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ABSTRACT

The second volume of the study contains the sections on management feasibility and economic feasibility, which comprise more than two-thirds of the document, and sections on simulation modeling, client acceptability, inservice design, evaluation, and maintaining relevance of the model for teacher education in the 1970's. The section on management feasibility describes the administration arrangements that have been conceived to accomodate the program and the steps that will be taken to implement these arrangements. The section on economic feasibility presents a 5-year budget outline, with breakdowns for each program subsystem. It identifies an optimally feasible number of students, proficiency modules, and instructional alternatives. The section on simulation gives a brief description of the simulation models used and their respective functions, and the section on client acceptability relates the use of several methods to gather opinions on the model--questionnaires, conferences, and the Delphi Technique. The section on inservice design contains the results of a survey made by the Massachusetts Center for the Study of Educational Innovations to assess the inservice needs of Massachusetts teachers. Subsequent sections briefly describe plans for evaluating and continuously updating the model. (Volume I of the study is SP 004 259 and a separate summary is SP 004 261.) (RT)

Final Report

Contract No. OEC-0-9-310417-4040(010)

A FEASIBILITY STUDY ON THE MODEL ELEMENTARY TEACHER EDUCATION PROGRAM (PHASE II)

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January 1, 1970

The research reported herein was performed pursuant to a contract with the Office of Education, U. S. Department of Health, Education, and Welfare. Contractors undertaking such projects under Government sponsorship are encouraged to express freely their professional judgment in the conduct of the project. Points of view or opinions stated do not, therefore, necessarily represent official Office of Education position or policy.

U. S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE

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Bureau of Research

SECTION III PART I
MANAGEMENT FEASIBILITY

Educational Programming Systems - An Overview

The Model Elementary Teacher Education Program is concerned in part with developing an organizational process that will be responsive and adaptive. As noted in previous file report number 8-9023, p.7,

> "There can no longer be any doubt that education as a professional endeavor must undergo radical changes in the decades ahead. The present attempts to append minor improvements to the maze of existing practices are simply not sufficiently bold and imaginative enough to meet with the rapidly changing needs that face American education. If meaningful changes are to be made in the profession, we must go beyond the mere development of new variations on old themes. In fact, professionalism in education is likely to die out unless we capitalize on the process of change. We must institutionalize change so that it becomes an integral part of the educational structure, thereby meeting the functional needs of society and the individual students as they arise."

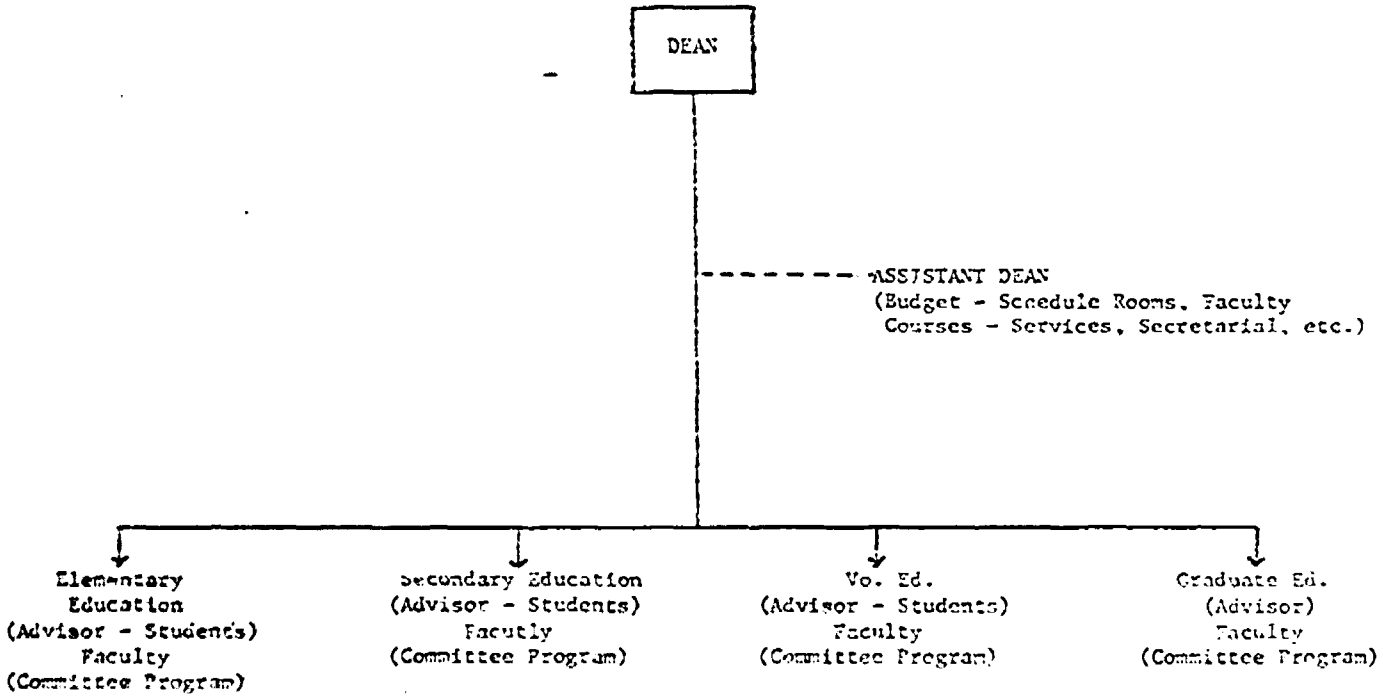
What is required is a new and improved educational programming system. An educational programming system can be defined as that institutional process whereby educational programs are developed, instituted, operated, and reviewed. A school of education or that segment that is concerned with elementary education can be viewed as such a system.

METEP represents a suggested innovation in educational programming or an improvement in the state of the art, or the creation of new knowledge. To determine whether METEP represents such an increment in the state of the art one has to compare it to the present state of the art, or how educational programs are currently typically developed and delivered.

Method of Analysis. In order to illustrate the improvement in educational programming that METEP represents, first a model of the current state of the art will be presented and analyzed and then a model of METEP will be presented, and, finally, the two models will be compared. As the established or traditional educational programming processes are well known they need only be briefly reviewed, so as to recall for the purposes of analysis their essential characteristics. Figure 1 represents a hypothetical organization structure of a typical school of education. This might be a state college or university. Such a school is organized along academic disciplines and it may have areas or departments of elementary education, secondary education, vocational education, graduate education, etc. The administrative structure may consist of a dean and an assistant dean. If one takes one segment, such as elementary education, typically one finds a faculty advisor for students who are majoring in elementary education. Advising may

FIGURE 1

ORGANIZATIONAL STRUCTURE PRESENT STATE OF THE ART



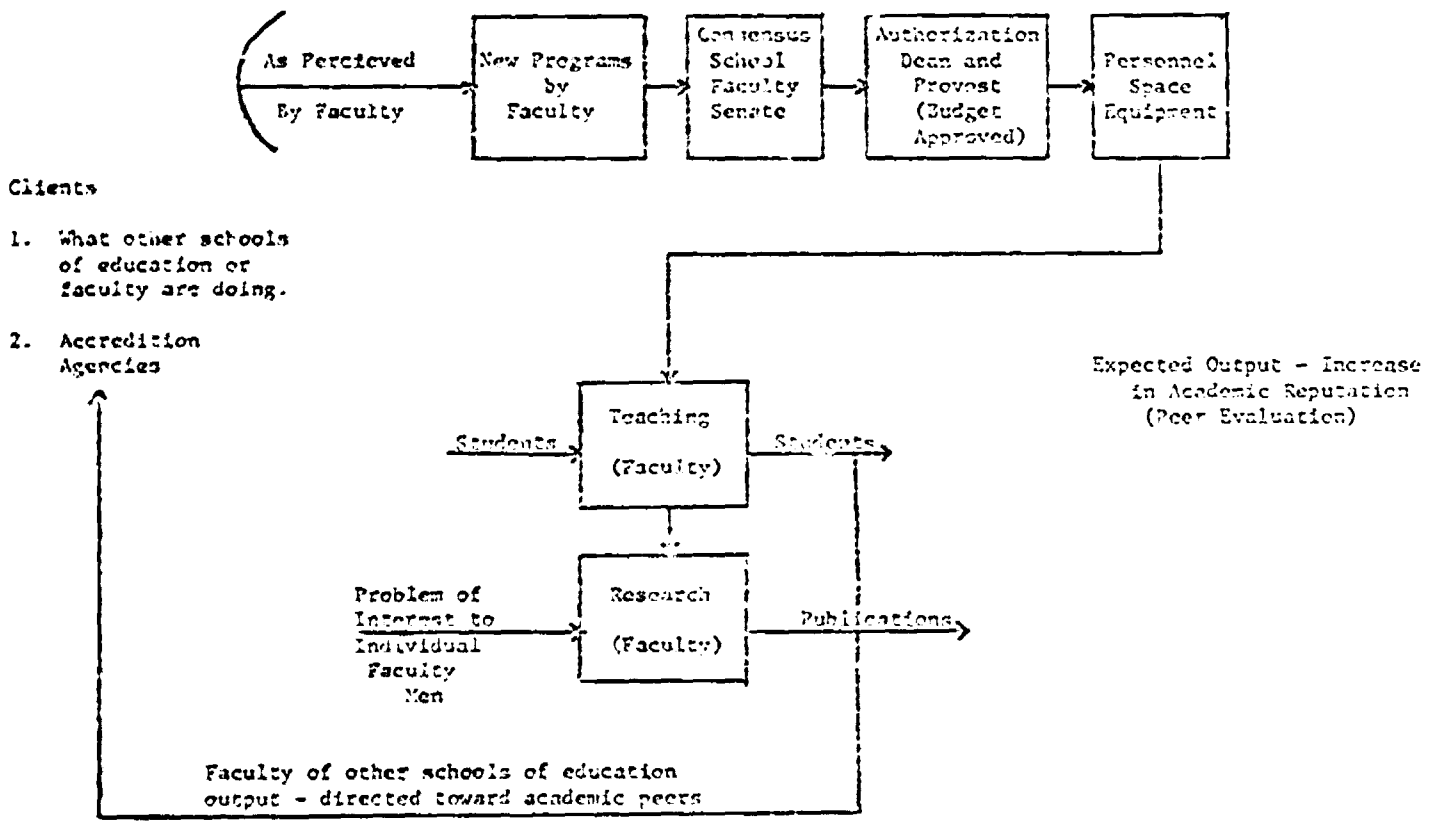
constitute part of his faculty duties. In addition, there would be a faculty committee responsible for developing educational programs or courses in elementary education. If the school is organized along departmental lines, there may be a chairman or department head in charge of elementary education. The assistant dean may be responsible for preparing yearly budgets, scheduling rooms, faculty courses, and providing services, such as providing secretaries for the faculty.

Figure 2 represents a very rough organizational programming process as it is presently executed. It should be noted that the expected output of this programming process is an increase in the academic reputation of the faculty, department, and/or school. An academic status hierarchy exists in which, through peer evaluation, schools of education, or the elementary education segment of such schools or individual faculty are evaluated by each other. If a department or a school wants to maintain or increase its academic reputation, its effort, then, is directed toward other faculty in their respective discipline. Thus, one has essentially one client group toward which that organizational programming is directed - the academic community. Starting at the beginning of the figure, faculty and/or deans attempt to remain current as to what other schools of education or faculty are doing. This can be done by attending meetings or reading the literature in the field. If certain changes are occurring, particularly on the part of high prestige schools, there is a tendency to emulate such changes. As a consequence, new programs in the form of new courses may be prepared by either the individual faculty man, or in consultation with his peers in the area or department within a school. Such proposals are then submitted to the school faculty senate and, perhaps, the total university senate for approval. Once such approval is achieved these new courses have to be authorized by the dean and, perhaps, the provost, and a budget necessary to support such programs acquired. The argument for budgetary approval is usually that such new programs will increase the academic prestige of the department and/or school, and require an addition in space, personnel and equipment. Once such approval is achieved, the faculty who proposed the courses then teach the courses. Essentially the same process occurs insofar as faculty research is concerned, except this is entirely an individual undertaking, where the individual faculty select problems of interest to them, conduct their research, and publish such research, again to their peers. Given the faculty's publications outputs to other faculty and the academic programs which they are currently conducting, both of which are directed toward the faculty of other schools of education, the faculty hope that such an output will be viewed favorably and the academic reputation of the school, in terms of its relative ranking or status, will be improved.

What are some of the essential characteristics of the present educational programming system? In terms of its organizational structure and process, perhaps the closest analogy one could use is that it is essentially a guild system. In a guild system one relies basically on a

FIGURE 2

ORGANIZATIONAL PROGRAMMING PROCESSES - PRESENT STATE OF THE ART



craftsman or an artisan, which in this case is the faculty, to produce or make the entire product on entirely an individual basis. In the present system we have the individual faculty man perceiving what the programming need is, designing new educational programs in the form of course content, processing his proposals through the administrative apparatus, teaching the course, once approved and in the catalogue, and subsequently evaluating his own effort.

