat Grant of $650		Contract Per Head	
		Cond. Opp. Loss	Expected Opp. Loss	COL	EOL P(qi)(COL)	COL	EOL P(qi)(COL)
0	.05	0	0.00	650	32.50	0	0.00
10	.25	100	25.00	250	62.50	0	0.00
20	.30	200	60.00	50	15.00	0	0.00
30	.20	550	110.00	0	0.00	250	50.00
40	.20	950	190.00	0	0.00	550	110.00
Expected Opportunity Losses			$385.00		$110.00		$160.00

Table 6   EXPECTED MONETARY VALUES USING EQUALLY LIKELY CRITERION

State of Nature: Demand (qi)	Probability of Demand	Reject Offer		Flat Grant of $650		Contract Per Head	
		Cond. Value	Expected Value	Cond. Value	Expected Value	Cond. Value	Expected Value
0	.20	0		(650)	(130)	0	0
10	.20	0		(250)	(50)	100	20
20	.20	0		150	30	200	40
30	.20	0		550	110	300	60
40	.20	0		950	190	400	80
Expected Monetary Value	1.00		$0.00		$150		$200

To simulate decision analysis using "equally likely" as the decision criterion an additional table is needed, identical to Table 4 but using flat prior probabilities for the various states of nature (see Table 6). Flat prior probabilities assign equal liklihood of occurrence to each level of demand, and may be used when there are no historical data on previous demand. The highest expected monetary value, given equal probabilities of occurrence, is the optimum act using "equally likely" as the decision criterion. Therefore, the director should contract on a per head basis. If there actually are some historical data, one drawback to this criterion is the assumption that past levels of demand have no influence on present demand. Without historical data the criterion assumes that the decision maker has no opinion as to what the demand will be. If this were indeed the case he would be an incompetent administrator knowing very little about the business and industry clientele he was supposed to be serving.

Using minimax as his decision criterion, the director should hold the workshop and contract on a per capita basis because that would maximize minimum profit with minimum possible losses (Table 2). However, had the original problem incurred overhead expenses (i.e., lunch, facility), the director might well have decided not to hold the workshop at all, since these would have been losses incurred if demand were zero. One who would choose minimax as the decision criterion is likely to be conservative, and unlikely to take chances.

The criterion "maximum likelihood" places complete value on the historical data and/or the feelings of the decision maker. The optimum act is that which yields the greatest payoff given the state of demand with the highest probability; therefore, the director would elect to contract on a per head basis because a probability of .30 (highest probability of demand level) for that act would result in an expected payoff of $60 as compared to $0 if the offer is rejected and $45 on a flat grant contract (Table 4).

The director who chose the Bayes' Decision Rule as his decision criterion, would be most interested in the figures of 4 and 5. Bayes chooses the act with the largest expected monetary value or the lowest expected opportunity loss; therefore, to hold the workshop and contract for a flat fee of $650 for the day would be the optimum decision on that criterion. The Bayes' Decision Rule has become the preferred decision criterion in business and industry (and increasingly in education) because it combines the probabilities (based on historical data or current feelings) of uncertain events with various decision alternatives to predict quantitatively the optimum action to be taken.

Conclusion

Too often in the past decision making for an educational institution has been a hasty, haphazard response to a given stimulus. In a period of inflation, recession, and dwindling budgets, the decisions of administrators must be seen to reflect some rationale. In our opinion the failure to use management models in educational decision making has been a major cause for that institution's "lag" with respect to other organizations in our society. Education has become big business, and it must be treated as such. Administrators must think in terms of minimizing educational losses, maximizing monetary payoffs and encouraging reinvestments in the more productive areas of institutions. With relatively simple applications such as those described, their decisions may be directed by sound postulates. At the very least, they will be able to demonstrate that in conditions of uncertainty their decisions were the product of deliberation rather than conditioned response.

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DESIGNING A NATIONAL SYSTEM FOR DEVELOPMENT: THE SUDANESE EXPERIMENT

Introduction

In the past decade there has been increasing world-wide criticism of the purpose and direction of education. Yet in spite of many suggestions for reform, school systems seem almost impervious to any real alteration. The few experiments at educational reform in formal schooling at local and national levels have met with resistance or quiet but effective integration and subsequent dismantling. Educational Planning researchers are currently attempting to assess the reasons for these massive failures in educational change strategems.

The need for change, however, is real and acute throughout both the developed and developing world. While the western world is struggling with educational reforms to make schools more relevant, humanistic, and practical,[1] the poorest countries seek massive amounts of basic education to harness energy, their human and natural resources for the production of food, and the elimination of disease. The most thorough indictment of the failure of schools to meet both these objectives may be found in UNESCO's 1972 report *Learning to Be* which carefully documents the incapacity of schools to meet student or societal demands.[2] This and similar reports suggest that schooling is nothing more than an expensive exercise in artificial information gathering—one which prepares the bearer for more such exercises but not to deal effectively with the rigours of everyday life. On the other hand some, particularly in the West, argue that schools never were intended to meet any social purpose beyond the generation and regeneration of knowledge. However in an era of diminishing resources and highly visible educational needs this argument carries little weight. Europe, Japan, and North America might accept education as the art of the leisure class but that is a luxury the rest of the world cannot afford. Therefore, if a developing nation intends to expand access to education it must have a justifiable reason for doing so. It must assure itself that its entire educational system can be reoriented to its national needs.

Some reformers have gone so far as to propose (and establish) alternative systems of education outside the formal framework. These efforts variously known as nonformal or development education to date are sporadic and unproven. According to some observers China and Cuba have totally reoriented their education systems to their national needs.

The barriers to educational reform in a developing nation have been suggested in many UNESCO reports and elsewhere. They include:

- Ill fitted adoption of inappropriate Western (particularly British and French) classical educational systems.
- Cultural and social status barriers to vocationally-oriented education.

- Lack of human and physical resources for scientific training.
- Brain drain of qualified personnel, who might provide leadership for the educational system, to the West.
- No coordination of educational goals and priorities with national development goals and priorities.
- Extreme separation between the educational sectors (primary, secondary, and higher).
- Extreme regional separation and inability to plan for integrated national programs.
- Little or poor data available on which to base national manpower planning.
- Rigid, inflexible curricula which are wasteful but difficult to change since they are part of the "credential" system.
- Poor links between the research and public service activities of government and the institutions of higher education.

There are many reasons for these conditions, but in this paper we shall concentrate on one critical element only: the inadequacies of national educational reform plans due to their failure to start in the right place. Almost all the current experiments at national educational reform in underdeveloped countries have focused on their primary and secondary schools. The reasons for this are fairly obvious: more students are immediately affected, because more people enter the primary and secondary schools; the impact of the reforms will be felt more quickly than would be those carried on within the narrow world of the universities; and many educational planners are convinced that universities are too conservative to change so this is the least rewarding arena for reform. We feel that it is the university which sends out the social signals indicating what is right or wrong in the nation's educational service. If the university system remains aloof, indifferent, or hostile to educational change, no reform will ensue. The rationale advanced for this view comes both from observation and literature. Let us consider the following:

National Value Set: In most countries the university best reflects the nation's values and culture. The preference choices for degree programs usually reflect the nation's social values (e.g. where law is prestigious the law school is the first choice of the most capable entering students.)

