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ABSTRACT

The paper described the Input, Process, Product, and Impact (IPPI) model in preparation for a 1972 Management Information System for Occupational Education (MISOE) planning conference. The IPPI model is designed (1) to provide a structure for integrated State and local decision-making within occupational education and for decision-related descriptive information which accounts for reality by decision types within the model, and (2) to provide a framework for analysis of relationships between inputs and process with product and impact. The system also permits decision-makers to simulate the interactive effects of the total system over time. The model describes the totality of occupational education; links to the larger world occur with input and impact. The paper establishes some differentiations, distinctions, and definitions, and thereby provides a structure for project development which not only stipulates developmental tasks, but ties consultants and staff to development in a functional way. Eight tasks are described in the paper, related to space differentiations, variable selection, instrumentation, the sample, the information system, analysis types, simulation, and other information needs. The final section of the paper suggests an integrated procedure for task development, including a schedule for the planning conference. (Author/AJ)

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OCCASIONAL PAPER #2

TASK DIFFERENTIATIONS

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The IPPI model is designed (1) to provide a structure for integrated state and local decision making within occupational education and for decision-related descriptive information which accounts for reality by decision types within the IPPI model, and (2) to provide a framework for analysis of relationships between inputs and process with product and impact. Analytical information feeds back into the decision-making process such that prediction for future product and impact can be empirically estimated. The system under construction also permits decision makers to simulate the interactive effects of the total system, particularly inputs and process on product and impact, over time. Essentially the IPPI model describes the totality of occupational education, and links to the larger world occur with input and impact.

The purpose of this paper is to establish some differentiations, distinctions and definitions and thereby provide a structure for project development which will not only stipulate developmental tasks but will tie consultants and staff to development in a functional way. The final section of this paper will suggest an integrated procedure for task development, including a schedule for the February sixteenth conference.

TASK I

SPACE DIFFERENTIATIONS OVER AND WITHIN MODEL ELEMENTS

A fundamental task is to mark off with logically related verbal symbols the space within each of the IPPI model elements. These boundaries must account for the total conceptual space within each model element and at the same time provide for variable information types within each area. The total IPPI model accounts for all occupational education. Within each IPPI element are discrete spaces which can be filled to various levels. Space within each

IPPI element is defined by specific variables which can be determined by decision makers and change over time. Levels describe the degree or extent to which these within element variables exist. Definitional decisions establish expectation standards for each of these subspaces within IPPI elements, while descriptive information describes the actual level within each IPPI subelement, by variables. In general, levels are established by rates, rates are a function of decisions and other phenomena. The level and rate relationships will be discussed in more detail in Occasional Paper #3.

The following is offered as a tentative designation of space within each of the IPPI elements:

Input Space

Input space is divided into two sections, one is simply entitled students and the other capital, meaning dollars. Student space is divided into two sections, one is labeled, student characteristics and the other student descriptions. Student characteristics are further divided into five spaces, which are: (1) capabilities; (2) interests and attitudes; (3) personality; (4) physical attributes; and (5) biographical information. Student descriptions are subdivided into four spaces, which are: (1) family characteristics; (2) peer characteristics; (3) neighborhood characteristics; and (4) city or town characteristics. Information about students which is categorized as input describes characteristics and descriptions of students prior to entrance into an occupational education program. Perceptions by students of process is categorized under human factors within the process element of the IPPI model.

Capital is divided into four categories: (1) local; (2) state; (3) federal; and (4) other. Expenditures must at all times be identifiable by these distinctions.

Figure I outlines input space as herein described:

FIGURE I INPUT SPACE DIFFERENTIATIONS		
STUDENTS		CAPITAL
STUDENT CHARACTERISTICS	STUDENT DESCRIPTIONS	SOURCE
1. Capabilities	1. Family Characteristics	1. Local
2. Interests & Attitudes	2. Peer Characteristics	2. State
3. Personality	3. Neighborhood Characteristics	3. Federal
4. Physical	4. City or Town Characteristics	4. Other
5. Biographical Inf.		

Process Space Differentiations

Process space differentiations are difficult to determine. Monograph #1 differentiated between structural and organizational process space as those which are easy to manipulate and those which are difficult to manipulate. This is a useful differentiation, however, limited. Another problem not considered in Monograph #1 is that variables are not one or another across the management hierarchy. For example, time is totally manipulatable at the state level and hardly manipulatable at the classroom level. A further problem in defining process space is that some variables are constant across programs, while others are unique to particular configurations of behavioral objectives sought. The following conception of process space is offered as a first attempt to usefully differentiate this space for description and analysis. Due to the complexity of this model element, Figure 2 is presented as a preliminary map of process space and referenced by the discussion below.

The focus for process space is the instructional event, which is defined as the totality of a specific teaching and learning experience within a program. (There are simple and complex instructional events). Process is simply defined as the totality of instructional events across all occupational education programs. Although all process space is related to instructional events, levels may be analyzed separately across factors.

As displayed in Figure 2, process space is conceived as two dimensional with columns representing factors and rows depicting levels. Levels will be dealt with first as they are relatively uncomplicated. Basically, two levels are conceived; (1) the state level and (2) the local level. The state level is described as over-all schools and includes the following role incumbents: (1) policy makers; (2) administrators; and (3) support personnel. The local level provides for a separate administration over all schools and a distinct administration over all programs within schools. In addition, it includes role incumbents at the within program, within school level. This is, of course, a very truncated representation of process space, as considerations must be made for each program. Levels allow consideration of factors as they are developed and exist within the hierarchy.