In terms of organizational staffing patterns there is only one professional role; one does not find a differentiated staff. The one role is that of the faculty man. And, as in any guild system, to join the guild one has to serve an apprenticeship in the form of graduate study and acquire a Ph.D. degree before one can become a member of the guild. In terms of a total programming effort, what one has clearly is what might be considered a non-integrated system random process, whereby each craftsman is able to develop and deliver his own unique produce. There need not be any relationship between one course or educational program and another course, in fact, if there were such a relationship it would be entirely accidental. Or, as noted in report "A Feasibility Study for Phase Two of the Elementary Teacher Education Project", p. 15, what occurs is the "Prevailing process of independently introducing a variety of often unrelated changes, such as calendar innovations, curricular modifications, independent study programs, new facilities in computer-assisted instruction." The educational process, in a sense, is similar to a Medieval fair, in which individual craftsmen - the faculty - offer their wares, which they have lovingly developed and which are uniquely their own, to the student, who can pick and choose to satisfy relatively loose requirements. As there is great variability between artisans and great individual autonomy, one gets a very random, non-integrated result.

The educational process is frequently thought of as a sequential educational productive process, in which the student moves logically from one course progressively to another course, all of which are necessary and logically provided to achieve a given end product. This analysis suggests as presently conducted, the educational process is not a process at all, but essentially an academic market place where, within the monopoly constraints in the form of required courses, artisans negotiate among themselves (share of market, everything going through the faculty senate), and the students shop around. Within monopolistic constraints noted, artisans compete with each other in the selling of their wares to the passing student largely in terms of academic worth. Their courses are more "rigorous", "significant", "productive", "worthwhile". This is the academic guild market place, and, if the artisan is successful, he will be promoted, receive academic recognition, more income, more consulting, etc. There is little reason to believe what a student buys in one "stall" will be in any way related to the next "stall". This can result in duplication, voids, and little relation to end product student results.

In terms of the budgetary process, funds are allocated essentially along fixed ratios. For example, for every additional 15 students a school can acquire one faculty man, and schools are built so that one has classrooms in which one can maintain a one to thirty student teacher ratio.

As to a school's clients and environment; in the main, as noted, the effort of the school is directed toward a single client group -- other academics. The client group of a school of education are other schools of education in the country. Other client groups, such as students, tax payers, public school systems, or society in general are ignored. The existing educational programming system is essentially a closed one or one that is restricted essentially to the academic community itself. Other constituent groups are precluded. Such a closed system is directed essentially toward the satisfaction of academic values as distinct from economic or social values. The question of academic values and their maintenance shall be taken up at the end of this report.

As noted in the outset of this report, inherent in the entire MITEP effort is the concept of a responsive and an adaptive educational programming system, in the form of responding to changes in the environment and new demands by client groups. How responsive or adaptive is the present or traditional educational programming system? The traditional system is essentially a self-energizing system. Either the individual faculty man or the dean or both, in terms of whatever advantages they perceive, have to initiate educational programming changes. If they perceive no advantages, then no change will occur. There is a tendency for such a system to move to a static state. If the faculty and the dean are relatively satisfied and perceive no academic advantage in introducing new programs, then the system will remain unchanged, and the same courses will be taught in the same way by the same artisans with the same requirements over what could be a very long period of time. Why can this and why does this happen? As noted previously, this is essentially a closed system, meaning that it is effectively protected from external demands and pressures in its external environment. It does not have to compete for consumers as might be the case with a business firm. Traditionally, business firms in the United States, as one form of competition, have continually introduced new and improved products for the consumer as a device for increasing their share of the market and increasing their profits. The academic community finds itself in a monopoly position in which one of the clients at least - the students - must accept what the academic community is willing to deliver. Following that old bromide - there is little reason why the academic system will not make and deliver buggy whips indefinitely.

There are no organizational mechanisms whereby the clients can effectively make demands on the educational programming system either for changes or to meet client needs. There are no internal processes within the system that will automatically generate demands for a new program.

Given such an educational programming system a natural development would be that the educational process would become increasingly divorced from the rest of society until it became so irrelevant that a crisis would be reached. Other client groups, such as students, tax payers, the professional business community, etc. would begin to make demands in any manner they could to assure that the academic process did not become a complete waste of time and resources. This is, of course, what is currently happening and what has created the demand for change. However, one must recognize that the current situation is a unique one and the typical state of affairs, if one would go back ten or fifteen years, is one in which there exists essentially a non-adaptive, non-responsive system. The present educational crisis has emphasized the inadequacy of the traditional educational programming system in terms of its organizational structure, processes, techniques, functions, and value system. The METEP model is an attempt to rectify what are obvious and serious deficiencies in the present state of the art of organizational educational programming processes.

METEP Model

The METEP model represents an innovation in organizational process, function, structure, and values in terms of educational programming systems. This model is directed toward the correction of the deficiencies found in the traditional model which has been reviewed above. The METEP model will first be explained and its essential characteristics noted. A comparison will then be made with the traditional model and, finally, the advantages of the METEP invention will be delineated.

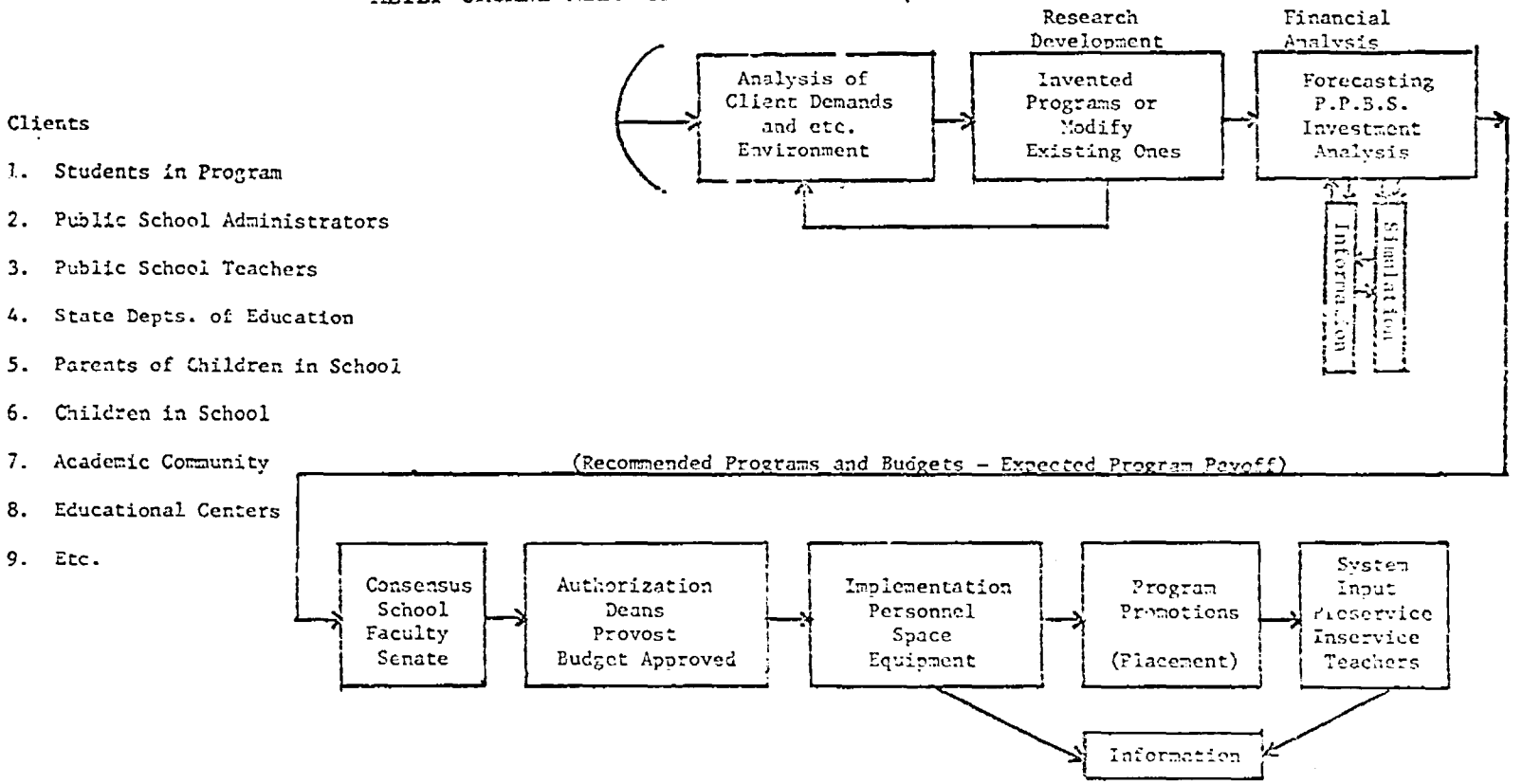
Figure 3, METEP Organizational Programming Sequence, provides a rough overview of the proposed educational programming system. It should be noted that the model is made up of a series of sub-systems; this aspect of the report is concerned only with looking at the total system and the interrelationship between the sub-systems. The detailed operation of each of the sub-systems will be taken up elsewhere in the report.

Under the rubric of clients, one should note that a series of groups whom the system is to serve has been delineated - students in the program, public school administrators, public school teachers, state department of education, parents of children in school, children in public schools, academic community educational centers, etc. Data as to characteristics of the clients, their members, their demands, and needs, is picked up by a function which, on the chart, is noted as the analysis of client demands or sometimes referred to as determination of client acceptability. This function presents a central monitoring effort on the part of the organization, or an intelligence unit to ascertain what the external demands are, insofar as the system is concerned. It is assumed that the nature of the clients will change over time, that their demands will change, and this unit will, through appropriate monitoring procedures, sensitize the system to such changes. In addition, this unit will be concerned with more general changes in the environment, which relate to what other educational schools' research units are doing, what new technology is emerging in the field, and, in general, will concern itself with the overall problem of changing societal demands on the educational system.

Given the analysis of the intelligence unit as to changing environmental demands, such analysis will be sent to a research and development unit with concurrent recommendations that either new programs have to be invented, or existing programs have to be modified to meet changing environmental demands. It is expected that this research and development unit will develop educational programs in a fairly rigorous fashion, in the sense that prior to their implementation, feasibility, compatibility with the rest of the system, and client acceptability have been demonstrated. Within such a unit one would, of course, encourage as much creativity as possible, and research may be undertaken in developing new educational programs for which there may not have been a prior client analysis performed. Given such program development, the research and development

FIGURE 3

METEP ORGANIZATIONAL PROGRAMMING SEQUENCE



unit can ask what the intelligence unit ascertained as to the client acceptability of such new programs. In other words, insofar as research and development is concerned, the initiative for the development of new programs can originate either on the client side in the form of new demands or the creative side in research and development in terms of new ideas.

New programs or modifications of existing programs are then sent to the financial analysis unit or function. In terms of new programs, modifications of existing programs, or those ongoing programs that will not be changed at all, financial analysis would make a forecast over some reasonable period of time, for example, five years, as to the number of students who would be expected to utilize each program. In other words, financial analysis would have to ascertain the size of the program. Given the number of students and given the technology of the program, the financial analysis can ascertain the required staff, space, equipment, etc. Financial analysis then, in turn, can formulate a program budget for each program. In terms of each program there would be certain expected outputs in terms of numbers of students, program characteristics, output specifications of the program, etc. For example, if one of the programs were math, with so many modules, one could ascertain the expected cost per student unit of output in terms of acquiring the requisite unit of math.

Assuming that funds were not unlimited, the financial analysis would have to carry out an investment analysis of all programs, both proposed and current. Presumably such investment analysis would be done in terms of attempting to maximize the decision function of producing more education with less cost. However, this will be done, and it will be explained in considerable detail in the section on PPBS, the financial analysis unit, on the basis of their review, would provide a set of recommended programs and budgets which would delineate the expected total program payoff in terms of the entire unit and in terms of individual program components.

Assisting in financial analysis will be two basic sub-units - the information sub-system and the simulator. The information sub-system will be constantly storing basic data, client demand characteristics, program characteristics (particularly output specifications), cost and resource data, numbers of students, etc.

The simulator will also assist in investment analysis in which alternative allocation strategies in terms of program requirements will be ascertained and minimum costs searched for. While higher education has not reached the planning stage that one finds in the health field, with state, regional and local planning units that will assure improved economies of scale, such a simulator will assist in the determination of appropriate program size and the economic feasibility of each school or one specific school having certain educational programs.

Depending upon the arrangements of particular faculty senates at the school of education, recommended programs will be submitted to such a body by the financial unit. Or, if such recommendations do not have to be voted on by a faculty senate, they can be submitted directly to the dean and provost for budget approval.

With budget approval, programs can then be implemented in the form of acquired requisite personnel, space, equipment, material, etc. Concurrent with such implementation, where required, new programs or modifications of existing programs will be promoted and/or explained to potential client users. Although programs have been developed in terms of client needs, clients may not necessarily know of their existence, when they are to be started, how they can take advantage of them, or the particular advantages of new programs over old programs. On the basis of such promotion, potential students will be made aware of the existence of programs and, presumably, will apply, at which time they will be picked up by system inputs, processed into a unit called student guidance, and, finally, processed through the educator. Student guidance will not only have the responsibility of processing the student correctly through the educator, but will serve the control function of assuring that, while in process, the educator is meeting the student's particular needs and characteristics. A scheduling sub-system will schedule faculty rooms, modules, etc. to process students through the educator.