Resource Allocation: In most of the developing world education is an inverted pyramid with the bulk of its resources going to higher education directly through subsidy and indirectly via support for university research.

Intellectual Resources: The concentration of intelligentsia in the developing world usually is not in commerce or government but in the universities. This is both a blessing and a curse to national leadership since the university usually is also the source of political opposition.

Proximity to National Power: The university usually has enormous formal and informal influence over national policy through the relations of its staff with senior civil servants and elected government officials.

Therefore, if education is to be reformed and linked to national development the process must commence with the university. While we acknowledge the need to expand access at every level and extend the use of informal/nonformal education, we maintain that the only significant long-term educational improvement will emerge from the redesign of universities.

The Sudan provided the opportunity for testing this proposition. The opportunity to examine its universities and propose reforms came on invitation from the Ministry of Education. Before discussing our work, some background information is needed.

The Setting

The Sudan is at the confluence of two cultures, Moslem Arab and Black African. It is also at the confluence of two of the richest rivers in the world, the Blue Nile and the White Nile. Along their banks many civilizations have come and gone leaving behind a culturally polyglot nation with enormous agricultural potential and tremendous socio/economic problems. The Sudan is the largest country in Africa, with a land area of nearly 3 million square miles and an estimated population of 17 million, but the precise number is not known. The only reliable census was conducted in 1956; the results of the 1973 census have never been officially reported; 30% of Sudanese are nomads wandering through the vast high deserts of the North or swamps and plains of the South. The majority of the population is under fifteen years of age. The people live by subsistence agriculture. In per capita income and GNP the Sudan ranks among the poorest nations of Africa and the world.

The national economy is almost entirely devoted to agriculture; cotton is the major export crop (over 60%) and generates almost all the country's foreign exchange. There is great potential for the development of other cash crops and for achieving self-sufficiency in food, but the obstacles to this goal are formidable. There is no semblance of an integrated transportation or communication network. Only 12% (estimated) of the population is literate. The Gezira scheme in the central Sudan contains over 2 million acres of the best irrigated agricultural land in the world, but its yield is well below its promise. The South, which has recently been severely debilitated by civil strife, offers opportunities for livestock production, rain-fed agriculture and agro-industrial growth. But it is even more lacking than the North in the commercial infrastructures necessary for development. In addition to these problems of agricultural development, the Sudan is faced with rapid urbanization, encroachment of the Sahara, and a brain-drain to the wealthier Arab Gulf states.

In response, the Sudan has set forth a modest development plan—one which is based upon agricultural expansion and modernization. The plan calls for increased production of cash crops, raising the level of livestock production and improving the quantity and quality of rain-fed agriculture. Linked to these will be increased transportation and improvement of related infrastructures. The plan also calls for the redirection of education. A 1971 UNESCO report on education in the Sudan summarized its dilemma in linking its educational system to the development plan: "... education is seen as one of the major building blocks of a restructured future. [Yet the] Sudan, unlike many developing nations has a long tradition of formal education. The system is firmly established and its role in government, in the professions, and in the life of the nation is known and acknowledged. The problem, in part, is precisely that the system is established. There is a question as to whether its rather traditional form and content is open to receive and accomplish the task of development education".[3]

Like most developing nations, the Sudan is very generous to education as can be seen from Table 1. One quarter of its public expenditure is absorbed by the educational system, over 5% of the GNP. In spite of this heavy allocation the system should be greatly expanded if it is to meet even the current modest levels of demand. There are

nearly one million pupils in the primary grades and only half that number will matriculate to the secondary schools, and a very small percentage, indeed, hope to attend university. The bars to student progress are due both to the classical style of the system and its rigid examinations. The waste of human resources is, by any standard, intolerable.

Table 1   EDUCATION EXPENDITURE OF SELECTED AFRICAN NATIONS

Country	As % of GNP	As % of total public expenditure
Burundi (1969)	...	29.1
Central African Republic (1968)	*3.3	15.1
Chad(1969)	2.7	...
Kenya (1968)	4.8	...
Lesotho (1967)	...	21.6
Malawi (1967)	4.1	15.9
Mali (1967)	3.6	19.5
Mauritius (1969)	3.2	11.7
Niger (1968)	*1.6	11.3
Rwanda (1967)	...	*23.7
Somalia (1967)	...	7.1
Sudan (1967)	4.9	20.3
Tanzania (1968)	3.8	...
Togo (1969)	...	20.0
Uganda (1968)	4.3	18.1
Zaire (1969)	...	...

Asterisk (*) denotes an estimated figure.

The university of Khartoum is the apex of the system; there are also two other universities, a women's college and a handful of technical institutes. The development plan calls for the creation of two more universities, one to be located at Juba, the new regional capital of the South,* the other at the Gezira, in the heart of the irrigated land scheme. Our consultation work for the Ministry of Education included the design of these new institutions and re-examination of the University of Khartoum. In a prepared address instructing the consultants, the Minister explained:

In the Sudan [the technological gap between education and need is so great] that there has never been a sustained effort to articulate it. Existing institutions of higher learning have lost coherence, society lost faith in these institutions, and students and academics behind their portals fell prey to frustration. The failure to define the goals of the manifold centres of higher learning allowed those institutions to drift, sometimes aimlessly. Many of those within have found it convenient to give facile concession to tradition, which meant, in essence, the perpetuation of the status quo.[4]

*The peace agreement, terminating the civil strife, granted semi-autonomous regional government to the South.

He did not lay the blame entirely at the door of the universities, but suggested that government was equally culpable in failing to assist them to become a larger partner in the national development. In his speech he listed six needed reforms:

(1) National planning of higher education in the function of developmental objectives and community and manpower market needs;

(2) governance of higher education both at the national and institutional level;

(3) curriculum development to make it more responsive to the needs of society;

(4) structured [educational] progress toward degrees as well as using test and related measurements;

(5) [more open] systems for selection to higher education; and,

(6) motivating university professors to be more involved in productive work within the community.

The minister agreed that educational reform in the Sudan must begin at the top. This agenda spelled out the strategy of his government to achieve a redirection of higher education. Our role as consultants was to operationalize the national mandate.

The Consultation Process

Our consultation followed a model or organization development (OD) which is currently popular in the private sector for inducing modification in institutional or organizational behaviour. The OD methodology has as many fans as detractors. Basically the OD approach takes existing structures, policies, and procedures and attempts to modify them in a given direction, more or less simultaneously. As change is introduced in the organization, attitudes, motives, and values are altered along the same direction.[5] In the consultation we were organized to facilitate inter- and intragroup communication with the Sudanese who would be charged with effecting the changes discussed. Thus they were both parties to the proposals and the responsible agents for carrying them out. This approach is scarcely innovative but it is frequently neglected by consultants involved in national planning.