FIGURE 2
PROCESS SPACE

LEVELS \ FACTORS	Human Factors				Physical Factors		Organiza
	Characteristics	Behavior			Structural	Instructional	
		Decisional	Operational	Perceptual			Characte
1. State Over-all Schools (1) Policy Makers (2) Administrators (3) Support Personnel							
2. Local Over-all Schools (1) Policy Makers (2) Administrators (3) Support Personnel Over-all Programs Within Schools (1) Policy Makers (2) Administrators (3) Support Personnel							
Within Programs Within Schools (1) Administrators (2) Support Personnel (3) Teachers (4) Students							

FIGURE 2
PROCESS SPACE

	Physical Factors		Organizational Factors					
	Structural	Instructional	Human Factors		Physical Factors		Time	Organizational Factor Interactors
etual			Characteristics	Behavior	Structural	Instructional		

Three comprehensive factors are conceived to represent all of process across all levels: (1) human factors; (2) physical factors; and (3) organizational factors. Human factors include the characteristics and behaviors of all role incumbents in the process, with the exception of student characteristics and descriptions which are considered inputs. Characteristics include: (1) capabilities; (2) interests and attitudes; (3) personality factors; (4) biographical information and (5) physical data. Behavior includes the totality of what role incumbents do within the process and is subdivided into: (1) decisional behavior; (2) operational behavior and (3) perceptual behavior. Decisional behavior is described as goal or standard setting by role incumbents across factors and down levels. Standards and/or goals are not only set for physical and organizational factors but also by human factors for human factors. Operational behavior describes what role incumbents do within the process. This includes: (1) policy-making behavior; (4) teaching behavior; and (5) learning behavior, at all appropriate levels in this hierarchy. Perceptual behavior describes awareness of role incumbents within process. Such perceptions include factors usually described as environmental, including climate and press perceptions.

Physical factors are uncomplicated to describe, but require the development of a classification system. They are divided into two categories, structural and instructional. Structural factors are those that can be described as housing a program or programs, while instructional factors describe non-housing elements that are clearly related to an instructional event(s). Typically, structural factors will exist over all programs within a school, and instructional factors can either be over all programs or unique to particular programs. Physical factors are determined by human factors.

Determinations for physical factors are made at various levels within the hierarchy.

Organizational factors describe the configuration of human factors, physical factors and time which constitute instructional events. Human factors, physical factors and time are organized by human factors at various levels in the hierarchy separately or in combination across these three categories. The column entitled Organizational Factor Interactors is designed to include these combinations. Organizational factors are differentially determined at various levels in the hierarchy.

Classifying process variables within the designated process space of Figure 2 will allow the description of instructional events to include specific reference to factors and levels. Further, constraints on the determination of instructional events at lower levels of the hierarchy are made apparent by this scheme. Also, as implied above, such a display of information permits an analysis of impingement, by level, on instructional event(s).

The tool to make these determinations is yet to be developed, however, a coding system will allow instructional events to be referenced by specific process space. Classes of instructional events will be determined which describe groups of teaching-learning experiences. Given the nature of public education, this challenge is not nearly as difficult as it might appear, since the similarity of instructional events over programs and schools is hypothesized as being enormous.

An example of an instructional event might be the teaching and learning of Fortran programming by a class of students within a particular school. Such an instructional event could be described in terms of constraints that exist as a result of prior decisions by the hierarchy on the teaching-learning process. It could be further described by the characteristics of the teachers and learners, the operational behavior of the teachers and learners, and/or the perceptions of both groups toward the usefulness of the task. Further, this instructional event could be described by the physical factors which exist, as well as the organizational pattern of human and physical factors and time brought to bear on this particular experience.

The above scheme for classifying process is being further developed currently, and will be presented in more detail at the February sixteenth conference. It will also be the subject of an Occasional Paper. At this point, it should be noted that each subdivided area of process space can be described by one or several discrete variables which can exist or not. If they exist, they exist to some degree and can be described. The purpose of descriptive information types is to stipulate the degree to which these variables exist by instructional event(s) within programs, within schools and across schools. Such information will allow for interactive analysis across IPPI categories.

This scheme seems to lend itself to economic analysis, as columns and rows can be costed out and summed across. At any rate, it should give the economists among us something to consider, as cost product data, as described in Monograph #1 requires a rather careful analysis of expenditures within and across programs.

Product Space Differentiations. Product space differentiations are relatively straightforward. Basically, occupational education is conceived as purposeful capability production activity. Capabilities can be described as psychomotor, intellectual or cognitive, and affective. (Some consideration should be given to personality.) Figure 3 represents an initial attempt to mark off product space.

FIGURE 3

PRODUCT SPACE Capabilities			
PSYCHOMOTOR	COGNITIVE	AFFECTIVE	PERSONALITY

Missing in this particular conceptualization are considerations for summing capabilities within and across programs. It should be pointed out, however, that product space will include a stipulation of capabilities by total human being within programs and across schools, although considerations will be made for analysis of specific capabilities. The purpose of this section is not to examine data connectiveness within the sample nor is it to go beyond the straightforward marking off IPPI element space.