The educator, of course, represents the teaching process in the form of program delivery and execution. Upon program completion, a student is then placed, through the placement unit.

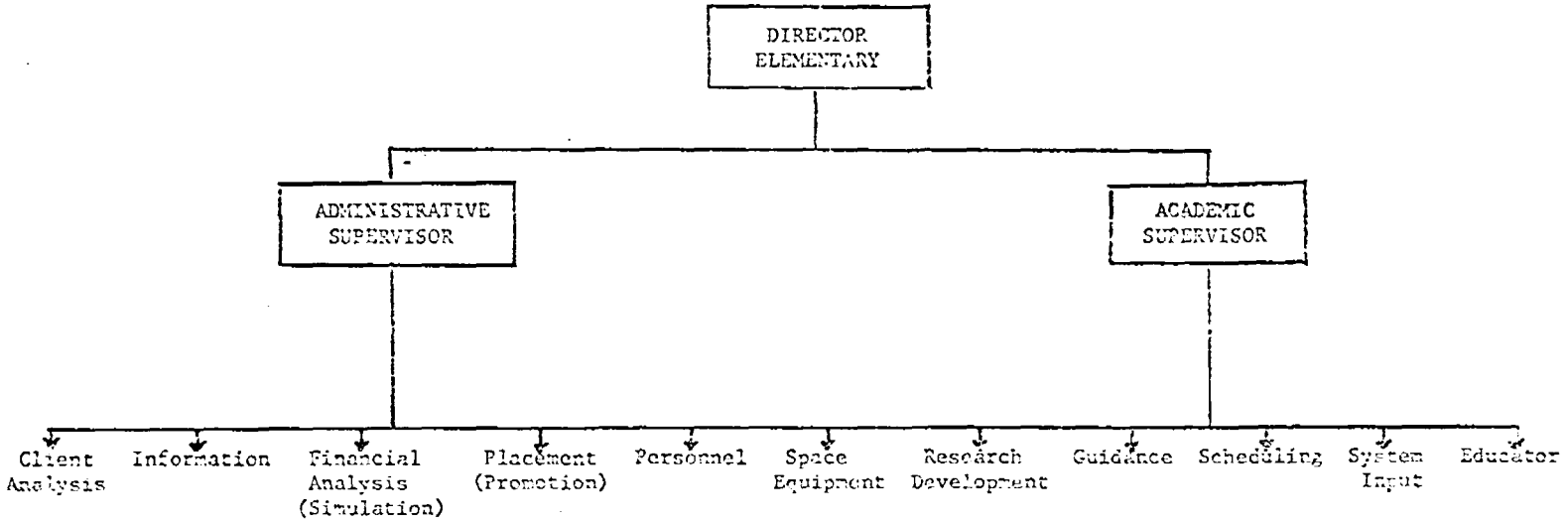
The last function to be performed, and this may be performed by the sentry unit, is program review or a determination of actual program payoff. It may be recalled that financial analysis, in recommending programs or drawing up its program budget, had a set of expected program outputs in terms of cost and client benefits. The question now is, was the actual program payoff the same as that which was expected. If not, the apparent error then is sent back to research and development to modify the program, or to financial analysis to correct. This reporting back to these two units closes the system and assures that programs will be modified or resources reallocated so as to meet client demands.

In terms of the total management of such a system, it is apparent that an appropriate planning horizon has to be provided for in terms of program development. Thus, while the sensory or intelligence units may note a changing client demand, an operational program may not be delivered for two or three years to meet such a demand.

Organizational Structure. In terms of the more traditional representation of the organizational processes one might look at Figure 4, METEP Organizational Structure. In comparison to the traditional academic structure it should be noted that it has within it a series of new and/or

FIGURE 4

METEP ORGANIZATIONAL STRUCTURE



with titles as with functions and task descriptions. And, if necessary, one might, for example, find an assistant professor who would be a financial specialist, devoting his entire effort to financial analysis, or one might have a full professor devoting all his effort and time to inventing new educational programs.

It should be apparent from the foregoing analysis also that program development in the METEP model will be an integrated process in terms of both the external environment as to client needs, running through the entire educational programming system to program review, and then looping back to research and development for program modification or financial analysis. The tightness of the relationship between all the sub-systems will be illustrated subsequently within this report. What will not occur, however, is the development of individual courses based on the interest, preference and competence of individual faculty, with little rationale as to the interrelatedness between courses.

The METEP system obviously is an open one and specifically provides for an intelligence unit to constantly monitor potential clients and environment. Further, it operates in such a fashion that programs have to be developed and delivered in terms of client demand.

As to the budgeting aspects of the model, these obviously will be done in terms of output characteristics through a program budgeting process rather than the traditional way of making up a budget in terms of the budget input items. Instead of classifying resources in terms of number of faculty needed, the amount of space required, etc., the budget will be determined in terms of numbers of units of output.

More importantly, the budget will be allocated in terms of organizational function. Depending upon analysis, if more funds are needed, for example, in the financial segment, then various staff would be put there; or, if a greater promotional effort is required in terms of more staff in the field, presumably budget would be allocated in that particular direction. And, while the particular school or unit of a school may still be restricted in terms of legislative budgetary ratios as, for example, for every increase in fifteen student majors, the school will be entitled to one professional personnel, the internal management of the school will have to reallocate such a budget so as to be able to effectively execute all of the sub-systems in the organization. It would no longer be an automatic allocation of funds into a teaching function, in other words, it would not necessarily hold to a fixed ratio of a teaching function of, for example, thirty students per faculty man. Or, as one implements the METEP program and moves from a traditional organizational programming process, which is largely academic in nature,

changed functions. One may recall that the traditional organizational structure was organized along disciplinary lines, or one may have an elementary education unit, a secondary education unit, etc. within a school of education. Within any one of these units, for example, elementary education, this might break down to a math unit, a social studies unit, a literature unit, etc.

The new functions which derive from the previous analysis are: 1) client analysis or intelligence unit; 2) the information subsystem; 3) financial analysis with simulation; 4) promotion; 5) personnel; 6) space and equipment; 7) research and development; 8) quality control, and 9) flexible scheduling. In terms of administrative structure, one would have not only a director of the elementary unit, but an administrative supervisor to administer what are generally within the academic setting considered administrative functions, and an academic supervisor to supervise that might be viewed as academic functions, although the distinction being made is quite arbitrary.

Characteristics of METEP Educational Programming System and Organizational Processing Terms. In terms of organizational structure, function, and process, the closest analogue to METEP would be the modern non-profit enterprise. Instead of a single function - teaching - one introduces organizational specialization and differentiation. Program development is no longer an individual undertaking of a single faculty man, which is the guild concept, but is a total organizational effort. One introduces differentiated functions within the organization. The striking characteristic of the traditional organizational structure of either schools of education or universities is that they are so primitive in the sense that they basically incorporate a single function--that of teaching. This might be similar to the very early business enterprises that had one function--production, or the very early hospitals that had a single function--nursing. However, as one views the history of the development of organizations, what is striking is that with this development comes increasing functional differentiation and greater specialization.

With the introduction of new functions, of course, one would have to develop a differentiated staff to perform the various functions. Training qualifications and rewards of the staff would have to fit the functions to be performed. Within the METEP model one would, for example, want a financial analyst to work full time in forecasting, program budget, preparation of investment analysis, etc. Or, similarly, given the unique qualifications of the individual, an individual might work full time in research and development in the creation of new programs. In other words, one would not have a single role of professor, who is currently expected to do everything. While it may be necessary because of university restrictions to maintain the professorial role structure in the form of assistant, associate, and full professor, this analysis is not so much concerned

one begins to build up other functions, and presumably the organizational budget would have to reflect such a development.

If the educational process is to become more productive, the amount of resource devoted directly to a teaching or educator subsystem has to be reduced. Or, over time, if all the other sub-systems operate effectively (finance, R & D, promotion, evaluation, intelligence, etc.), they should develop programs that provide more effective education at reduced costs. Thus, over time, the teacher-student ratio in the educator should increase from 30 to 1 to 60 to 1 or 170 to 1, while at the same time, the educational output is improving in the form of a better product. The holding to fixed teacher ratios precludes the possibility of introducing improvements into the system. Industry, over time, has been able to deliver better products at less direct unit labor costs. The number of employees in manufacturing has been going down for years. The reason that this is possible is because of the effectiveness of other sub-systems--finance, industrial engineering, engineering, marketing, etc.

Turning once again to the fundamental problem of developing an adaptive and responsive educational programming system, certainly the METEP model eliminates the deficiencies of the traditional and constitutes an increment in the state of the art. The METEP model is an open system in terms of environmental demands and changes. It will naturally and automatically respond to client demands and programs will be developed in terms of these client demands. This is assured through the development of new organizational functions and processes. No longer will one have a static, non-responsive system divorced from the society of which it is a part. The METEP model represents an attempt, in terms of organizational processes, to move the university into the twentieth century by changing it from a guild system, which is essentially Medieval in orientation (a fact in which many faculty incidentally, take great pride) to an organizational form that more nearly characterizes our more modern organizations.

The proposed system will also provide a set of benefits to all of its various clients; it is concerned with educational, economic, and social values in addition to the traditional academic values. The relative academic standing of the system or the particular academic reputation of the faculty is not necessarily of overriding concern. One of the underlying assumptions of the METEP system is that schools of education exist to serve society rather than society existing to serve schools of education. Further, a considerable measure of consummer sovereignty is provided in the system on the assumption that clients, be they students in the program, public school children, parents of children in school, or public school teachers, know perhaps better than anyone else what their best interest is. The concept of "the professional educator knows best" in terms of how society ought to operate, what students want or should want, what parents should put up with or what they should pay is

being seriously questioned. Our unfortunate experience has been that when we permit one group to determine what is best for all other groups they tend to devise a system which enhances their own professional interest.

The Management System

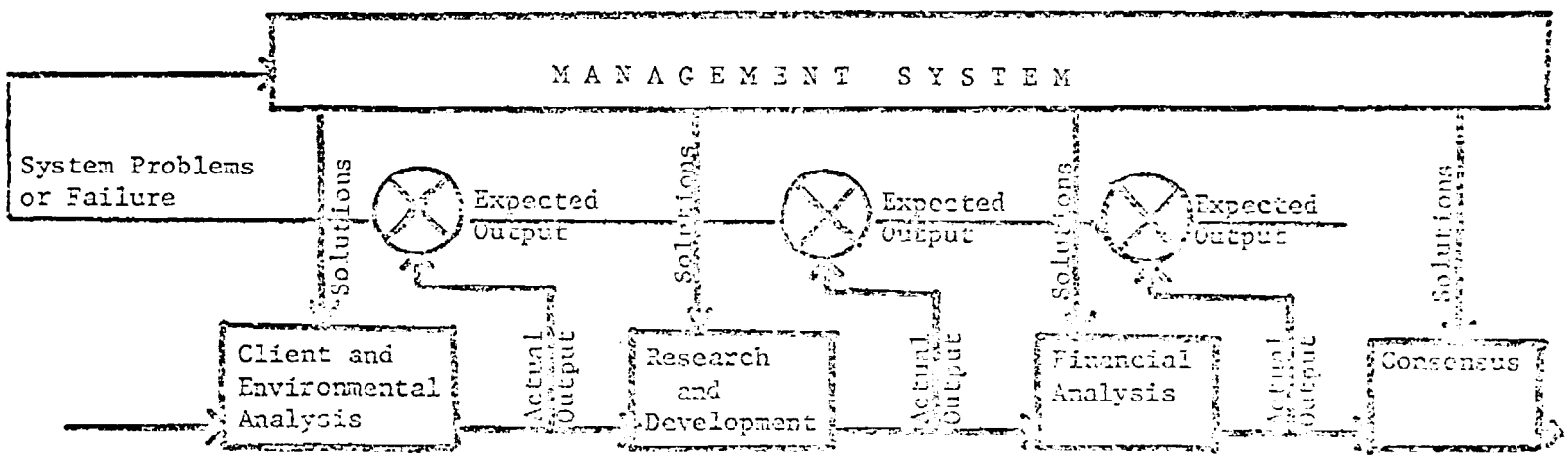
On the conceptual level, how will the management system be integrated with other systems or how can we assure some compatibility between the management system and the other subsystems of METEP? See Figure 5, Management System in relation to other systems METEP. In our previous functional analysis, one can assume that there will exist a client and environmental analysis unit, a research and development unit, a financial analysis unit, a consensus unit, a promotion unit and so on. Let us further assume that as we look down the road, these are ongoing, operating functions. That is, let us suppose five years from now, there exists within METEP, a staff or a function that performs extensive client demand analysis. Still another function, research and development, would be doing extensive work in new educational program developments, etc. It is further assumed that in charge of each of these functions is a manager or an individual who will be assigned responsibility for solving any organizational or METEP problems that might arise either within these functions or between these functions. Thus, we might have a market research manager, an engineering manager for research and development, a financial manager for financial analysis, a consensus manager, a promotional manager, etc. These need not be separate individuals. As a matter of fact, you may have because of the size of operations only one or two. We are only delineating the managerial function at this particular time. Let us further assume that within five years (and here we are viewing the METEP Model as an emerging system) a fairly clear set of expected outputs with rather definite output specifications will have emerged in terms of client demand analysis, as part of the expected output we may expect within the school system. And that is where, for example, Spanish American parents want Spanish introduced in the schools, etc. Further, on an input basis, the client demand analysis unit has been funded to carry out ethnic analysis at the parental level.