As consultants and their national counterparts examined data, visited field sites, and interviewed public officials understanding of the situation emerged. It was apparent that the university system not only was aware that it must change, it was seeking new directions. There were already under way an impressive number of activities to revamp testing procedures, standardize courses and revise the academic calendar. These activities were focused on internal governance and the educational process rather than the inputs and outputs of the system. The consultants' job, therefore, was to draw the Sudanese educators' attention to these topics. Teams identified specific issues and developed strategies not only to define problems but also to lay the path for implementing change.

In the Sudan as in most of Africa, programs of higher education reflect concerns with credentials, certification, and credibility (to the international world of higher education, particularly the universities of Europe and North America). As a consequence their curricula drift further and further from national needs. This drift was recognized, so a new decision framework for program planning was proposed.

The system suggested was a matrix similar to a cross impact matrix (see figure 1), which would have the nation's development plan on one axis and programs of higher education on the other. The notion was simply to place all the activities of higher educa-

Figure 1   MATRIX PLANNING MODEL FOR DEVELOPMENT

National Plan Requirements / University Curriculum	Increase crop production	Increase animal production	Increase health professions	Human resource development	Better environmental planning	More public administrators	Produce more agro-industrial managers
Discipline Programs							
Genetics							
Chemistry							
Physics	← Annual Evaluation →						
History							
Economics			Annual Evaluation				
etc.							
Interdisciplinary Programs							
Soil Science							
Crop and wildlife protection							
Water							
Community development				↓			
Applied economics							
Behavioural sciences							

tion against the template of national needs and priorities. The benefits are obvious. Each curriculum design decision is examined in national terms. Not every course need be subjected to this scrutiny but most of the degree programs themselves should be. Those in the arts and humanities should not be subjected rigidly to requirements of this nature, but it is appropriate to think of them as contributing somewhat to national development.

In spite of the rhetoric about interdisciplinary studies there is a strong international penchant toward specialized education by disciplines. This leads not only to rigidity and isolation of the disciplines but also to students' failure to perceive the connections among the courses of their programs, and to relate them to the real world. The consultant team proposed that every degree include specifically designed inter- and multi-disciplinary courses and seminars on the management of development. The seminars would show how the subject matter of a variety of courses could be organized to address a developmental problem. Case studies, simulations and other devices would be used to acquaint students with the knowledge needed to address national, regional, and community development problems. These courses would be laced through all the degree programs, from art to

zoology. In the courses, students of different programs would be mixed as they are in life, so that they would gain some appreciation of the ways of thought of various disciplines and how they relate to one another. It was argued that this integrated, process-oriented education might help prevent the unnecessary duplication of effort among agencies, bureaus, and private groups in the country. The interaction was to develop teamwork thinking while in the education environment, with the hope that it would persist later on the job. Interviews with public officials had suggested that teamwork and "marginal" knowledge were equally as important as "content" knowledge.

The Public Service and Development Education

A university system cannot afford (nor would it desire) to neglect its responsibility for community and public service. This is particularly true in the Sudan. The immense problems of national development cannot be met by government personnel alone. All sectors of national life must be organized to try to improve individual and collective well-being. And the university is a major instrument and resource for economic and social change. But it cannot fulfill its mission in a vacuum, any more than government can proceed without its active assistance. The problem, therefore, is how to link the university directly and continuously with the development process.

Extending the university's work beyond the confines of the campus calls for development of a national structure. Piecemeal, fragmented or uncoordinated activities of the public service or extension variety will not suffice. The consultants observed that although the notion of extension education was widely shared and supported, its employment was too scattered. This was the result of:

● Fragmentation of extension services among a number of ministries and agencies, e.g. Agriculture, Education, Labour, the Development Corporation, the Cooperatives and national schemes.
● Lack of central facilities and a program base for the extension work, i.e. provincial offices, village centres.
● Absorption of trained teachers and demonstrators into other lines of agricultural or administrative work.
● Lack of national coordination, cooperation and agreement as to the role, mission, and delivery system for Extension.
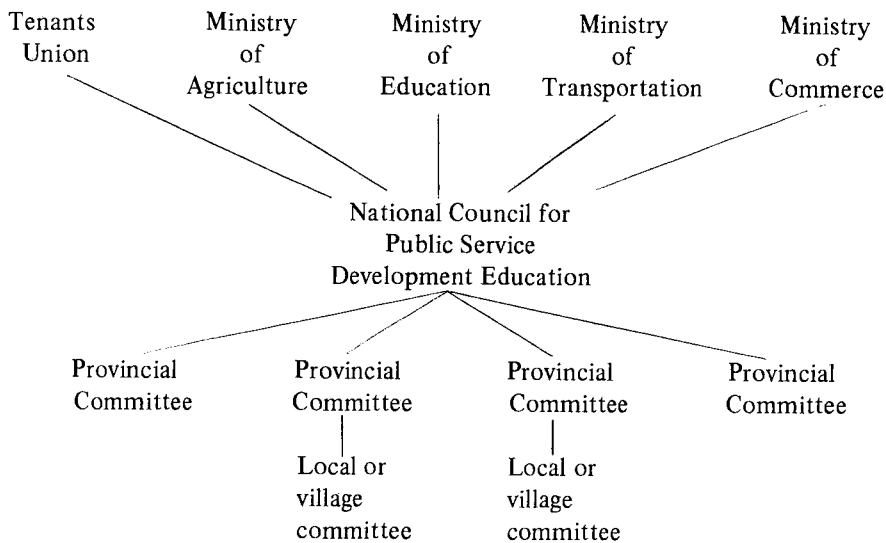
These and other barriers made inappropriate the adoption in the Sudan of the United States' model of Extension. The team felt that a public service system could be developed more suited to Sudan's local needs, customs and resources. They saw that many elements of a good system for public service were already in place. But these were vastly under-used and poorly articulated. Therefore the panel suggested that a public service and development education system be inaugurated at the national level with the university as the coordinating apex. The structure suggested is described below.

The organization of public service activities to stimulate development must be both linked to national needs and provide maximum feed-back. So it was suggested that a national council for public service and development education be formed as part of the Council for Higher Education. It would be composed of the chief administrators of the development centres and institutes which were to be created at the three national universities. It would also have representatives of the Council of Higher Education and include the Ministers or Deputy Ministers of Agriculture, Commerce, Local Government Develop-

ment, and Transportation as well as tenant representatives from the major agricultural development schemes and *ex officio* representatives from the Ministry of Information. The Council's purpose would be to develop national goals and priorities for public service and extension activities; review current and future public service planning in order to allocate resources to the most efficient and cost effective programs; coordinate existing public service activities; and guide the universities' research into economic and social problems and the priorities related to public services.