Impact Space Differentiations. Impact space differentiations are difficult to determine. The initial differentiation of Monograph #I is rather uncomplicated, i.e., self and society. It isn't particularly difficult to stipulate logical differentiations within self impact space. The following are offered as meaningful and useful definitions within self-impact space: (1) self as a worker; (2) self as a contributor to society; (3) self as a fulfilled person; and (4) self lifestyle characteristics. Impact self space can be further subdivided.

For example, self as a worker can be conceived to include: job satisfaction, job satisfactoriness, occupational productivity; and occupational growth. The other three self categories can be similarly marked off, and variables can be selected to describe this space (See Figure 4).

Differentiations within society space require considerably more audacity to suggest. Further, society should be conceived in geographic space, i.e., local society, regional society, state society, national society and world society. Obviously, such a consideration suggests a two-way table, with the columns stipulating impact space elements while the rows represent geographical areas. However, geographical differences will not be treated in this presentation, but will be in future development.

Societal space can be divided into economic and non-economic sub-space. Economic space can be further subdivided into productivity and non-productivity. Productivity can be described in terms of employment, production of goods and services and tax revenues. Non-productivity could be described as welfare, unemployment and perhaps rehabilitation costs. These are all quantifiable by dollars and thereby provide a measure of impact which can be described in terms of cost. Much of this information can be obtained by summing over self data of impact space.

Non-economic impact space is considerably more difficult to subdivide. The following is offered as a suggested ploy to differentiate non-economic society space. Non-economic-society-impact space essentially includes those desirable societal elements which consitute the "good life" as determined by the value system of a particular group within a particular society. Non-economic society impact space could therefore be differentiated in terms of concepts which extend from societal values, and variables can be

FIGURE 4 - IMPACT SPACE

SELF	SOCIETY		
	ECONOMIC		NON-ECONOMIC
	PRODUCTIVITY	NON-PRODUCTIVITY	
(1) Self as a Worker	(1) Employment	(1) Welfare	(1) Orderly Society
Occupational Satisfaction	(2) Production	(2) Unemployment	(2) Equal Opportunity
Occupational Satisfactoriness			(3) Free Enterprise
Occupational Productivity	Goods		(4) Strong Family System
	Services		(5) Self Government
(2) Self as a Contributor to Society	(3) Tax Revenue		
Citizen Behavior			
Family Behavior			
Consumer Behavior			
(3) Self as a Fulfilled Person			
(4) Self Life Style Characteristics			

selected which could estimate the level of those subspaces. For example, one could divide this subspace as follows: (1) orderly society; (2) equal opportunities within society; (3) free enterprise; (4) strong family system; and (5) self government. The next step is to select variables that describe this space and to measure levels within this space. For example, a variable that could describe equal opportunity might be a representative racial mix within occupations. Decision makers could establish variables and levels of expectation within impact space and could redistrict impact space. It is hoped, however, that the model will anticipate most impact space differentiations, and that decision making will concern itself with variable determination within stipulated impact space.

It should be noted at this point that occupational education makes contact with the larger society through input and impact elements. The information system and analysis within this system must deal with education as a subsystem of a larger universe, and stipulate the contact points at input and impact, such that these relationships can be dealt with. It is too easy to consider education as a closed system, and we must be careful to avoid such parochialism.

Summary

The task that remains for differentiating IPPI model space is to expand these differentiations to the point that total model space faithfully and usefully represents reality for the purposes of description, analysis and management. The accomplishment of this goal requires the joint efforts of both the staff and consulting team. Therefore, this will be an early agenda item during the February sixteenth conference and specific responsibility for this task will be assigned to members of the staff.

TASK 2

VARIABLE SELECTION WITHIN SPACE DIFFERENTIATIONS OF MODEL ELEMENTS

This is a somewhat uncomplicated task and involves a selection of variables within system space differentiations. At the beginning these variables will be determined by the project staff and consultants, but the system must be sufficiently flexible to deal with new variables over time. This task interacts with both analysis and instrumentation, two tasks to be discussed below.

System space is described as a summation of the variables within that space or subspace, administratively determined or otherwise. All variables which exist and are measured must be classified by predetermined system space. This requires a fairly complex coding and classification system for system space, within space variables and for measurement instruments.

Some examples of variables within system space are as follows: capabilities within student characteristic input space could be described by a list of aptitudes ranging from musical to mechanical; while family characteristics within input student description space could be described by a variable measuring father's attitude toward risk taking. Decision makers select variables within system space and stipulate the level at which these variables should exist. The information system describes the variables that exist within system space, and attempt to estimate relationships within system space in terms of these variables. There is obviously a dependency of variable description on instrumentation. This question will be examined below. However, it should be pointed out that the system will be developed so that it can begin to function with limited variables within system space, but it will be designed in such a way that it can accommodate more complex descriptions of system space.

Variable selection depends upon system space differentiation. It is anticipated, however, that space differentiations will be sufficiently developed by February sixteenth that the conference can spend some time stipulating variables within system subspace. A particularly prominent bias is that we have a responsibility to get the system operating with "straightforward" variables and grow into complexity. Variable selection or determination within system space will be a staff function or task to be directed by those responsible for system space development. This seems a logical requirement as a result of the interaction between the two tasks.