A similar stage would exist insofar as the other functions were concerned, i.e., R and D would be funded to produce two or three new education programs every year, perhaps one in the language arts, media, or social studies. Financial analysis would be programmed to produce various kinds of investment alternatives in terms of proposed R and D programming projects.

We further assume that five years from now we would have a monitoring or auditing unit which would be able not only to audit program payoff but functional payoff. This unit would be able to measure the actual output of such operating functions as client demand analysis, R and D, financial analysis, consensus, etc. Obviously errors would

Figure 5

MANAGEMENT SYSTEM IN RELATION TO OTHER SYSTEMS METEP

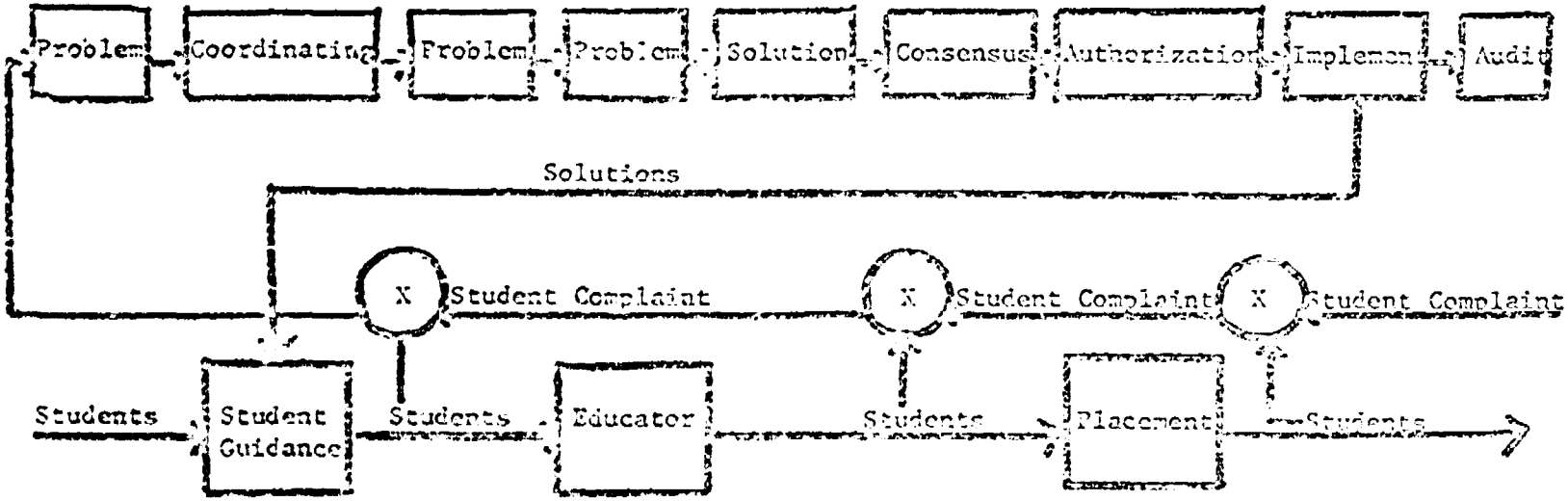


be generated here in that the difference between actual and expected output would represent system failure at the subsystem level. Such systems failure at the subsystems level would feed into the management system and be assigned, depending on where such error originates, to the manager who is responsible for solving problems relating to that particular function. One may find defects in the manner in which client demand analysis is carried out vis a vis, for example, ethnic groups; that is, the wrong data or conclusions were drawn from such analysis. One will find in certain research and development or program design where the defective programs were designed or incorrect investment analysis were made. It would be the responsibility of the manager in charge of these areas to correct subsystems failure. Thus, the problem will come into the management system, a solution would be devised, would be inserted into the function. (See Figure 5). Finally, the solution would be audited and presumably the actual expected output would then be equal and the problem would be eliminated.

If one views Figure 6, METEP Management System - Example, we see the management system generating a solution in somewhat greater detail, with the initial problem being generated from a source other than the monitoring or auditing unit. Presumably, the management system is going to involve problem raising on the part not only of its monitoring unit, but various groups that would be involved in the system such as faculty, students, deans, staff, perhaps government officials, employees, etc. Thus, as we see a student flowing through the system, he may be unhappy about guidance or the educator or the manner in which he has been placed and he may complain, which then would generate a problem which would feed into what would be a problem raising mechanism which would pick up effectively his complaints or concerns with any part or any subsystem of the total METEP system. These problems would go to the coordinating unit. The problem would be assigned to the manager in charge of that particular subsystem - it may be student guidance, the educator, placement, or what have you. The problem solver would generate or develop a solution which would, if necessary, go through consensus and authorization, the solution would then be implemented and one notes here it feeds back into the operating subsystems, the solution is then subsequently audited in terms of its expected consequences.

In terms of estimating costs of the management system five years hence, this would be largely speculative in nature. However, if one looks at Figure 4, METEP Organizational Structure, in terms of rather traditional organizational analysis, the assumption here is the administrative segment would consist largely of three full-time individuals plus some part time effort on the part of such systems such as client analysis, information, financial analysis, simulation, placement, etc.

Figure 5 MTEP MANAGEMENT SYSTEM - Example



The assumption is also made that the METEP Model will have to carry its entire management staff, that is, in terms of functions to be performed or that these functions should not be centralized in the school of education. If they were centralized, then presumably the administrative segment might be spread over programs in addition to the METEP Program as an overhead item and thus reduce its costs. Since it is not clear at this time either what the nature of the organizational structure of the entire school will be, Figure 4, in terms of organizational structure appears to be reasonable. In other words the budget will have to provide for at least three full-time administrators and a significant portion of part-time administration.

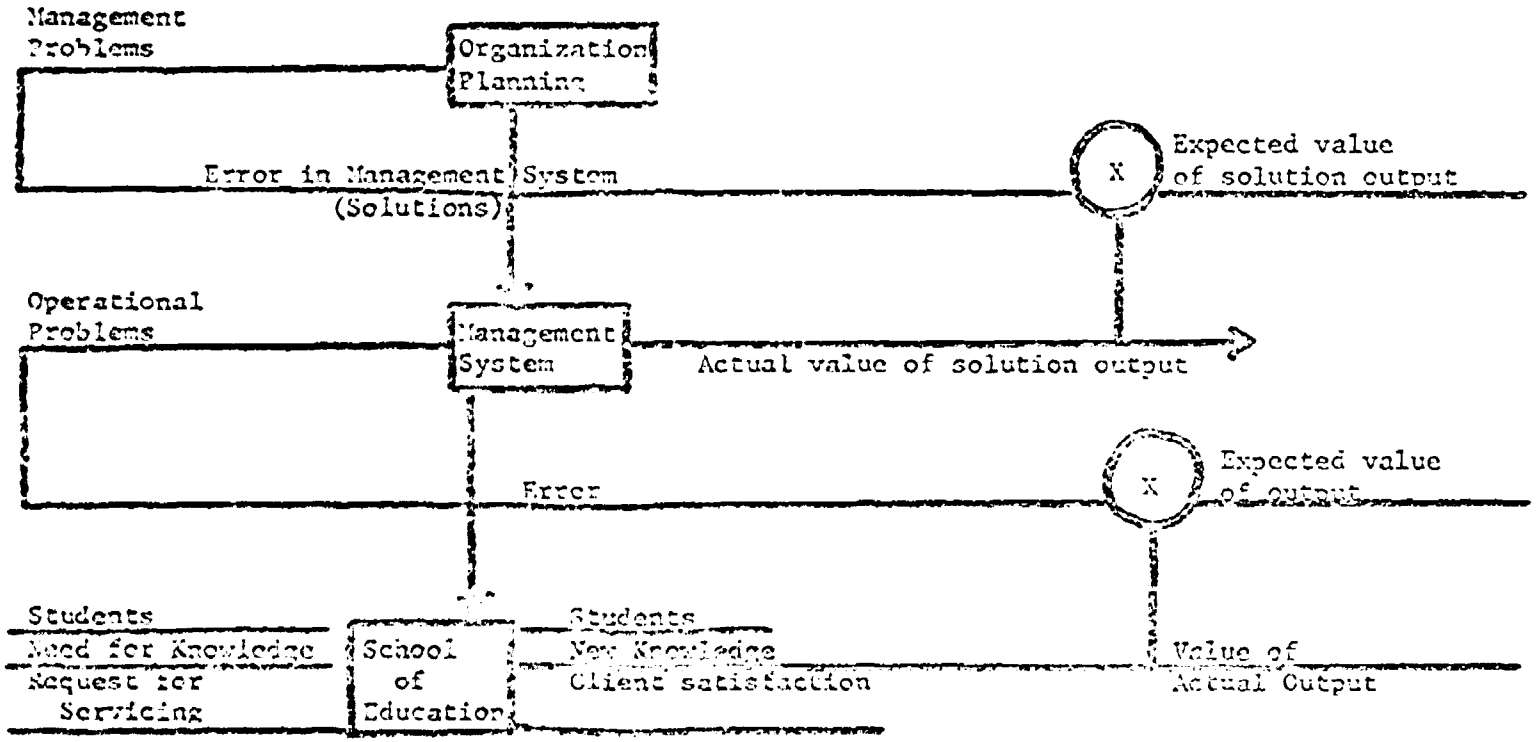
It's fairly apparent in order to estimate the future cost of a management system and to develop a budget for such a system one has to know within a given time period the total number of problems which the management systems would have to solve, the average time it takes to solve a problem, and the average cost per some time unit. Thus, for example, if in requesting funding for the management system for next year, fiscal year 1970 or '71, if we, for example, knew in that time period that 200 problems would arise over the year and that each problem on an average took 20 hours to solve; this would mean that we would have to budget 4000 man hours of managerial time. Assuming that managerial time costs $10 an hour in direct labor costs, insofar as the system is concerned, we would then request a $40,000 budget.

However, we are at the initial stages of setting up the management system and ultimately in order to develop the kind of budgeting that has just been noted, extensive documentation in the form of ledger, control boards, forms, production schedules, delineation of what is to be considered managerial time would have to be established. In other words, the whole area of measurability in terms of the management system is currently being worked on and no historical data exists, so that no forecasts can be made as to potential problem demand on the managerial system. It should be noted that the rough estimates made above as to budget requests are consistent with present accounting practices which view management as part of the overhead and as such provide very little operating guidance as to number or type of managers. Thus, even with this rough approximation, it is consistent with the present state of the budgeting art.

The entire METEP Model is viewed as a learning system or one which on the basis of its experience can self-correct its operations so as to make more productive, however, productivity is defined. The management subsystem is no exception, in that a management redesign capability would be considered a permanent part of the METEP Model or the management system of the METEP Model in the form of organizational planning. Thus, if one looks at Figure 7, Redesign of the Management System, one finds basically three subsystems. One, of course, would be the operating system which is the School of Education which will generate certain operating problems which are fed into the management system and solutions are generated to correct operation. This has already been reviewed in Figure 5 and 6 of this report and Figure 2 of previous Final Report. Viewing the METEP Model as a fully developed one, let's say five years from now, at that time there would exist a certain expected value output from the point of the management system both in terms of the quantity and the quality of solutions produced. One may find, for example, that an error may exist in the management system as the actual value and the expected value of the system may be considerably different. These, then, would constitute management problems and would fit into the organizational planning unit that would be concerned in the main with devising administrative solutions which would feed back into the management system and hopefully would correct management system deficiency.

In a very general way we might review how current redesign of management system might operate. Starting with the School of Education at the bottom of the chart we might look to expected value of output on some time unit basis. Suppose in the METEP Model one is looking at the language arts program and we are dealing with METEP here as being essentially a programming producing unit. Let us further assume that the METEP market in its largest sense constitutes the 25,000 local school systems in the United States and the 30 million children in grade school. Let us further assume in setting up for the next two years starting with January of 1970 that R and D and language arts will produce new pedagogical techniques that will result in an improvement of 15% in reading capability on the part of the average child. Let us further assume that as an objective within the next two years this new pedagogy can be implemented or that at least 2 million children will be affected. Let's further assume that a currently average cost of current teaching of reading runs about $200 a year and thus over the next two years the expected value of the language arts program in saving money would be 400 million dollars in two years of 200 million dollars in one year. Or to rephrase this, in terms of R and D in the School of Education, value of the invention is 200 dollars per child and we're going to affect 2 million children.