The Council would meet three times a year. The Minister of Education or his designate would chair its meetings. Its policies would be implemented by directives from the appropriate ministry. In each province a similar council would oversee and modify local public service programs. They would be chaired by the provincial ministers of education.

The system may be depicted in the following manner:

Tenants
Union

Ministry
of
Agriculture

Ministry
of
Education

Ministry
of
Transportation

Ministry
of
Commerce

National Council for
Public Service
Development Education

Provincial
Committee

Provincial
Committee

Provincial
Committee

Provincial
Committee

Local or
village
committee

Local or
village
committee

This would provide the organizational infra-structure for development extension work.

Under the plan the university system was expected to develop a vehicle for delivery of service. It is assumed that the universities would produce useful and relevant information, but they needed the means of coordinating and disseminating the information. Therefore it was suggested that the University of Khartoum and the two new universities establish public service and development institutes. Each institute would provide services to a designated region, and conduct research on the diffusion of technology and its economic and social consequences. They would house two types of professionals: community development specialists with a science background, who would be responsible for providing technical information; and university research staff responsible for economic and social research and the formulation of intervention policy.

Each institute would have much the same mission, but would have functions unique to its region. The institute at Khartoum could play the internal coordination role. The

details of institute staffing and the precise mechanisms for public service were to be developed by consultants at each university.

The institutes were to serve both as teaching and research centres. It was intended that each one offer courses in development studies tailored to needs of each university campus. In addition each would develop short courses, workshops and continuing education activities for adult education, community development workers, government officials, and local school teachers in conjunction with the extramural studies program of the university of Khartoum. It was proposed that the institutes function as the entry point for local officials to call upon university resources for agro-industrial development and social policy.

As in many other developing nations, the weakest link in the current public service system of the Sudan is at the community level. There it is haphazard and uncoordinated. It was proposed that the system be strengthened by establishing community-based, public service facilities linked to the university institutes. Within each province a series of community resource centres should be established, with each centre functioning as the central facility for dispensing of information about local needs and providing a base of operations specialists in agriculture, health, adult education, etc. The director of the community resource centre would be a science specialist with an M.Sc. in community development. His or her main role would be to organize short-term training activities for specialists and to supervise them in their delivery of information to their constituents. The specialists themselves might be assigned from the appropriate ministries but they would work under the supervision of the centre's director who would be an employee of the university. In this way, he would feel a natural allegiance to the university and be entitled to draw on its information and personnel for assistance. He would also encourage the development institutes to carry out relevant activities.

Toward Eco Development for Higher Education

The term "eco development" is intended to convey a holistic approach to natural and human resources. It is becoming the vogue in development theory and practice. Intermediate technologies are being proposed as the best way for national development to match man with his environment. Unfortunately too little thought is being given to how to match educational or learning strategems with this methodology. The proposal which we made as consultants in the Sudan, which has been described in this paper, is one step in that direction. We believe that an integrated system of higher education, geared to the national development plan can bring about fundamental shifts in national consciousness. We believe, this will result in a more harmonious relationship between the principle resource of all development activities—people—and the goals toward which the national plans are aimed. The result of our suggestions will not be known for several years, but the system described may be a useful model for others even at this embryonic stage.

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PERSPECTIVES ON EDUCATIONAL PLANNING

Introduction

The need for planning in education is becoming increasingly clear. In the 60s, particularly in the U.S., public education enjoyed high financial support. There were rising student participation rates, and dramatic attempts at curricular innovation. In the mid 70s, as the student population levelled off, we entered a period of scarcity and retrenchment: boards of education found that the local tax dollar, increasingly hard to raise, bought less and less service because of inflation; federal and state funds for research and program development dwindled; and school personnel became cautious about innovation, became fearful of public criticism of new educational techniques.

In earlier times when schools were smaller, more personal, institutions their costs also appeared to be more reasonable. When the systems grew in the 60s the increased educational costs seemed defensible in the light of the expected benefits. Today the high costs are criticized as unreasonable and insupportable. Education has become a leviathan requiring an overall annual budget of more than a hundred billion dollars and involving the lives of fifty million American students and staff. Its sheer complexity makes comprehensive planning both a necessity and a near impossibility. Our forefathers seemed to understand the meaning of their world where the verities seemed eternal. Educators today are expected to be equally certain of their world in which verities, if there are any, are uncertain and constantly in rapid flux. In our opinion rational planning is one means, in such conditions, of interpreting current events and anticipating the future. Planning, then, becomes a coping mechanism for educators in a complex, threatening, and uncertain world. There is, of course, the danger that in their need to find easy solutions, educational policy-makers may place unwarrented faith in planning technology. They may turn to planning because of its apparent rational, "scientific" characteristics, ignoring the subtle political and social ramifications of its activities. There is equally the danger that "planning" will be adopted as the "new look" delaying tactic. Claiming that they need more data in order to plan, educators may use planning as a way of avoiding decisions. Educational leaders may use the planning process as a device for controlling their systems, centralizing authority and protecting the *status quo*.

This paper has two purposes: one is to explore the strengths and pitfalls of the planning process. Educational planning can be a powerful and useful tool. Abused or misunderstood, it will exacerbate rather than relieve the pressing problems of American schools. Though we seek to provide policy options, we might, through planning, in fact, systematically exclude alternatives by the planning models which we use. Or by promising much from planning and delivering little, we might erode public trust and political support. The second purpose is to outline a number of changes which have influenced American education. Lying outside the educational system are the economic and social conditions which constrain it and determine the probability of success of even the best laid plans. Educational master plans, drawn up for one situation, at one point in time,

may well be inappropriate in other situations. To do justice to planning, the relationship between current educational practices and their historical precedents must be considered.

Definitions of Planning

There is no precise and widely accepted definition of educational planning. The field is still in its infancy. Other types of planners (town, economic, and transportation) might provide useful models for specific activities, but they are themselves divided over the meaning of what they do.[1] The definition which we regard as a useful working one sees educational planning as a somewhat specialized form of goal-setting, decision-making, and option-building—one which borrows some of the techniques and values, and shares the problems of other forms of planning. Certain commonalities between educational and other types of physical and social planning can be identified, although there are qualities of the educational enterprise which set it apart even from other activities in the public sector. Like other kinds of institutional planning, educational planning is a set of purposive activities, generally initiated by a planning agent—activities which are believed to be useful in the allocation of scarce resources and the administration of institutions.[2] Since it necessarily involves decision-making some considerable time prior to that when action is to be taken, it requires the description of policy choices, based upon assumptions about the 'good life' and how schools will contribute to it and the criteria which shall govern data gathering, choice making, and evaluation of the effects of the choices. If we review the most common definitions and descriptions we see that educational planning has five main characteristics:

● It has a behavioural component. Therefore, certain goal-directed activities occur as people plan. Meyerson and Banfield describe it as "a course of action which can be expected to lead to the attainment of ends sought, and which someone intends to carry into effect".[3] These actions may consist of public meetings or solitary sessions devoted to research and writing. The work may be in the 'field' (literally or figuratively measured) or in influencing the interpretation and acceptance of 'findings'. Whatever its intent, an observer has no difficulty in recognizing planning activities.