TASK 3

INSTRUMENTATION

Instruments are described as those devices which measure system space. System space is a summation of variables within system space, and instruments must be developed to detect the degree to which variables exist within system space. Further, these instruments must be cataloged in a way that references within IPPI element system subspace, and at the same time describes the error with which system space is measured, by instrument. Obviously, some variables are extremely difficult to measure, while others are straightforward. In many instances, there are well developed instruments to measure variables. In general, the non-psychological variables are fairly easy to detect and can be described quite accurately in an uncomplicated way. Some instruments for some psychological variables have been well established and can be easily adapted to the system. However, many psychological variables are difficult to detect and instruments to estimate their existence are either non-existent or very poor. As was previously indicated, it is the current bias to develop an operational system from variables that can currently be detected, and to provide within the system the flexibility to treat new information as it evolves.

Another instrumentation requirement is to develop communication devices to record the stipulation of goals and standards by decision makers at various levels for IPPI elements. These instruments must, of course, be consistent with the elements of the total system, and allow for clear communication across levels. Analysis of state information, emanating from both census and sample data, will provide a description of reality in terms of standards and objectives. Such a description will be on a state-wide basis, and will not be available by LEA goals and standards within the system. This avoidance development is designed to protect and encourage diversity within occupational education in Massachusetts.

Currently, a file of instruments is being developed by the project staff for all elements within the information system, with particular attention being paid to process space. As a matter of fact, we are developing a fairly comprehensive test file. To repeat, it is our bias that we should begin the system with existing measures and grow to developing new measures over time.

Instrumentation is a vital concern and will be a topic for discussion at the February sixteenth conference. Since, in part, the variables to be selected which describe system space are somewhat limited to those that are currently measurable, a determination of these instruments as well as a description of the constraints of these tools is a high priority item. Therefore, an Occasional Paper is requested on this topic which deals with the issue separately, and as it interacts with analysis and system space.

TASK 4

THE SAMPLE

Preliminary consideration of the sample, as well as sample population relationships, were offered in Occasional Paper #I. Nonetheless, the determination of the sample, as well as sample population relationships through data and instrument connectors is a task. As stipulated in Occasional Paper #I and Planning Chart #I, the sample will be by program and over specific dimensions of occupational education; including geographical areas; school types and levels; and student types. The task can be described as selecting and maintaining a sample(s) such that analysis and descriptive data for both the sample and the population are connectable, within the constraints of the system. There are some problems that should be considered by the staff and consulting team concerning the sample and the population. Given the effect of these concerns, an Occasional Paper will be commissioned to describe sampling procedures in detail, as well as specifications for sample population relationships, within system constraints.

Two major considerations for the sample are; (I) implications for analysis; and (2) the so-called camera effects. The first one is methodological, and will be treated briefly during the February sixteenth conference. The second problem is developmental, and involves an anticipated contaminating effect of measurement on the performance of human factors within the sample. A data requirement that makes the sample selection somewhat complex is that longitudinal information of students, over time, is desirable. That is, the system seeks information about particular students prior to entrance to specific programs, during the program, and after the program.

Information can become irreparably damaged unless some attention is given to solving this problem. For example, if one focuses on the same sample over time, the measurement experience is very likely to contaminate the process. If, on the other hand, one selects a new sample each year, soon there will be very little to differentiate between the sample and the population. Consider the following:

FIGURE 5

SAMPLE BY PROGRAM TYPE OVER FOUR YEARS

	INPUT	PROCESS	PRODUCT	IMPACT
Manpower Programs	X	▯	X	□□□
Post-Secondary Programs	X	□□	X	□□
Secondary Programs	X	□□□	X	□
Adult Programs	X	□	X	□□□

This figure displays samples over four years of time. Prior to the first year, students are considered as input and observed. Programs include manpower development training, post-secondary, adult and secondary. Large boxes represent one year of time. At the end of four years, there is impact data for three and a half years of most MDT programs, two years for post-secondary programs, three years for adult programs, and only one for secondary programs.

Perhaps a solution to the problem is to select a new sample at the termination of the process experience for each separate occupational education type. This would allow a continuous flow of information over time and guard against the testing effect. Of course, comparable control samples for each type must be simultaneously selected for cost impact data. The consequence of this, in terms of Figure 5, would be as follows:

(1) MDT. At least eight separate waves of students will be processed, resulting in eight separate impact studies.

(2) Post-secondary. Two cycles would be treated, each cycle representing a sample, with two year follow up or impact information on the first cycle.

(3) Adult. Since adult programs are displayed as one year programs, impact groups would range from one to three years, and the fourth separate sample would be under study.

(4) Secondary programs. The second separate sample would be experiencing process examination while the first sample is being studied from an impact perspective.

Except for impact, only one IPPI element per occupational education type could be under consideration at a time, and no two schools would be contiguously examined. However, at the end of eight years over forty-six impact studies would be required.

Sample determinations are going to have to be made soon and the above is offered to suggest the scope of the problem. Obviously, accommodations are going to have to be made such that the amount of information treated is reasonable. The conference of the sixteenth will develop specific guidelines for sample development, and, as stipulated above, an Occasional Paper will be developed describing a sample within the guidelines.