Figure 7 REDESIGN OF THE MANAGEMENT SYSTEM



However if, in terms of this program, instead of achieving expected values of 400 million dollars over two years or 200 million dollars per year, one received 50 million dollars a year or a total of 100 million dollars a year? An error would exist between actual and expected value of approximately 300 million dollars. Obviously in our operating systems there must be considerable error problems or subsystems failure or we wouldn't have such differential assuming these problems are being fed into the management system. Going into subsequent time periods then in terms of expected value of solution output or management system output we then want this management to reduce this 300 million dollar error in the operating systems. Thus we might have as an expected value of the management system of solution output per year 100 million dollars which means in the subsequent three years the error of 300 million dollars should be eliminated. Looking again at the operation systems of the School of Education at the end of the five year period the expected value of output is 400 million dollars and actual value of output should be also 400 million dollars.

Let us suppose that at a subsequent time instead of expected value solutions output of 100 million dollars per year, one achieves the actual value solution output of about 50 million dollars a year (see Figure 7). This error now constitutes managerial or administrative problems or errors in the management subsystem which is generated into organizational planning which in turn must delineate certain kinds of solutions in order to ultimately eliminate the error or system.

Returning once again to the initial problem where one has an expected value output of 200 million dollars and actual value output of 50 million in the language arts program this error is fed back into the management system. There may exist in all the subsystems deficiencies causing this error. Thus the client demand analysis may have overestimated the demand for new pedagogy in language arts. The engineering section may have made errors in terms of the productivity of the technique. It may not have actually increased reading capability 15% once introduced in the field, but only 10%. Finance may have made errors in forcasting how quickly one could gear up to deliver the system to various school systems. The marketing and promotion people may have been optimistic about how rapidly they could introduce this into school systems and made errors in their analysis, or they estimated they could deliver and implement a program for 2 million children a year and perhaps more realistically it should ahve been a million and so on. In other words the fact that we have a gross error in the language arts expected value over a two year period of 300 million dollars is really only symptomatic of a series of errors or deficiencies thay may exist in all the other subsystems which taken together aggregate 300 million dollars over the two year period.

ESTIMATED AGGREGATE VALUE OF METEP AS A DIFFERENTIAL IMPROVEMENT IN THE STATE OF THE ART OF EDUCATIONAL PROGRAMMING

It may be recalled that it was suggested that the METEP Model constitutes an improvement in the state of the art of educational programming systems. It is definitely an improvement in the state of the art of producing and delivering improved educational innovations. Let us consider the METEP Model as a basically R and D shop that develops and delivers new and useful educational programs. In terms of demand analysis versus potential payoff of new programming which the METEP Model is geared to produce, assume that demand analysis finds that 30 million children in grade schools spend an equal amount of their time in grades 5 through 12 in language arts, social studies, math and science. On a per child per year basis assuming that the cost is now running about 600 million dollars a year (and this would be) for 30 million; about 150 dollars per child per year for each of the programs - science, math, social studies and language arts. Our current expenditures on these programs is 18 billion dollars a year. Thus 18 billion dollars would represent the total potential program market. Let us suppose that one could develop an educational or technological programming system which in the language arts could improve the teaching of reading 10% and install this improvement throughout the country in five years. Such improvement over the five year period would represent a 400 million dollar saving or improvement in teaching. In terms of different organizational or administrative process one should be able to measure the total educational consequences in terms of the development and delivery of new educational techniques. One is more likely under the METEP Model to develop, deliver and install new educational programs than you are under the present state of administrative and organizational development in the educational field.

Based on the guild organization already noted, schools of education are not organized to develop and deliver new and improved educational programs to local education systems, that will result in significant improvements in these systems.

FEASIBILITY OF AN EMERGING MANAGEMENT SYSTEM

The management component of the METEP model has been described as a two part process of organization development, implementation and redesign over a five year period. New and improved existing organization functions were recommended (e.g., client demand analysis, research and development of education programs, new program promotion and PPB in the financial function) in order to prevent newly generated programs from receding in time into the ranks of the well-established and eventually frozen in a form which is not responsive to clients or the environment they were intended to serve. This part of organization development is to be matched with the concurrent emergence of a planned effective decision making process which will hereafter be referred to simply as the management system. As has already been conceptualized as an organization problem solving process (see Figure 3), it is the latter - the management system - that we are primarily concerned with in this discussion.

The problem at hand is, of course, whether or not the management system that emerges over a five year period can feasibly solve the organization problems that the METEP model will generate. Although our initial test system is necessarily based on a set of highly arbitrary standards and assumptions, we believe for the reasons discussed earlier in this section that the suggested conceptual model is a feasible point from which to begin. Since we rely heavily on redesign of the initial test system over a five year period, the feasibility of the management system as it emerges can realistically be ruled on in terms of economic, human and technical limits actually imposed throughout the implementation period.

We believe the most glaring design deficiency at this point in time to be lack of measurability of the initial test system. In terms of the prototype system recommended herein, metrics is several steps behind conceptualization. The system designer's ability to rule out infeasible model alternatives depends critically on the availability of historical data on the performance of the management system as it emerges. An essential part of providing some assurance of maintaining feasible design is, therefore, the provision during implementation of the means to generate historical data which is required as a basis for redesign. The importance of the measurement problem can be seen against the background of monetary, human and technical constraints within which the system will emerge.

Budgetary Restrictions. Management costs (in the sense of management problem solving activities) are appropriately part of education program costs with the quantity of solution outputs (decisions) generated by the system. Organization problem input and solution out-

put volume is in turn related, in presumably measurable ways, to changes in program (s) size from year-to-year and to changes in variety or mix of education programs over time. As discussed earlier in this section, the future expected costs (over the five year period) can be obtained through knowledge of the total number of problems the management system would be expected to solve, the average time required for various types of organization problems and the average cost per time unit.

Personnel. Under the major premise that we can approach reasonably systematic management of decision making in the METEP organization, we must not only rationally allocate problem solvers over the problems to be solved, but to do so within restrictions imposed by the quality and quantity of managerial personnel. Infeasible system performance can be caused by deficiencies in management performance rather than system design. Indices or measures of skills required and of current managerial performance must be developed in order to distinguish between design infeasibility and infeasibility associated with management skill deficiencies. If foresight is applied to system measurement, this is a basic data problem which can provide the informative detail (through essentially qualitative measures) needed to evaluate the more productive alternative uses of current managers in problem solving as well as forecasting personnel requirements.

Technical Restrictions. In addition to human limitations, the quantity and quality of solution outputs generated by the management system depends on the ability to specify the management information for problem solving required, in advance of the need. This problem of the kind and variety of management information must be searched and judged in terms of cost/effectiveness and within the technical limits imposed by the concurrently emergent capabilities of the management information sub-system and the range of data and reports it can feasibly provide. This general problem will be referred to again in Section III - Information Systems.

Initial Test Design Measurability. The general system measurement problem touches not only the problem solving itself, but also the design of all monitoring mechanisms associated with the outputs of each functional activity in the organization and with the retrieval of external intelligence data from the various client groups. Our attention in this discussion, however, is given to the measurement problems associated with the management problem solving and its solutions.

Documentation (nature of the problem solving process). The ultimate achievement of an elevated model requires that the nature of the organization's problem solving tasks be specified as the tasks, or steps, involved. This has already been specified conceptually (see

Figure 3), but not in terms of precisely what steps various types of problems raised will follow or what will be the procedures followed at each point and who will have or share responsibility for performance. For example, some problems may bypass authorization because its expected solution may require little or no allocation of financial or other resources. Or, certain problems and solutions devised may not jointly involve or affect other managers or functional activities thus perhaps eliminating the necessity of running solution alternatives through the organization concensus functions. Certain problems may better be processed where the sequence of authority and concensus may usefully be reversed. Moreover, we can anticipate problems of day-to-day operating nature that may very well avoid the entire organization problem solving process and remain fully decentralized and in the control of the particular manager of the functional area involved. We would also expect certain problems to be of repetitive nature for which an acceptable solution may in a certain sense become a programmed solution and therefore solved only once. Under the assumption then, that the system designer can learn to specify the detailed nature of the problem solving steps and improve the process in terms of sequence, and the organization problems associated with a sequence, the integration of organization problem solving activities can be feasibly planned over time. Given human, monetary and technical resource limits that will arise, the accumulation and analysis of such basic data should permit sufficient control over the test model as well as the potential means to maximize the volume of solutions outputs and to minimize average time while increasing the value of solutions over time.

What is required at the time of implementation is a simple, inexpensive form of problem processing documentation which would serve as problem scheduling and control tests. Facsimiles of such tools are shown in Figures 8 and 9. Using Figure 8 as a guide, the master control board would be maintained in the control unit, or by its coordinator. As problems are initially raised, either through monitored outputs of operating functions, externally raised problems, or by the organization members, each would be documented and specified as to problem definition, the nature and likely cause and when possible, the specifications of the expected solution. Written, recorded problems would be assigned, in most cases, directly to the manager concerned, assuming of course, a programmed solution does not already exist. Documentation, scheduling and control throughout the problem solving process as indicated by items in the master control board would permit "problem runs" to be actively managed and analyzed in order to reveal opportunities for system redesign if necessary. Historical data on "test runs" should reveal to the system designer whether or not the test system will perform reliably, that is, solutions will be generated within an acceptable

FIGURE 8
MASTER CONTROL BOARD

Problem No.	Problem Solution				Consensus			
	Assigned	Date	Scheduled Completion	Completion Date	Assigned	Date	Scheduled Completion	Completion Date

FIGURE 8--Continued

Authorization				Implementation			
Assigned	Date	Scheduled Completion	Completion Date	Assigned	Date	Scheduled Completion	Completion Date

FIGURE 8—Continued

Assigned	Date	Operation Scheduled Completion	Completion Date	Assigned	Date	Audit Scheduled Completion	Completion Date

FIGURE 9

PROBLEM PROGRESS REPORT
(BY MANAGER)

Manager	Problem Assigned	Schedule	Consensus	Authorization	Imple-mentation	Audit

FIGURE 9 (Cont'd)

PROBLEM LEDGER
(BY PROBLEM)

Problem No.	Problem Received From	Date	Sender Acknowledged	Problem Assigned To	Nature of Disposition

range defined in terms of volume, cost and value of solutions. Measurability, moreover, must also permit the designer to rule on the stability of the system as program size changes, or organization structure changes or unexpected surges in problem input volume occur and still maintain a relatively stable state of solution output.

The ultimate emergence of an organization planning function described earlier will provide the essential integrating function, or management of the management system. This function is an innovative way to reconcile the needs for specialization in the METEP organization with the need for integration of total organization effort. Assuming that over the five year period the actively managed management system can develop expected solution standards, and given the achievement of system measurability, this organization function, as explained earlier, provides the device for controlling the management system in terms of the quality and value of its solutions.

Management As An Emerging System

Given a five year development METEP Program, what will be the nature of planned management development in this time period? In order to answer this question we might consider three sub-questions: 1) what is the nature of our present managerial capability, 2) what type of capability do we want to develop, given the rationale or overview in terms of a total educational programming system and 3) how would we determine whether or not we have achieved our managerial objectives in the five year developmental period.

Present Management Systems and Functions of METEP. One would logically expect that the nature of the managerial thrust would reflect in large measure the nature of the organizational function to be managed. The METEP project reflects this phenomenon. METEP has been essentially a research and development effort. The most appropriate type of management for such an effort is what we have come to call project or program management

We might briefly look at what a research and development function is in an organizational context, as distinct from a financial function, a personnel function or a client demand analysis function. The purpose of the research and development effort is to produce productive educational innovations or programs -- to improve the state of the pedagogical art. Such a research operation usually consists of a series of small research teams working in particular areas on specific educational problems. This has been the case with the METEP project and thus, in the pedagogical area: one finds a team working on Language Arts, another team on Human Relations skills, and another team on the teaching of Mathematics, and so on. In addition, one finds teams working on simulation, information systems, management systems, et cetera. Although the first phase of the METEP Project is concerned with planning or design, it is hoped that these plans and designs will be innovative and productive.

The characteristics of the management of such a function emerge in large measure from the nature of the research and development function. Because the essential output of this function is productive educational innovation - it is important that the manager of the project encourage and develop a free and creative environment for the researcher, in order to ensure a high productivity of educational innovation. The nature of the managerial process concerning the research and development function can be determined in part from noting the nature of the creative process itself.

Concerning the creative process, Anne Roe noted,

> "The (creative) process is intimate and personal and characteristically takes place not at the level of full consciousness but at subconsciousness or preconscious levels. Many effective

scientists and artists have learned a few techniques which may reduce interference with it but no one to my knowledge has discovered any means by which he can set it in motion at will."

It is probable that the fundamentals of the creative process are the same in all fields, but in those fields in which advance in knowledge is necessary there is an additional requirement - this is the need for a large store of knowledge and experience. The broader the scientist's experience and the more extensive his stock of knowledge, the greater the possibility of a real breakthrough.