● In education, as elsewhere, it takes place in an institutional context.[4] Much institutional planning is indistinguishable from other forms of bureaucratic behaviour: titled personnel performing routinized functions within hierarchically differentiated settings. When conflict arises over aims and means efforts to resolve the problems are bounded and conditioned by the particular institution involved. The 'rules of the game', so to speak, are set and legitimated by the political realities that govern the distribution of power and resources within the institution. We cannot hope to understand planning or the difficulties of the planner unless we understand its educational setting.

● It involves a controlled sequence of events. According to Russell Ackoff, "if we desire a certain state of affairs at some future time and it takes time to decide what to do and how to do it, we must make the necessary decisions before taking action".[5] The planner is attempting to control the future direction of the institution.

● It rests upon a critique of some desired future state; thus, it is highly normative. The desire to improve is the main motivation to planning. This impulse to improve society through education, in the hands of planners is translated into a hierarchy of community objectives which can be acted upon, even if there is no guarantee of consensus.

● Planning itself must be planned.[6] This requires two conditions which appear to be in opposition to each other: on the one hand, the planning activities must be divided among experts in various fields who work with varying time tables; on the other, they require

coordination and inter-relatedness among people and among sets of decisions, otherwise chaos results. Planners, like other bureaucrats, resolve the conflict by playing both roles simultaneously. They distribute authority and specialization, while relating and coordinating. And the various roles within the planning organization reflect both sets of needs. Lateral differentiation (e.g., as between demographers, program specialists, legal experts) enables an agency to handle its manifold tasks concurrently; hierarchical structure (with directors, coordinators, department heads, cadre leaders) promotes regularity and control. The specialist planners focus technically on the narrow problems within their purview; the coordinative planners handle the 'total picture'. Hence, planning is best characterized as a multi-faceted process with both specific and generalized functions.[7]

Educational planning shares with other forms of planning a concern for efficient decision-making, goal-setting, and option-building. It uses similar methods—surveys, analysis of statistical data, the building of explanatory, predictive or simulation models and the preparation of plans. It also occurs within the public arena, complete with all of the political and social cross currents well known to public service employees. Yet, in three essential ways it differs from other forms of planning.

First, educational planning must concern itself with the nature of the teaching-learning act itself. Although educational planners seem to be most successful and secure when designing such non-pedagogical functions as budget systems, bus routes, and school building designs and locations,[8] planning of that most vital area of education, instruction, is at the heart of the activity. It is true that planners have attempted to provide curriculum guides, learning 'packages', textbook series and other pedagogical aids, but we do not really know much about how pupils learn most easily or how best to teach them. However there are some reference points for beginning the investigation of classroom interaction. Planners can isolate particular structural features within educational programs which are bound to affect the nature of the learning environment being provided. Changes or refinements in these features are amenable to the planning process. Before embarking upon the design of comprehensive instructional approaches the planners should review aspects of historically-determined models which seem appropriate even today. Grannis recalls three:[9] The 'family school', exemplified by the one-room schoolhouse of early America and the current 'alternative' school. The 'factory school', with its emphasis upon the efficient production of goods. What might be termed the 'corporate school': often found in suburban districts and wealthy urban districts, it addresses standards established by corporate management and uses such devices as motivational psychology, information technology and 'contracts' between the teacher and child. Borrowing models such as these the planner can attempt to structure the environment in which the teaching-learning process will take place.

Second, educational planning is often frustrated by the near absence of measurable and acceptable criteria by which to generate and evaluate educational outcomes. In spite of the rhetoric of educational evaluation, there are few clearly defined ends in education. Without these and the criteria for gauging them, priorities cannot easily be set, and the success of the planning cannot be assessed.

Third, educational planners have somewhat unique concerns because in the U.S. education has been held to have a special mission. Our society looks to schools to equalize (or at best mitigate) social and economic differences, to dispel prejudice through enlightenment and example, and to promote a sense of national unity and commitment. These are goals which most would endorse, and one interpretation of the history of

American education in the 20th century is to see its changing fashions as attempts to achieve these goals. What has changed is the degree of satisfaction in the resolution of such ideals. Not many years ago, for example, the ideal of 'equality for all' seemed to be fully satisfied by the provision of separate but equal educational facilities, or by the mere provision of a 'ladder' system on which the underprivileged could climb to success. Both solutions are recognized as inadequate today.

Yet it remains commonplace to expect the educational system to accomplish what other branches of government have been unable to. Federal interventionist programs, amounting to over seven percent of total school budgets, have been criticized because they indirectly attempt to redistribute class and social patterns without affecting the underlying causes which remain untouched.[10] This basic inconsistency within the structure of educational funding is but one example of the kind of problem the educational planner faces. Other reasons include the highly de-centralized structure of public education in the United States which makes comprehensive planning difficult, the absence of planning expertise among school personnel, and the sense that schools have done fine thus far without formal, long-term planning – so why bother to introduce it here, though it may be needed in other countries. It is hardly surprising that educators have been slow to apply formal planning techniques. When faced with such formidable questions as the design of a program which will narrow the gap between rich and poor, or will assist in erasing generations of racial and class bias, it is understandable that planners seek the comfort of such manageable projects as planning for administrative reorganization or for optimal school size.

But the importance, complexity and seeming insolubility of the large educational problems offer greater opportunity for social action and 'destiny-shaping' than can be found among the smaller, more malleable problems. Our society is becoming increasingly oriented to social action which is goal-oriented, 'rational', scientific and technical. Planners are rarely asked to deal with the substantive issues of 'what'. They are expected only to address the technical questions of 'how'. If they refuse to consider the basic questions about education (what it should be doing and why), and look to solving only the trivial issues which lend themselves to flowcharts, then they will fail to take advantage of opportunities for social change, utopian though they may be.

Approaches to Planning

As we have seen, definitions of planning are useful in characterizing the various kinds of planning work and responsibilities but they remain static until they are applied to actual situations. To understand planning and its potential, therefore, we must examine it in the broader context, not merely of categories of behaviour but also their *intent, scope, and method.* One means of showing the different effects of the use of various approaches to planning is to describe two different current approaches, both of which have roots in the tradition of thought and action on the subject.* For want of better terms we shall call these the technocratic and social reform perspectives. They share a number of common

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*We regard the roots of social planning as resting in the utopianism of early Greek and Christian writings, e.g. Plato's *Republic* and More's *Utopia.* They, and other thinkers, presented models for social life which included prescriptions for authority relationships, life tasks, and the division of responsibility. American utopists like Skinner in *Walden Two* and Belamy in *Looking Forward* spent time describing the technology of the new setting, though they could hardly be called planners in any real sense; both, in fact, used fiction to convey their dreams.

The history of physical planning, on the other hand, is not much more than a century old. It

assumptions, such as the belief in progress through a degree of social intervention and control, but they diverge sharply over means and ends.