TASK 5

INFORMATION SYSTEM

The information system is a description of total model space presented in Monograph #1 and developed to this point. It is helpful to think of the information system as a computer model, with two major capabilities: (1) storage; and (2) analysis. Another characteristic of computer systems is a potential to examine manipulated and/or stored information and determine further analysis needs from specified criteria. Further analysis could be a part of a fixed computer system or optional. Unplanned analysis, which can occur at specified intervals, permits flexible examination of relationships.

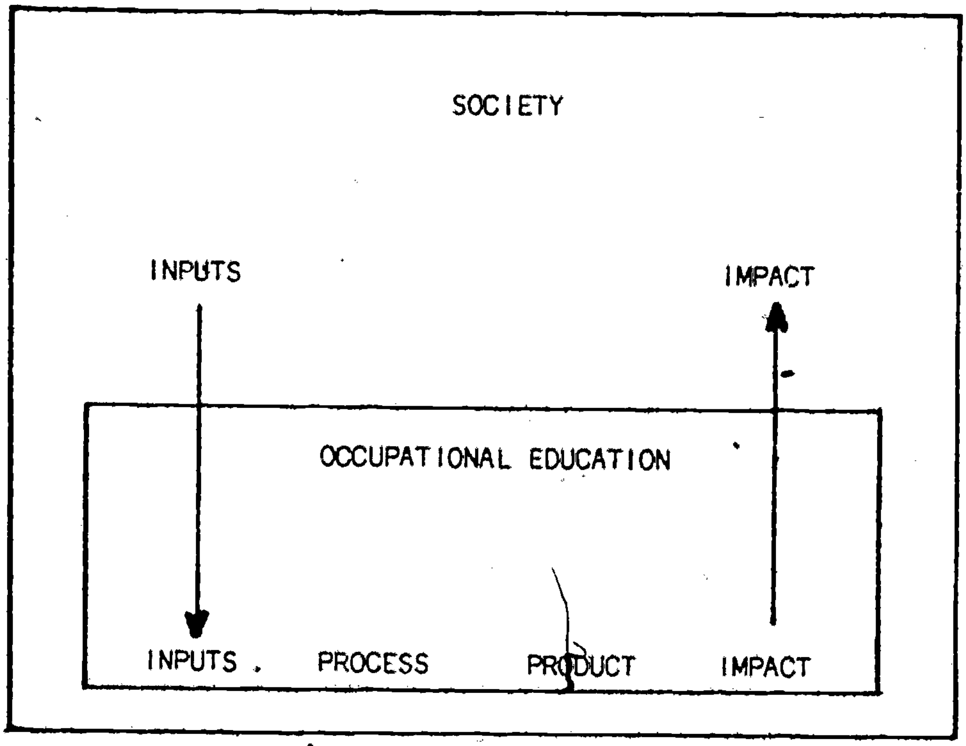
Three levels of the computer information system can be distinguished. The first level is a description of the total population in terms of census information available, which includes; (1) anticipated and real enrollments by program, by school type and level, by student type, etc.; (2) program completors by the same dimensions; and (3) relationships among these information types, for example, average cost per completor, by program.

The second level of information is at the sample level, which not only describes levels within IPPI elements by information types, but presents a detailed picture of relationships among information types. The descriptions have been specified as data types A_1 to A_6, and, taken together, stipulate a comprehensive explanation of system space.

The third level of information is prediction, frequently described as simulation or forecasting. These information types have not been developed at this point, but provide an estimation of the future consequences for an array of alternative decisions. It might help to think of these information types as..."What would happen if--?" These predictions are based either on real or "manufactured" information, appropriately labeled. As an example of forecasting, reconsider the IPPI model as follows:

FIGURE 6

IPPI RECONSIDERED



A forecast at the society level might be for example:

Given:

(1) Specific student types;

(2) Specific impact goals;

Display:

(1) Product objectives within programs most likely to obtain impact goals;

(2) Least cost process to attain goals;

(3) Impact of goal attainment on society.

Or at the educational system level:

Given:

(1) Current product objectives within schools, geographical areas, and specific programs;

Display:

(1) Least cost process variable(s), (specify factors) to maintain current output, by student type.

The information system must be thought of as both fixed and manipulatable. Phase I of the system could be characterized as predominantly fixed, i.e., the description of IPPI levels, relationships among elements and reports will be predetermined. However, the computer system will be conceived such that new analysis and report potential can be simultaneously developed and added to Phase I. The system will become increasingly manipulatable over time.

An Occasional Paper describing the computer system is currently being written, which will describe developmental phases. It is important to communicate a development requirement at this point, the computer system will become operational across the Commonwealth with Phase I, but is designed such that growth and flexibility can be developed and incorporated over time. Finally, the system must be conceived as an ongoing management tool for occupational education in Massachusetts and will be a crucial part of decision making. The system is not to become an historical data storage contraption, but, rather, an active and growing body of related knowledge which guides the action of those responsible for educational management.

Since the computer system provides an excellent communication tool for development, it will be used as a way of describing development. Therefore, this task involves developing models of the computer system which will structure our work, which will summarize our work, which will coordinate our work, and which will work. Occasional Paper #3 will preliminarily describe the computer system and will be completed by the February sixteenth conference. System development will be an in-house function, under the general direction of Mr. Breslow.