The creative process involves a scanning or searching through stocks of stored memories. There seems to be a rather short limit to the possibility of very significant advance through voluntary, logical scanning of these stores. For one thing, they vary enormously in their accessibility to conscious recall and in the specificity of their connection, so that reliance upon conscious, orderly, logical thinking is not likely to produce many results at this stage, however essential such procedures may become later in the verification. This scanning is typically for patterns and complex associations, rather than for isolated units. It may be, however, that a small unit acts as sort of a key to the pattern. What seems to happen, in creative efforts in science as well as in every other field, is that the individual enters a state in which logical thinking is submerged and which thought is pre-logical. Such thought is described as rambling largely because it typically tries seemingly illogical and distantly related materials, and it often makes major advances in just this way. It is not fully random, however, because it is goal-directed and because even in this preconscious work there is appropriate selection and rejection of available connections. This stage of the creative process is accompanied by a generally confused or vague state of preoccupation, or varying degree of depth; it is well described as 'stewing'. It is this stage which apparently cannot be hurried or controlled.

Although termination of this stage (finding a solution or 'getting insight' as it is often called) quite frequently occurs in a moment of dispersed attention, it apparently does not help to induce a state of dispersed attention in the hope of provoking a quicker end to the process. It should be added that while insights do frequently occur 'in a flash', they need not do so, and that the process is the same whether or not the insight turns out to have validity.[1]

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[1] In "The Psychology of the Scientist", The New Scientist, Paul C. Obler and Herman A. Estrin, Eds., (Garden City, N.Y., 1962) pp.86-88

Given the nature of the creative process what type of organizational environment is believed to be most productive?

Professor Orth has suggested five basic components of a creative industrial research climate. The first is the necessity to accept the status of the researcher. This involves permitting considerable freedom to the researcher in the decision making process concerning the research activity, and also the acceptance of the researcher as an equal. The second basic element for a creative research setting is appropriate facilities and assignments: specifically, good laboratory facitilites, colleagues of high professional stature, and work assignments of interest to scientists. An other factor concerns the relationship between the administrator and researcher. Highly creative scientists do not consider themselves as employees, but rather as professionals. As such, they believe that they should be served by the organization for which they work, rather than be regulated by them.

Another characteristic of a successful industrial research climate is the opportunity for mobility along the continumm - from basic research, through applied research, to development by the researcher as his orientation and interests change.

The final important characteristic noted by Orth et al. is the need on management's part to recognize the importance of research effort.[2]

While final judgment cannot be made at this time as to how innovative the METEP effort has been, both in terms of the quantity and the quality of educational innovations suggested in all of METEP's dimensions, there is little question that there has been a conscientious, consistent attempt on the part of the management of the School of Education, (particularly as it relates to this project) to create an organizational environment that would maximize innovative output. The present leadership style is entirely consistent with the desired managerial R and D model noted above. Researchers have been encouraged to be as free as they like. New ideas were encouraged and no matter how far fetched, initially, were given serious consideration. Researchers were encouraged to innovate through the search and exploration of possible avenues which fell outside of the traditional educational approaches and/or disciplines. It was a deliberate managerial strategy to avoid early closure, or to move too early to freeze design, which might preclude significant innovation.

Thus, the mission of the project and the style and techniques of management of the project were always kept in mind to produce effective educational innovations. For the most part, each research team was

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[2] Charles Orth, John C. Bailey, Francis W. Wolek, Administering Research and Development, (Homewood, Ill., 1964), p. 336.

granted considerable freedom in terms of developing that product which the research team felt was best. The managerial effort was directed toward creating appropriate facilities, and providing stimulating colleagues of similar interest. Underlying the managerial effort of the project, has been the commitment to the idea that if we are to have a better, more productive undergraduate program in education, it will have to be invented.

Emergence of METEP as an Educational Programming System. The second question is, where do we go in the next five years? The basic question to be answered related to planned organizational growth. Specifically, what organizational functions should be developed, in addition to those which presently exist? The basic function which currently exists is production or teaching. The educator, the research and development function is currently evolving.

In the next five year period, in order to develop a total educational programming system, in addition to a research and development and educator function, it will be necessary also to develop a client demand, analysis function, finance, personnel, space, consensus, promotion and delivery, and finally, program review. To have systematic and planned growth, these functions must be introduced. What stages are logically required for developing the additionally needed functions? At the outset, permanent functional managers must be obtained. These individuals would be responsible for the designing or planning of how a specific function is to be executed. For example, the financial manager has to plan or design how budgets are to be put together, programs defined, how investment decisions are to be made, how budget data is to be scheduled, coordinated, and so forth.

Besides planning, managers of these additional organizational functions implement the plans. They organize potential staff and hire trained personnel to execute the planned function. In addition, the managers supervise day-to-day operations to resolve incidental problems that may arise and finally, they control or monitor the function to assure that it performs or produces as expected. Insofar as the organizational functions are concerned, it is assumed that over a five year period each of the organizational functions would have a set of expected outputs. Thus, viewing the research and development function in any given year there would be certain expectations as to the number and quality of innovations to be produced. Financial management would have a set of expectations as to the amount of money that might be saved through effective financial analysis. Similarly, promotion function should have an expectation as to the number of innovations introduced in the school systems. And if these expectations were not met, this would create a managerial problem which would be fed back to the manager, who would review his work either in terms of design staffing or in terms of functional objectives. to assure that in subsequent time periods, functional objectives will be achieved.

This, of course, means that as additional functions are added to the METEP effort, managerial staff will move from essentially a project management motif or style, to a multiple management function. Specifically, in terms of managerial capability and staff, the project has to fund, in addition to research and development which currently exists, additional management for augmented organizational functions. Once this happens, it is reasonable to expect that by increasing managerial differentiation, ultimately a new managerial function will be introduced: the management of the managerial function itself.

Time Projections. How long will it take before the additional functions become operational? This depends of course, on the size of the functions, the number of employees and the problem solving load within the function.

In terms of time sequence, assume that it will take approximately six months to find and hire qualified functional management. Further assume that they will devote at least one year to the planning and analysis of their functions. It might then take them six months to implement their plans, which will relate to organizing, staffing and acquiring the resources needed. Plans have to be approved through the consensus and authorization steps. Thus, additional organizational functions, in terms of finance, client demand analysis, program review or program promotion, etc. might not be operational for at least two years. However, given a five year development plan, operational functions can be monitored for the last three years of the program, so as to improve functional productivity.

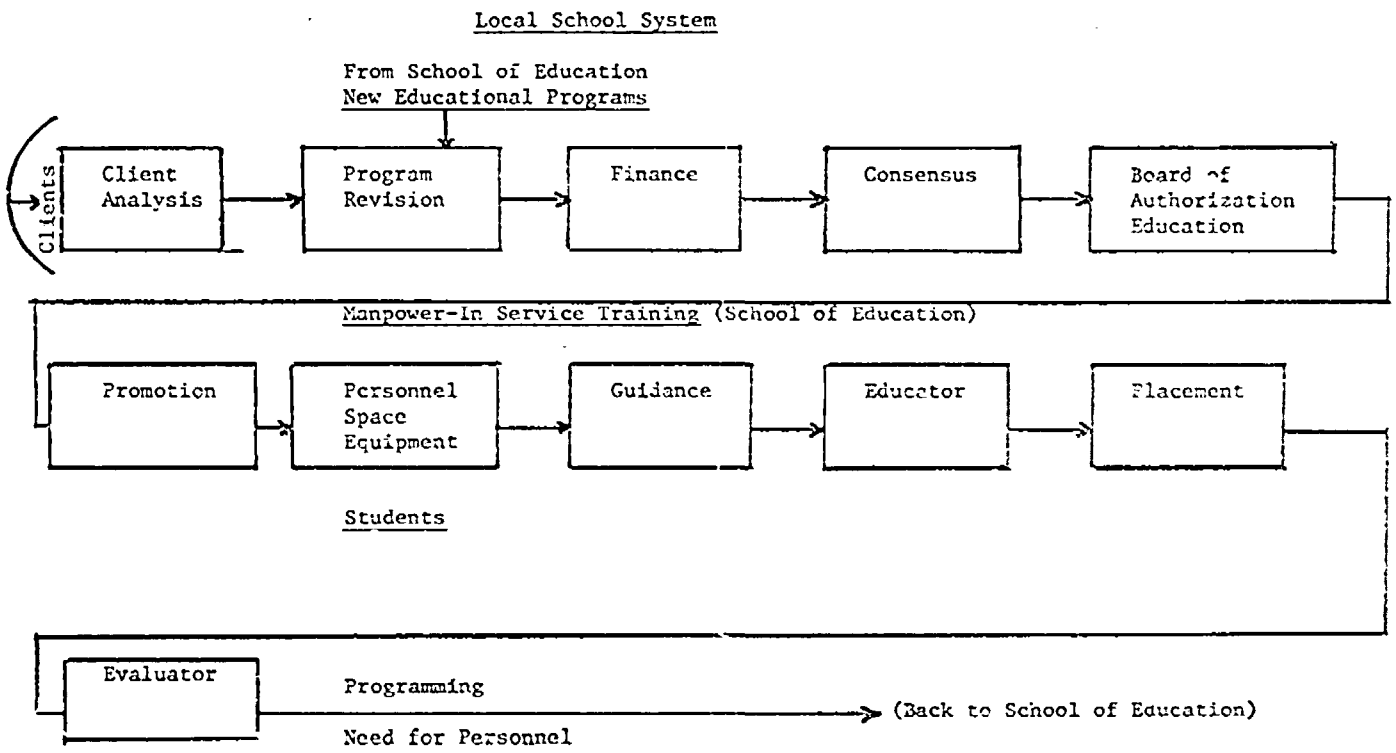
In terms of managerial selection and development, the next immediate stage is to find qualified managers for the organizational functions to be created. It would seem at the outset, that one might concentrate upon functional skills, rather than disciplinary skills. Although the administration of an educational operation is important insofar as management of the specific functions is concerned, the professional educator would not be recruited as a manager or administrator, unless that person has the requisite functional skills. Therefore, in hiring a manager to develop the financial area, the concern is essentially for a manager with financial training, experience, and skills. Such an individual may not emerge from the field of education at all.

Once there has been a decision as to what functions are to be developed, there follows the problem of developing position descriptions for managers, delineating both the task that is to be performed and the qualifications necessary to perform this task. Such position descriptions amplify the organizational chart and structure of the METEP project. For example, in hiring a promotion manager, an individual who had training and experience in public relations, advertising, media, selling, and so forth would be sought.

How to Assure Managerial Objectives Are Met. Given the time projections noted above, the new functions will become operational in approximately two years. In operation, the total managerial system will be monitored as noted under section, "Plan Effective Decision Making", and specifically Figure 7 of that section. Or, given the objective function of the educational programming system, over time, the managerial system has to produce a solution output in terms of that designated objective function.

For example, if one of the requirements of the total educational programming system is to reduce the cost of training, presumably a solution output over time will effectively do this. If another objective function is to produce effective educational innovations and deliver these to the school systems across the country, then, the systems solution output will contribute to that educational objective. A system will exist to monitor functional managers to ascertain the extent to which their management solution outputs are contributing to the total educational programming system.

Figure 10 Generalizing the METEP Model (Two Organizations)



Generalizing the Model Elementary Teacher Education Program Model - A Two Organizational Analysis

The purpose of this section is to illustrate how the Model Elementary Teacher Education Program (METEP) Model and its organizational administrative features can be generalized and applied to an array of educational settings. Specifically, the attempt will be made to illustrate how two educational organizations, the school of education and any given local school system can be coupled by using the METEP Model (See Figure 10). In this illustration, one of the basic functions of the school of education is to develop or invent and deliver new, improved educational programs. (Other terms have been used insofar as the function is concerned: social and educational change agent, educational revolution. However, the terms invention and delivery of new and improved educational technology seem to be somewhat more precise.) And although the school of education may have other outputs and concerns, for the purposes of this analysis, it will be viewed as a basic research and development unit.

Looking at the chart generalizing the METEP Model - two organizations - one sees the organizational administrative METEP Model applied to a local school system. Since the subsystems of this model have already been explained, they will not be reviewed here. What is of concern are those subsystems in the local school system that will be coupled with the school of education in terms of programming change. One should note that there are three entry subsystems at which point the local school system is linked to the school of education. The first would relate to program revision or the engineering unit; the second is the personnel or manpower unit; and the third is the evaluator unit. We might look at each of these subsystems as programming linking units. New educational programs can be packaged and delivered in two or three ways. One package would be in some form of media books, films, lectures or television. Another form in which new programs can be packaged is to transmit the new programs through students at the school of education. These students will be hired and placed in the local school systems and will utilize the new material. The thrid way is to take the existing personnel and imprint the new programs in the form of in-service training.