The technocrats tend to consider their work as highly positivistic, scientific and value free.[11] Madge characterizes this kind of planning as the attempt "to apply engineering techniques to the solution of social problems",[12] with the result that technocrats give the impression that they believe that complex issues can be reduced to matters of methodology and technique. In education such planners generally are part of the central office staff, and they interpret their role primarily as that of providing the advisory 'software' and 'hardware' necessary to implement decisions. Their net effect usually is to reinforce authority and strengthen the status quo. In their defense it must be admitted that the work of the technical planners increases systematic fact finding, improves the coordination of separate decisions and policies, helps make explicit the presentation and sequencing of objectives, and, often, provides the basis for an objective evaluation of the results of decisions.

The dangers of such a purely technical approach to planning are obvious. There is no sense of moral purpose. Planning is simply a functional enterprise which places the planner at the mercy of the prevailing ideology, no matter how pernicious.[13] Therefore the *intent* of technocratic educational planning may be said to be to carry out the orders of those in charge; its *scope* constrained by current political and ethical positions; and its *method*, rational and neutral.

In contrast, the planner who plans from the ideological base of the social reformer believes that his work should cause major adjustments in the social and economic order. For such planning the *intent* may be said to be drastic change, even at the expense of those in charge, its *scope* is that of a social crusade or reform movement, its work often encompasses value-ladened exercises, and its *methods* resemble more the strategies of the political activists than the neutral, objective ones of the scientists. Since the goals of such planning are major socio-economic realignments the problem of scope is to define the boundary. Nor is there any real constraint on method. Anything which is effective is permitted – this includes political organizing, mass movements, public pronouncements, and public exposure (the planner as Nader's Raider). The strength of the planner-as-reform-activist approach is its emotional and moral appeal. Its weaknesses are (frequently) the lack of an institutional base for carrying out the planned change, the disruptive, dysfunctional nature of its interventions, and the likelihood that the changes will be short-lived unless they are adopted by the system.

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grew out of a concern by nationalistic European governments to control the non-Western world. As early as 1841, Fredrich List wrote in *The National System of Political Economy*: "It is the task of politics to civilize the barbarous nationalities, to make the small and weak ones great and strong, but, above all, to secure to them existence and continuance. It is the task of national economy to accomplish the economical development of the nation, and to prepare it for admission into the universal society of the future" (p. 142). Deliberate planning efforts were later employed in the development of European nations, particularly in Germany and Russia. Again, the motivation was primarily nationalistic, economic and military, and the goal was growth.

In the United States, the first real efforts at physical planning centred on the design of cities (Olmstead in 1841. See A. Dunham, "City Planning: An Analysis of the Content of the Masterplan", *Journal of Law and Economics*, Vol. I, 1958, pp. 170-186 or E.M. Bassett, *The Master Plan*. New York: Russell Sage Foundation, 1938.) Both world wars did much to increase the tempo of centralized technical and social planning, but by the 60s the emphasis had shifted from defence and physical planning, through the civil rights movement and the subsequent war on poverty to national human resource planning which encompassed both the 'soft' and 'hard' sciences.

The ideas of two contemporary American writers seem to exemplify the different approaches to social planning: Herbert Simon and the late Saul Alinsky. The juxtaposition of a university professor and a professional political activist may seem strange, but in their writings they embody the values and methods that we associate with the two schools of planning which we have defined above. Simon finds impractical the traditional model of decision-making in human organizations, sometimes called optimization.[14] Instead, he urges administrators and planners to 'satisfice', that is to select outcomes which are not always perfectly rational but which are good enough — will 'satisfy'. The Simon concept lets the policy-maker off the hook. It concedes that rationality is less than complete (which everyone admits) and, therefore, that decisions must be both pleasing and feasible. The satisficing paradigm skirts the issues of political implications and social injustice of the decisions. There are no higher goals against which the planning decisions shall be judged. Thus, it stands firmly — though creatively — in the same company as other scientific, or value-free thought systems.

Saul Alinsky's approach begins with a strong critique (which makes no attempt to be unbiased or objective) of the social and political ills of a polity. He finds that, particularly in the urban centres, poverty and bigotry erode the human spirit. Moreover, he has no hesitation in unequivocally, dogmatically, assigning the blame for this condition. "Here," he explains, "dispute between capital and labor have not been 'interesting topics' for controversial discussion, but raw, bitter, bloody conflict — the fight for life".[15] The methods of Alinsky are clear: expose injustices in rousing terms, attack by rallying all forces of disaffection (whether immediately affected or not) to move against the power structure. His goals are total social change; his strategy is to "push" the system wherever the pathology is greatest, his activities go well beyond the tolerance level of most institutions to self-improve, so the Alinsky model requires financial and organizational support from outside the system itself. The Simon model may be criticized for its lack of social conscience and political acumen, the Alinsky one for its lack of feasibility. It leads not to planned change but to political revolution.

The activity which we call educational planning must have elements of both approaches: planners can and do gather data effectively, make decisions rationally (recognizing the limits of rationality), and evaluate outcomes (recognizing the points of objectivity). They can do this and *still* maintain a vision of the better life. Planners can successfully pit the system against itself to push for important changes. It is only a seeming paradox to superimpose these planning styles upon each other, combining the cool and rational with the emotional reformist, in different proportions at different times, depending upon the circumstances. But this requires planners who will use both styles while not completely believing in either — ones who are aware of the tolerance limits of each method. The technocratic style loses force when technique outweighs substance. Planning loses status when technically perfect plans are made for trivial purposes. A reformist effort becomes ineffective if it juggles the 'facts' or tries to argue them 'away', and when it attacks merely for the sake of attack. A good example of a balance of styles used for a contemporary reform in U.S. education is the so-called free school movement.[16] It influenced the direction of public school education by combining hard work within the systems with ideas and models drawn from romantics outside the system.

Bruce S. Cooper

Major Concerns for Educational Planners

Effective educational planning depends not only upon understanding of the approaches to the planning process but also on appreciation of certain social, political and institutional contexts of the planning activity. The following items are not intended to be exhaustive:

Building the credibility of the planning function. Formal planning in education is a new enterprise. The educational planning official is a new professional specialist. His role until recently in the U.S. received little public recognition or status. If planners are to gain the authority and resources which will enable them to plan effectively, they must strive to build the image of their office. Profession-building, then, requires that early planning activities be highly visible and success-oriented, but that road is not an easy one. And the planner may enjoy *de facto* success if he is careful *not* to challenge old roles and authority hierarchies. Other departments, encrusted in school systems and municipal and state governments, will harbour resentment against any new group. Educational planners, particularly those not drawn from the field of Education, may find that they cannot communicate with teachers and school administrators who do not think in planning terms and who are ignorant of its procedures. The lay public will also be sceptical of the pronouncements of officials whose work and role they do not understand. One central mission of professional education planners, then, must be to legitimate educational planning efforts during these formative years.