TASK 6

ANALYSIS TYPES

In general, analysis types are determined by the kind of outcomes sought, although it is acknowledged that analysis can precipitate unexpected results. Phase I development of MISOE is to be characterized by fairly predetermined ranges of outcomes and it is therefore possible to stipulate analysis types by outcomes sought. The purpose of this section is to describe several distinctions and considerations to serve as guidelines in determining analysis types.

An important part of the February sixteenth conference will be given over to analysis needs and four (4) Occasional Papers will deal with analysis requirements. It is planned that by June of 1972, most of Phase I analysis needs will be resolved.

Analysis Considerations

As suggested above, Phase I of MISOE development is to be characterized by fixed analysis, based on prescribed data outcomes as described in Monograph #1 and Occasional Paper #1 (data types $D_1 - D_4$ and $A_1 - A_6$). However, even though Phase I is considered as fixed, it will allow branching or alternative analysis to occur, based on preconceived decision rules within contingency tables. Actually, three levels of analysis are distinguishable:

(1) Entry level analysis is defined as first step analysis for all similar data types upon entry into the system. This analysis type tends to organize information for further treatment, and (by definition) provides a basis for status reports, which includes data types $D_1 - D_4$ and A_1, for both census and sample information.

(2) 2nd level analysis is described as a fixed analysis type for all appropriate sample data required to develop analytical data types $A_2 - A_6$. The chief characteristics of 2nd level analysis are: (1) a dependency on entry level analysis and (2) consistent or similar analysis for all appropriate data.

(3) Contingency level analysis is described as fixed analysis which is performed on selected data. The decisions for selecting the data for further analysis are expressed in contingency tables, and only appropriate data is branched for contingency analysis.

All three types of analysis are to be included in Phase I development of MISOE, and are described in more detail in Occasional Paper #3. A fourth analysis type which is not included in Phase I development can be described as variable analysis, which is generally described as a within system provision for non-predetermined analysis. MISOE, during Phase I development, will have the capability of incorporating new, fixed analysis types, either entry level, 2nd level or contingency level, but will not be able to respond to "on line" commands to alter an analysis process. Variable analysis is a Phase II project. However, Phase I development does provide for variable status reports on data types within the system, "on line".

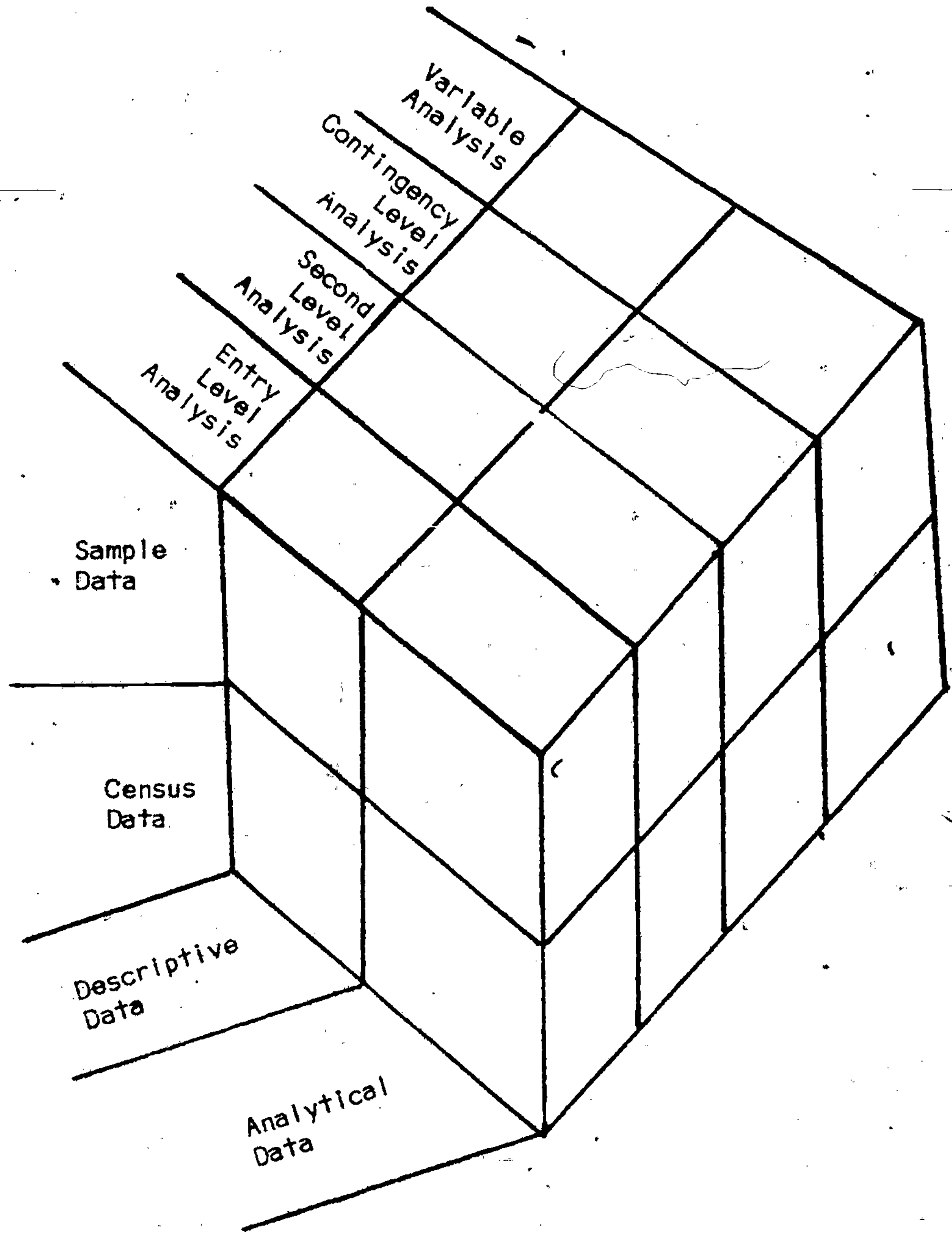
Figure 7 offers a review of the several distinctions within analysis types to this point. In general, it can be assumed that entry level analysis for census and sample data is comparatively uncomplicated. Second level analysis and contingency analysis are complex. At this point, it is suggested that all analysis on census data be considered entry level and that second level and contingency level analysis be reserved for sample data.