Returning to our chart; in the subsystems program revision, one assumes the existence of a program design capability in the local school system or an engineering function. This function, on the basis of client analysis, can take the existing educational techniques and combine them into an acceptable and effective program in terms of unique client demands and unique constraints of the particular local school system. Rather, the local engineering group would have an array of educational techniques on the shelf, as it were, and given particular demands they would have the design capability of selecting and utilizing the correct shelf items. To use a rough analogy, we might view the local school systems as a special machine job shop with an array of various tools. When a customer submits a particular order, the engineer in the shop can draw up a blueprint which utilizes

the various machine tools available to produce that the customer desires. This engineer, however, is not inventing new tools. Because different local school systems have different clients and client needs, that is, one school may be in a ghetto, while another school may be in a very high income suburb, local engineering units will require a different program mix to produce the desired output. Irrespective of the different environmental conditions of local school systems, what is postulated here is that schools of education as basic R and D units are continuously producing educational innovations that are flowing to local school systems. What is of significance in delivery terms is that the school of education has a promotion unit that is in the field explaining its latest new programming approaches, and presumably, this unit constitutes a kind of output or delivery unit for the school of education. This field group would be explaining or promoting the new technology to the local "engineer" which is the program input unit of the local school system. In this way the two systems become coupled. Thus, the METEP Model assumes a field staff or marketing staff which on the basis of its current successful research, would be going from local school system to local school system selling or demonstrating such new techniques as differentiated staffing, instructional alternatives, use of performance criteria, various media, et cetera. Assuming that the local engineering unit found these techniques to be productive, and redesigned programs along these lines and processed these programs through the local system, a demand would be generated for either new manpower or the retraining of existing manpower in terms of new technology.

This brings us to the personnel subsystem. At this point, once again the school of education may become involved in terms of converting the innovations into human behavior through its own educational programs.

The last subsystem to become involved with the school of education would be the evaluator. One assumes here the existence of a subsystem, which in terms of the rest of the system, can generate educational problems which the METEP field staff would pick up and redirect back to the school of education. The school of education, in trun, would invent new programs to meet the needs of the local school system. A technological gap would exist. Present shelf items would be inadequate. An obvious case might be ghetto schools where the existing educational technology is clearly inadequate in terms of what these schools would like to accomplish. Assuming such R and D could be funded and given the creative impulse of the school of education, a new program would be developed in terms of local school system needs which would be promoted or channeled through the marketing and promotion field staff back into the local school system at the program revision point.

Thus, we have a closed, improving programming system between local school systems and the school of education using the METEP Model as the basic device to couple these two systems. The above view has been approached largely in terms of the point of view of the user of the programs, the local school system, rather than the producer of the programs, the school of education, which has been the essential thrust in other parts of this report. A rationale for the METEP Programming Model is included in the Appendix.

Summary - Implementation of Emerging Organizational Functions And Management System

The purpose of organization is to execute plans. Thus far, a year and half has been devoted to program planning of METEP. Phase III will continue program development while at the same time developing an organization to execute those plans. Currently there exists a METEP Project Management which has been directing the Phase II operations. If one looks at Figure 11 the present organizational form can be seen. There is a Project Director, Assistant Project Director in a staff position and a series of planning groups reporting directly to the Project Director.

Within a year the organization seen in Figure 13 will be developed to execute Phase III's development. This constitutes an interim organization and natural development from the present organization. The Project Director will continue as Director of the METEP Program and two Associate directors will be added, Associate Director of Education and the Associate Director of Administration. Each of these directors will be responsible for a series of functions; all delineated on the chart and discussed in other parts of this report. Some personnel currently exists to execute, see Figure 12, while others will have to be hired to perform these new functions. By the end of the second year of Phase III full functions will have been developed and METEP will be in final organizational form (see Figure 13). It should be noted that all functions will be consolidated under five directors. This will require three more directors than existed in the interim organization. The present Associate Director of Administration will probably become Director of Finance. A Director of Program Delivery and Program Services will have to be appointed. An Associate Director of Research and Development will be appointed. The Associate Director of Education in the Interim Plan will become Director of Education. These directorships are assumed to be full time administrative positions. It is further assumed the work load in: 1) Program Delivery, 2) Finance, 3) Research and Development and 4) Director of Program Services will be sufficient to warrant such administration. If not, some of these functions may be consolidated, so that one individual may perform more than one function. Each director shall determine how much supervisory assistance shall be required within his respective functions. The present budget proposal provides for the foregoing organizational and administrative developments.

The steps necessary for the implementation of the management subsystem are outlined in Figure 14. Interactions with other system components are implicit. The management subsystem is described as an emerging process. Therefore, although feedback loops and cycles are

FIGURE 11

PRESENT MANAGEMENT CHART

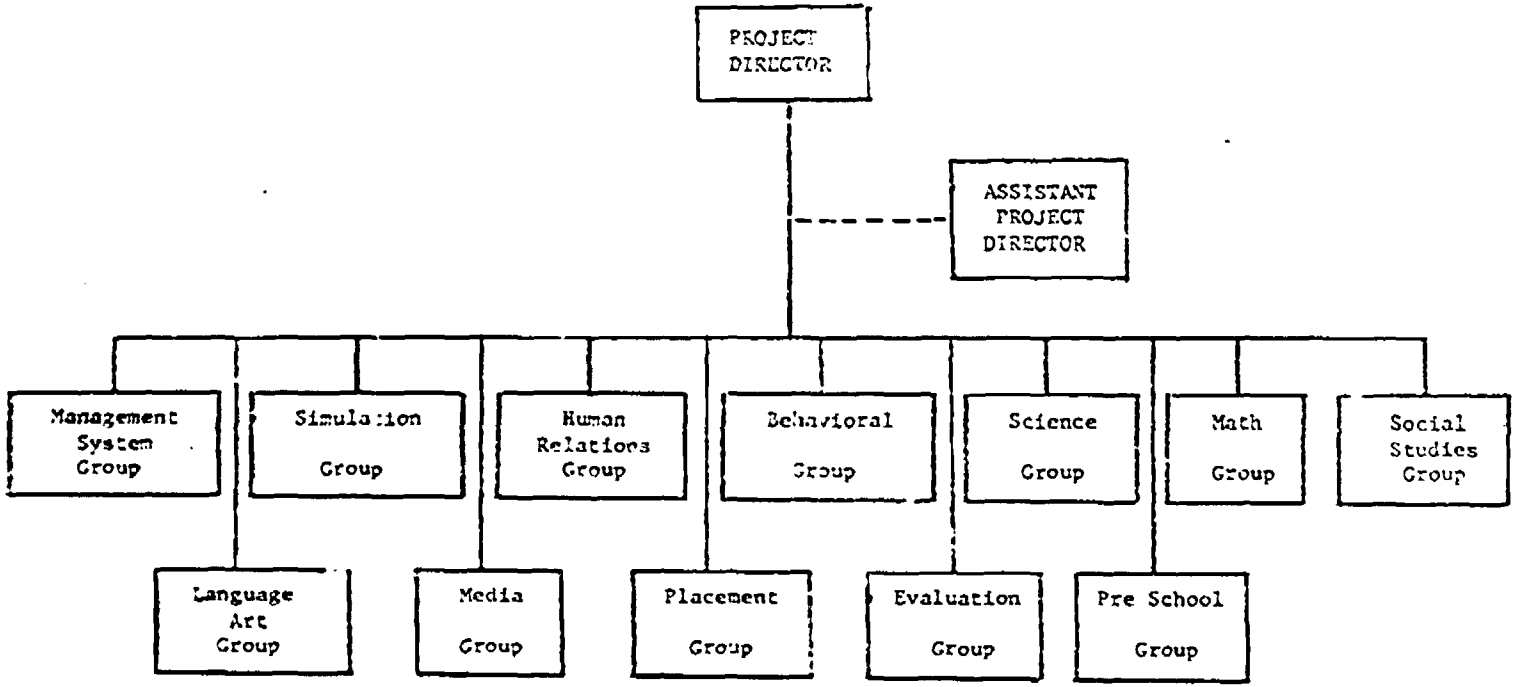


FIGURE 12

INTERIM ORGANIZATION

(SEE CHART IV -- OVERVIEW)

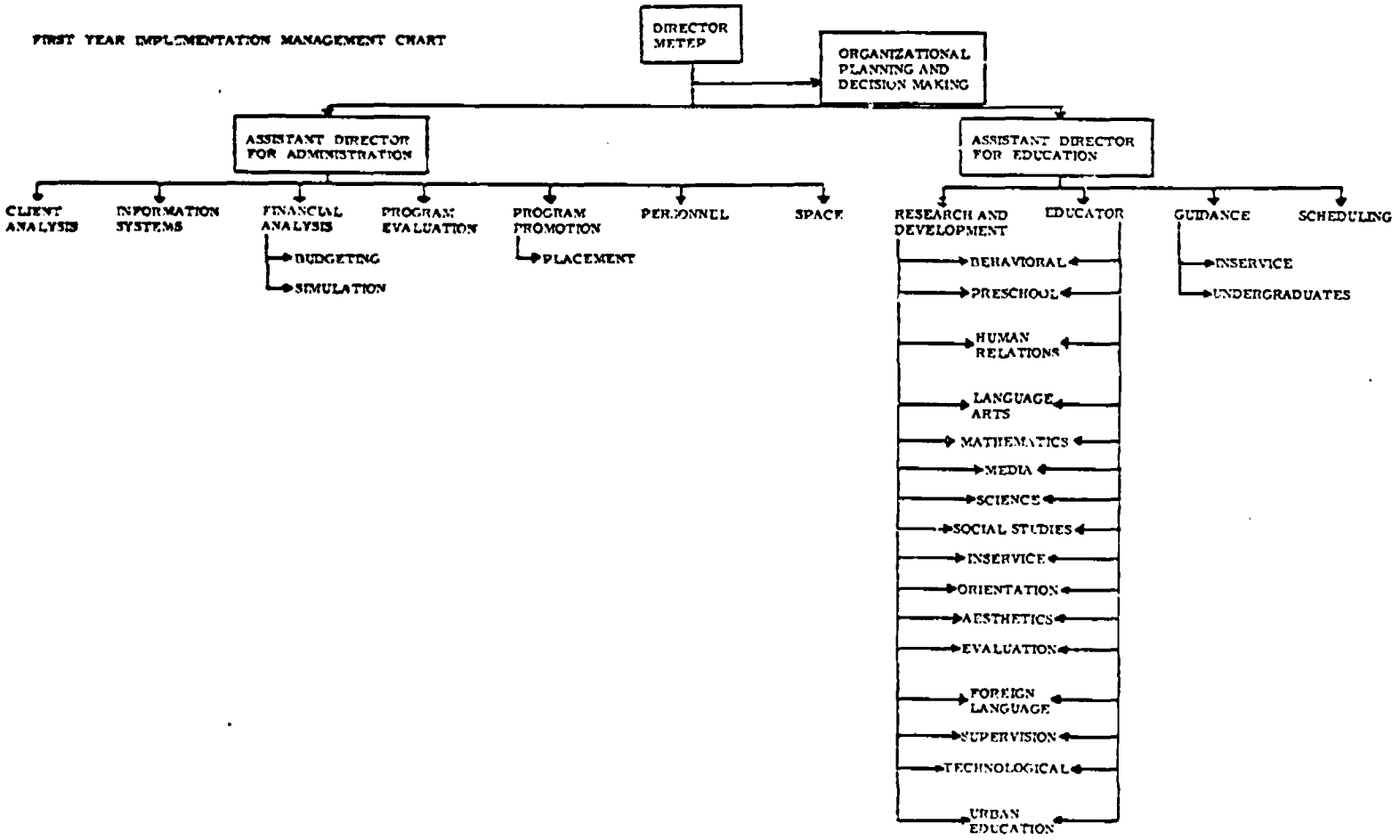
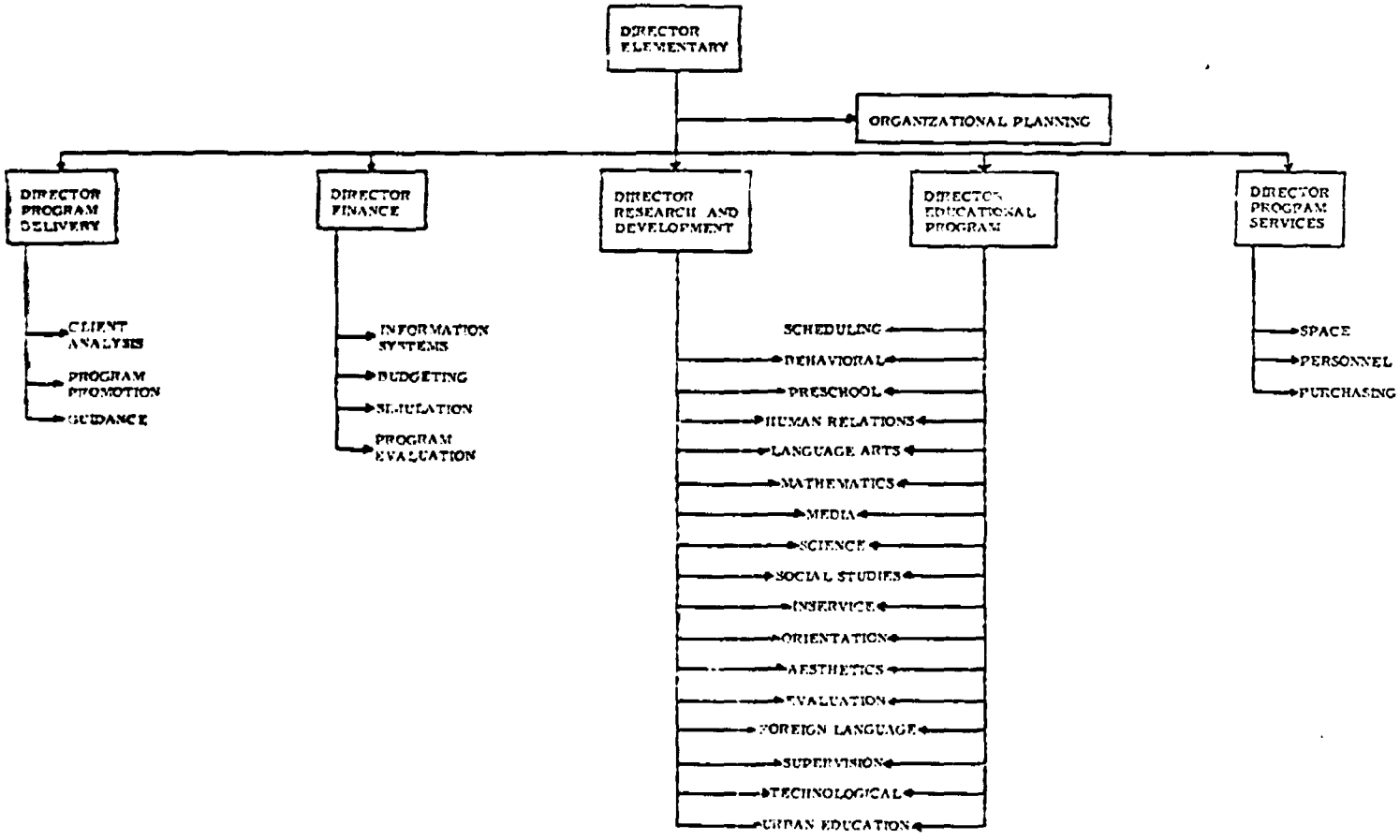