Analyzing the political milieu. Educational planners are aware that another source of resistance to planning stems from widespread mistrust of the consolidation of power. Political scientist Theodor Lowi calls this the fear of the "authoritative use of authority".[17] Our commitment to a liberal democracy based on pluralist principles makes it difficult to solve social problems through planning. Liberal governments tend to proliferate social agencies, adding new agents rather than improving the services of existing ones. We are reminded of James Madison's statement: "You must first enable the government to control the governed; and in the next place oblige it *to control itself.*" Planners encounter similar constraints within their jurisdictions, and a tremendous effort is required to assemble the power necessary to create and implement new educational plans. Old line agencies, supported by pluralist notions of the division of power, will withhold power from the officials of the planning office.

Locating the planning office. If we assume that the planning agency must have sufficient resources to carry on thorough work, and only such work can have an impact on the organization, the location of the planning office within the school system bureaucracy is a crucial factor for its success. How independent from the political and administrative school district decision-makers should it be? What are the trade-offs between being closely affiliated (having the ear of the executive) as compared with being comparatively free from the political pressures within the system?

Such questions suggest the possibility of at least three organizational arrangements: an independent planning office, perhaps with its own governing board; a planning office under the direction of the superintendent; an office under the direction of the elected board of education.

The independent board concept rests on the notion of the planner as a technical expert, most useful when he is isolated, free from the political and administrative mainstream (See Figure 1). But for whom does this independent educational planner work?

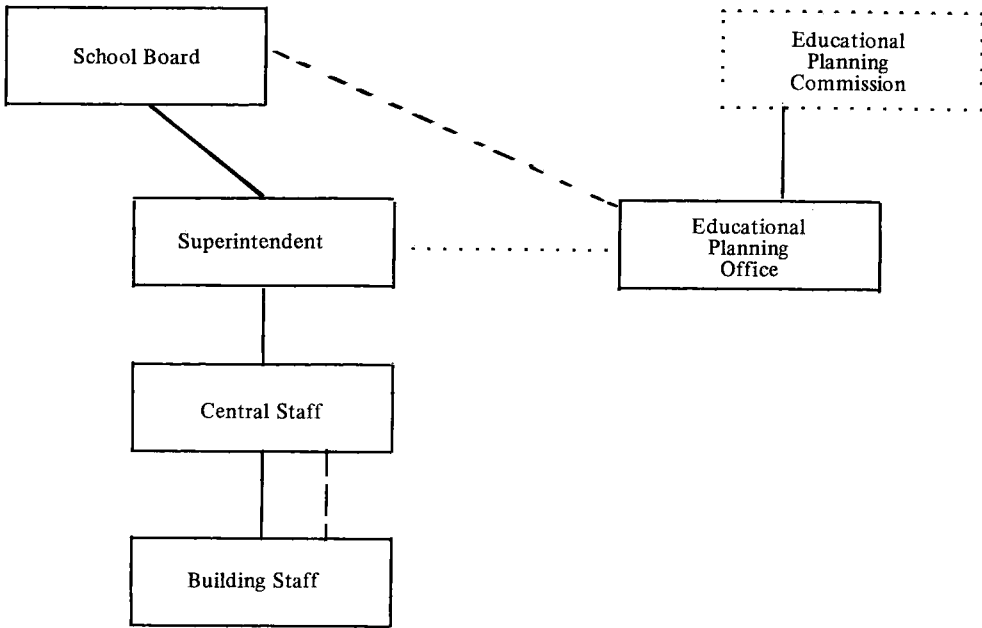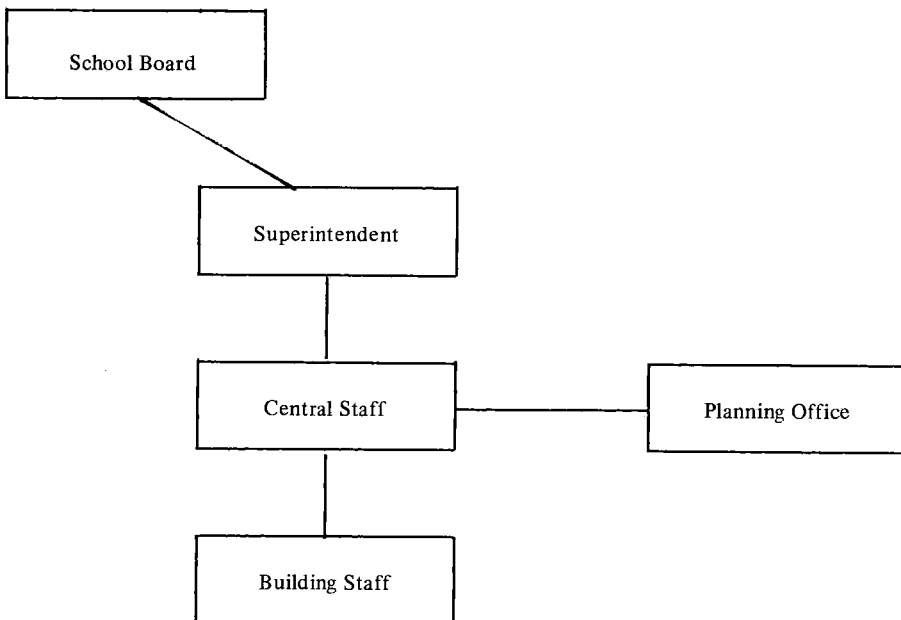Figure 1   INDEPENDENT PLANNING OFFICE AND PLANNING COMMISSION

Figure 2   PLANNING OFFICE AS PART OF SUPERINTENDENT'S STAFF

In city planning, the planner-as-expert frequently reports directly to a publicly elected planning commission. If we translate this into educational terms at the local (district) level we would have a non-partisan, elected educational planning commission comprised of community-minded citizens. This would give the planners an elevated function of great importance but what would be the relationship of the educational planning commission to the board of education and the superintendent of schools? The experience of urban planning is not hopeful. Debate has raged for years over the relationship of the professional town planning office, the urban planning commission, the city manager or mayor, and the city council.

The office reporting to the superintendent of schools has the advantage of a direct relationship with the officials who operate the educational system. This gives the planners, in Altshuler's words, "direct access to the chief executive, so as to help him formulate the comprehensive policies of his administration".[18] Such a structural arrangement (see Figure 2) affords easy access and availability of the machinery to implement planning policies. But the planners face serious constraints, not less rigorous because they are implicit and self imposed. Walker warns against independent action which might embarrass the chief officials,[19] in our case the superintendent of education. Nash and Shurteleff caution that, "If he [the planner] is being deliberately by-passed, or if he strongly disagrees with managerial policies [of the chief executive], it is his duty to tender his resignation if the differences cannot be resolved".[20] So, although the opportunity to intercede at the top of the system is heightened by making the planner an adjunct to the superintendent, this location carries with it restrictions upon the planner's actions.