A distinction between economic and non-economic analysis is important to consider. Typically, analysis can be differentiated as one or the other. However, an additional analysis requirement of this system is that economic analysis permeate all analysis, such that cost product and cost impact analysis can be regularly obtained. This requirement should force the development of applied analysis types.

Historical trend analysis by data type is relatively straightforward, and provides a basis for projection as well as analysis, over time. Provisions for storing and reporting such information are described in

FIGURE 7

ANALYSIS TYPES



Occasional Paper #3. It is referenced in the analysis section because specific analysis is required to meet this need. Historical trend analysis spans all data types and all analysis levels.

Finally, analysis requirements for simulation could be described as contingency level, trend analysis. Clearly, simulation demands complex analysis. During Phase I development, simulation will not be variable, but restricted to predetermined outcomes. Examples have been provided elsewhere in this paper, and are discussed in Occasional Paper #3. Further, a specific Occasional Paper or simulation is to be developed. The objective during Phase I development of MISOE is to field test and make operational a comprehensive but fixed simulation model. Phase II of MISOE will develop a variable analysis potential for simulation, as well as the entire system.

Conclusion

The analysis task is relatively straightforward. The first phase is to develop a fixed analysis system, which has the capability of accepting more fixed analysis and, eventually, variable analysis. The first conference is designed to focus on analysis, and Occasional Papers by the consultant staff will treat Phase I analysis needs. The permanent staff has a responsibility to synthesize specific analysis specifications into an analysis process, to be constructively criticized by the consultant staff in the Spring of 1972, and finally adopted into a system.

TASK 7

SIMULATION

Simulation is simply described as providing a capability to explore the future implications of current decisions given specific assumptions and information. MISOE will include a simulation capability which will be fixed during Phase I, but become variable during Phase II.

Examples of simulation have been offered in an earlier section (Information System) and will not be repeated here. It should be pointed out that future trend analysis (simulation) can be reviewed in light of historical analysis, which not only provides a tool for making better the predictions, but a basis for judging the usefulness of simulation.

A special paper on simulation is being developed, and therefore little attention will be devoted to this task now. In general, simulation data turns out to be probability statements about specific outcomes over time, based on explicit data and assumptions. Simulation typically deals with the long term consequences of decisions. MISOE will focus on simulation for predetermined outcomes of obvious significance, with particular emphasis on the relationships between the long term consequences of input and process on product and impact.

The tasks in simulation development are straightforward: (1) to determine the specific forecasts to be made; and (2) to develop the analysis tools. Considerable attention will be paid to simulation during the February conference, and within the Occasional Papers dealing with analysis. It is anticipated that the Occasional Paper focusing on simulation will offer a clear blueprint of Phase I simulation development.

TASK 8

OTHER INFORMATION NEEDS

MISOE is a closed information system, which includes a potential to interface with other relevant data. So-called other information is particularly crucial for impact analysis.

This information includes: (1) manpower needs information; (2) societal data which is likely to describe impact; and (3) occupational practice data which would tend to validate the objectives sought by schools within a state. Occupational practice information would include convertible information from Project TALENT and information being developed by Project CAREER. Further, all impact analytical data types of MISOE provide an estimation of these relationships.

Other information is particularly crucial for impact analysis and simulation. An Occasional Paper describing these requirements for external and related data will be developed by June of 1972, so provisions for obtaining linkages with interfaceable data can be established. It should be pointed out that Project CAREER is a part of MISOE, and has a potential to provide an interface with Project TALENT. All Department of Labor manpower data is connectable to MISOE, if coded by the Dictionary of Occupational Titles. Providing for linkages with related data systems, therefore, is conceived as a part of MISOE development.

The Developmental Process

Phase I development of MISOE is designed to be operational by September of 1973. It is characterized as a fixed analysis management information system as described in this and preceding documents. Phase II development will occur largely during the last contract year, and provide a variable analysis potential. Phase II development will place considerable emphasis on simulation and "on line" variable analysis. Occasional Paper #2 has focused on Phase I development.