The planning office within the board of education should not be lightly dismissed. Since final authority for school policy rests with the board of education, it makes sense, in terms of delegated power, to affix the planning office to that body. T.J. Kent discusses the advantages of such an arrangement in terms of city planning and government.[21] It provides the board with the staff advice on which to base intelligent decisions about schooling for the district, while providing some constancy to a body which is periodically changing (see Figure 3). Furthermore, it gives some professional 'muscle' to a group of part-time lay people. However, problems will arise whenever the board, on the advice of its planning office, challenges the superintendent and his professional staff. It is the superintendent's staff who will undertake the implementation of the planned change. Planners could be seen as undermining the authority of the professional educators in the system.

Whatever the institutional set-up, each has benefits and drawbacks. What is essential is for the planners and policy-makers to become sensitive to the problems inherent in their particular arrangement and to devise informal mechanisms to ensure that conflicts are contained.

Staffing the planning office. Wherever the educational planning office is located in the system, the key role is that of its director. The ramifications of the role are not clear because the practice of employing planners has grown rapidly. To understand the role, we need to know the range of responsibility of current incumbents; how many school districts are employing full-time planners; whether the function is centralized in a bureau or carried out by personnel scattered among various administrative offices such as curriculum, staff development, budget, plant and maintenance. Where there is an actual planning office, the director probably will have to be a generalist, a jack of all trades.

Figure 3   PLANNING OFFICE AS PART OF SCHOOL BOARD STAFF
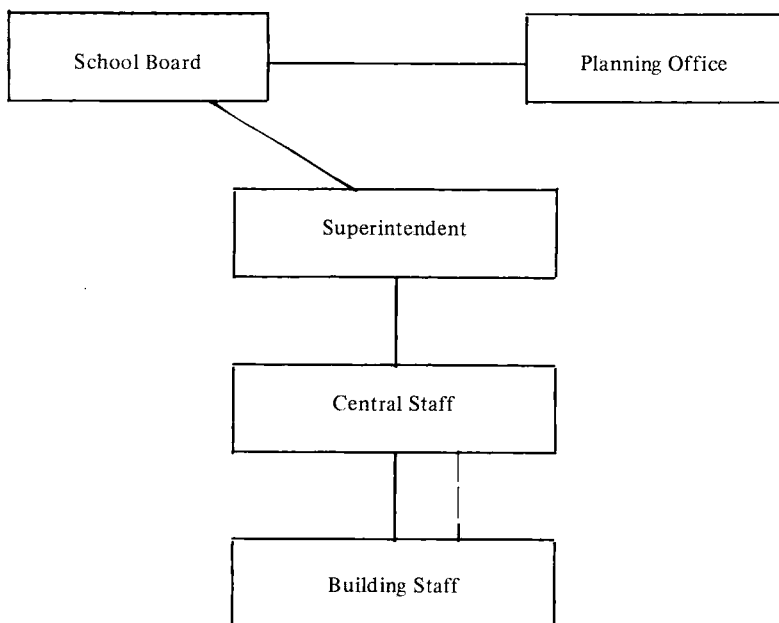
Under the director there will be a number of experts whose precise range of skills will depend upon the size and problems of the system to be served. They might well include people trained in such areas as demography, educational research, computer systems, land-use planning, engineering, architecture and so forth. Also since such a planning office would be expected to alert the school board and the superintendent to general community problems, it may be necessary also to add professionals trained in community organization, manpower development, and social services. The planning professionals would provide the liaison with other public and private agencies in the community and the officials may find it necessary to establish contacts with similar personnel in state and federal agencies and various other public bodies. Since educational planning is affected by every major shift in the physical environment, the educational planners would quickly find themselves sitting on the planning and advisory boards of many related public and private agencies. Whether the planning office should become its own bureaucracy or should act merely to coordinate the experts in other bureaus of the organization is an unresolved question.

Anticipating the future. According to E.L. Trist, "We [planners, must] prepare ourselves to assist the emergence of a society radically different from the industrial societies which have evolved in the last two hundred years".[22] We have come to a stage where theoretical rather than practical knowledge is emphasized; where technology is that of computers rather than assembly lines; where the educational level of the average citizen increases yearly; and where the economy has become service-centred rather than

production-centred. This means that the functions which planners perform for society are no longer *incidental* to the main job of administering the system, but essential to its administration — particularly to conserving the fast-dwindling resources of the world. What a few years ago might have been merely a small error of judgment of a superintendent or a board of education, in today's world might lead to serious crisis for the entire school system. Perhaps such a view gives the planning office a role and authority (in the peaceful management of policies of great social change) which it cannot fulfil or at least not fulfil by itself. School principals, superintendents, and board members must have some understanding of the planning process in order to allow the planning office to work effectively. We expect, for example, that the social interaction network of any large school system will grow dramatically within the next twenty years. Some of the network development will be carried by the professional educational planners, but not all. Schools will become increasingly responsive to external influences — federal and state regulations, economic and legal constraints, and the pressures of community groups for greater control over their children's education. The administrator will have to be sensitive not only to the local social and political environment but also to developments on the national and international scene. The administration will be required, much more than is presently the case, to anticipate events and conditions, and to simulate the effects of possible responses to conditions. For this work the professional planner is needed.

It is not clear from whence these educational planners will come, particularly in the U.S. where an elaborate series of educational specializations already exists. Some will come from degree programs in education, economics, architecture, public administration, and urban and regional planning; or perhaps from cooperative programs in schools of education which are dedicated to the professional training of educational planners. We foresee a period of some confusion about standards and qualifications at the beginning of the establishment of formal planning officers in education, similar perhaps to the problems surrounding the 1928 Standard City Planning Enabling Act which was responsible for the creation of city-planning commissions.[23] We are only beginning to scrape the surface of the questions about educational planning likely to arise in the coming years. Perhaps the greatest challenge to educational planning as a professional activity or an academic discipline will be our ability to control its growth and development, to plan for planning.

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21. T.J. Kent, *Op. cit.*, p. 16.

22. F.E. Emery and E.L. Trist. *Toward a social ecology.* New York: Plenum Press, 1973, p. 157.

23. The act was prepared by the then-secretary of Commerce, Herbert Hoover. See Kent, *Op. cit.*, pp. 31-59.

The International Society of Educational Planners

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The Society was founded on December 10, 1970, in Washington, D.C. Over fifty local, state, national and international planners attended the first organizational meeting.

Since then its growth has demonstrated that there is need for a professional organization with educational planning as its exclusive concern.

Purpose
The ISEP was founded to foster the professional knowledge and interests of educational planners. Directly and indirectly it is also concerned with the state of the art of planning.

Activities
The activities of the Society are those of most professional associations: it publishes a newsletter and a journal, holds an annual conference, sponsors training workshops, conducts professional liaison with related organizations and encourages research.

Committees
The Society currently has only one standing committee the chairman of which sits on the Board of Directors. Professor Don Adams of the University of Pittsburgh is Chairman of the committee which deals with the Society's relations with international organizations and other learned societies.

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