During the first eight months of Phase I development, each task described in this paper will be appropriately resolved, consistent with Phase I objectives. Task resolution will take the form of Occasional Papers by the consultant and permanent staff, which are a function of interactions "among and within these groups". These Occasional Papers will form the basis for MISOE Phase I development, which will occur and be field tested during school year 1972-73. Considerations and materials for implementation of Phase I will occur during school year 1972-1973. Phase II development is scheduled to commence during the 1972-1973 school year, with the total system operational by June of 1974.

This paper includes a listing and schedule for Phase I Occasional Papers, as well as a schedule for the February 16th conference (See Appendix A).

APPENDIX A

PLANNING CONFERENCE SCHEDULE

OCCASIONAL PAPERS

SCHEDULE

PLANNING CONFERENCE

PHASE I

Management and Information System for Occupational Education

Division of Occupational Education

Winchester, Massachusetts

Wednesday, February 16, 1972 through Friday, February 18, 1972

Participants -

Martin P. Breslow	Research Associate, MISOE
William G. Conroy, Jr.	Principal Investigator, MISOE
John A. Creager	Research Associate, Office of Research, American Council on Education, Washington, D.C.
Gerald T. Downey	Associate Professor, Lowell Technological Institute, Lowell, Massachusetts
Jacob J. Kaufman	Director and Professor of Economics, Pennsylvania State University, Institute for Research on Human Resources, 407 Graduate Building, University Park, Pennsylvania
David V. Tiedeman	Director, Institutes for Research in Education, American Institutes for Research, Palo Alto, Calif.
Elizabeth Weinberger	Research Associate, MISOE

Wednesday, February 16, 1972

Morning

9:00 - 9:30 "Expectations"

William G. Conroy, Jr.

9:30 - 10:00 "Space Differentiations and Variable Selection"

Elizabeth Weinberger

10:00 - 10:30 "A Very Tentative Computer Model"

Martin P. Breslow

10:30 - 10:45 Coffee

10:45 - 11:15 "A Framework for Discussing Analysis"

William G. Conroy, Jr.

11:15 - 11:30 Discussion

Chaired by William G. Conroy, Jr.

Afternoon

All sessions from here on are discussion oriented, with guiding chairman, except for Friday, February 18, 11:15 - 12:00.

1:30 - 2:15 "Non-Economic Analysis Perceptions"

John A. Creager

2:15 - 3:00 "Economic Analysis Perceptions"

Jacob J. Kaufman

3:00 - 3:20 Coffee

3:20 - 4:30 "Non-Economic and Economic Analysis in Tandem"

David V. Tiedeman

Thursday, February 17, 1972

Morning

9:00 - 10:15	"Simulation and Analysis"	Martin Breslow
10:15 - 10:30	Coffee	
10:30 - 11:00	"Instrumentation and Analysis"	Elizabeth Weinberger
11:00 - 12:00	"The Implications of Marginal Analysis"	Gerald T. Downey

Afternoon

1:30 - 3:30	"A Reconsideration of Space Differentiations, Variable Selection and the 'Computer System' in View of Analysis."	David V. Tiedeman
3:30 - 3:45	Coffee	
3:45 - 4:30	"Unresolved Analysis Questions"	John A. Creager

Friday, February 18, 1972

Morning

9:00 - 10:30 "Focus on Simulation"

a. Explicit projections

b. Other data required

c. Analysis

Jacob J. Kaufman

10:30 - 10:45 Coffee

10:45 - 11:15 "The Total Computer System - Problems Resolved and Unresolved"

Martin Breslow

11:15 - 12:00 "Specific Assignments"

William G. Conroy, Jr.

-LUNCH-

Fun Schedule

1. Wednesday evening-tennis-if any takers, and dinner at Colonial.
2. Thursday, dinner in Boston.

APPENDIX A

OCCASIONAL PAPERS

Title	Author(s)	Due Date
1. Population and Sample Relationships	William G. Conroy, Jr.	February 7, 1972
2. Task Differentiations	William G. Conroy, Jr.	February 7, 1972
3. A Very Preliminary Computer System Model	Martin P. Breslow	February 16, 1972
4. Process Space Differentiations	Liz Weinberger	February 16, 1972
5. Total Space Differentiations	Liz Weinberger Gerald T. Downey	March 1, 1972
6. A Classification System for Total System Space Which Considers Instruments and Variables Within Space	Martin P. Breslow	March 30, 1972
7. Non-Economic Analysis by Non-Simulation and Simulation Data Types for All Analysis Levels for All Data	John A. Creager	March 30, 1972
8. Economic Analysis by Non-Simulation and Simulation Data Types for All Analysis Levels for All Data	Jacob J. Kaufman	March 30, 1972
9. Non-Economic Analysis by Non-Simulation and Simulation Data Types for All Analysis Levels for All Data	David V. Tiedeman	March 30, 1972
10. Psychological Instrumentation and Analysis	David V. Tiedeman	March 30, 1972

APPENDIX A (Continued)

Title	Author(s)	Due Date
13. Analysis Specifications	William G. Conroy, Jr. Gerald T. Downey Others As Requested	May 30, 1972
14. A Less Tentative Phase I Computer System	Martin P. Breslow	May 30, 1972
15. Other Data Requirements	William G. Conroy, Jr.	May 30, 1972
16. Phase I Simulation	Martin P. Breslow	May 30, 1972
17. Phase I Development Schedule	William G. Conroy, Jr.	June 30, 1972