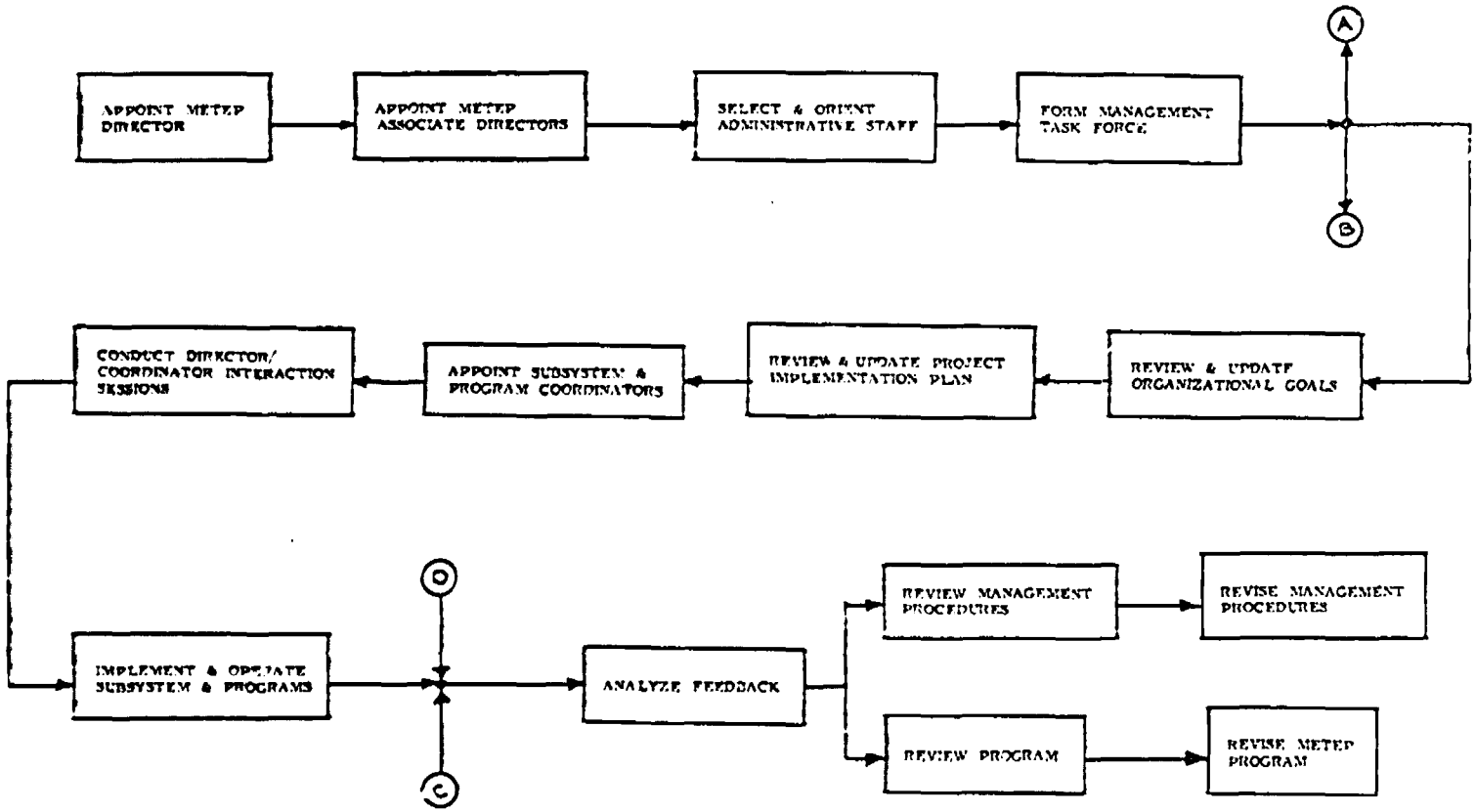
FIGURE 13

MANAGEMENT CHART SECOND YEAR -- FINAL ORGANIZATIONAL FORM



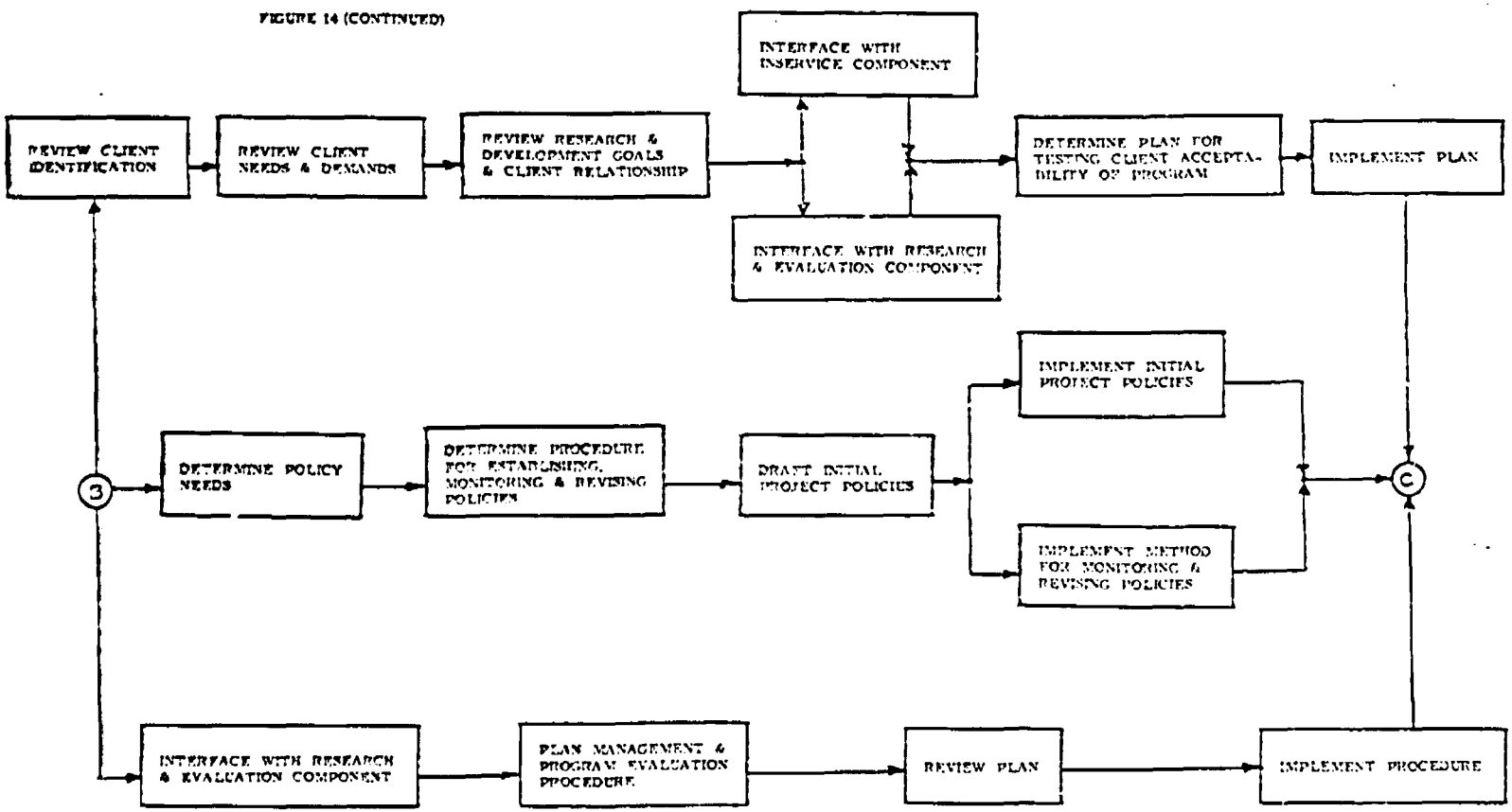
IMPLEMENTATION ACTIVITIES:
MANAGEMENT SUBSYSTEM

FIGURE 14



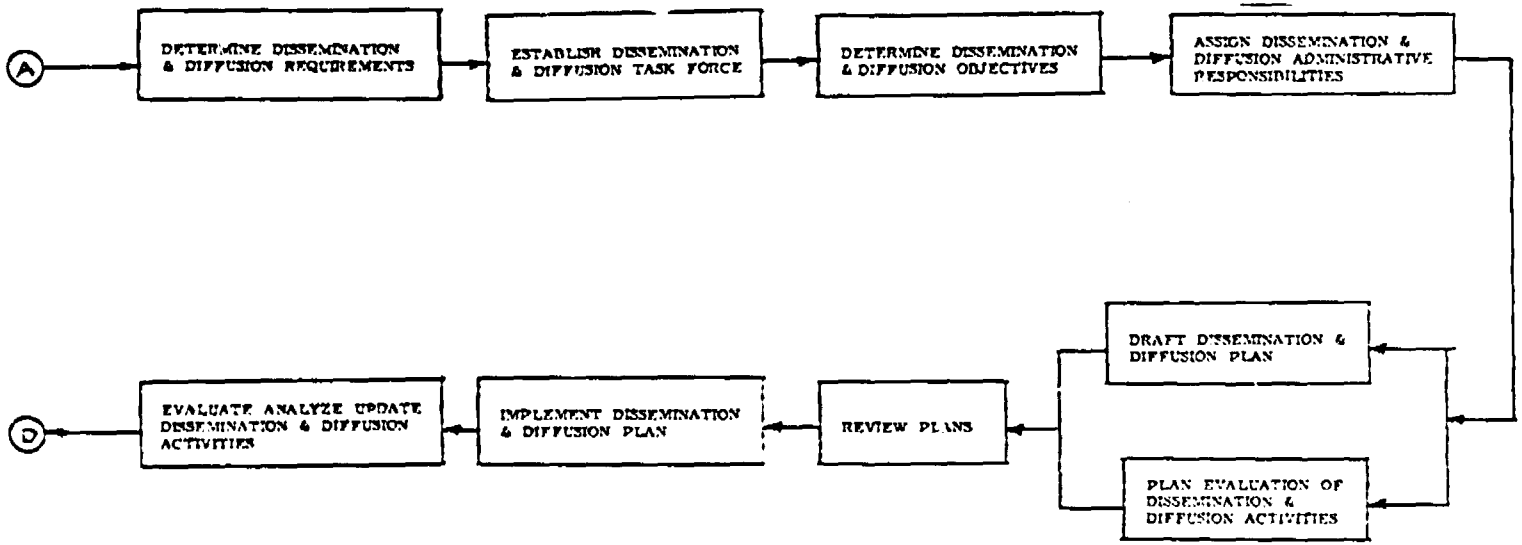
IMPLEMENTATION ACTIVITIES:
MANAGEMENT SUBSYSTEM

FIGURE 14 (CONTINUED)



IMPLEMENTATION ACTIVITIES:
MANAGEMENT SUBSYSTEM

FIGURE 14 (CONTINUED)

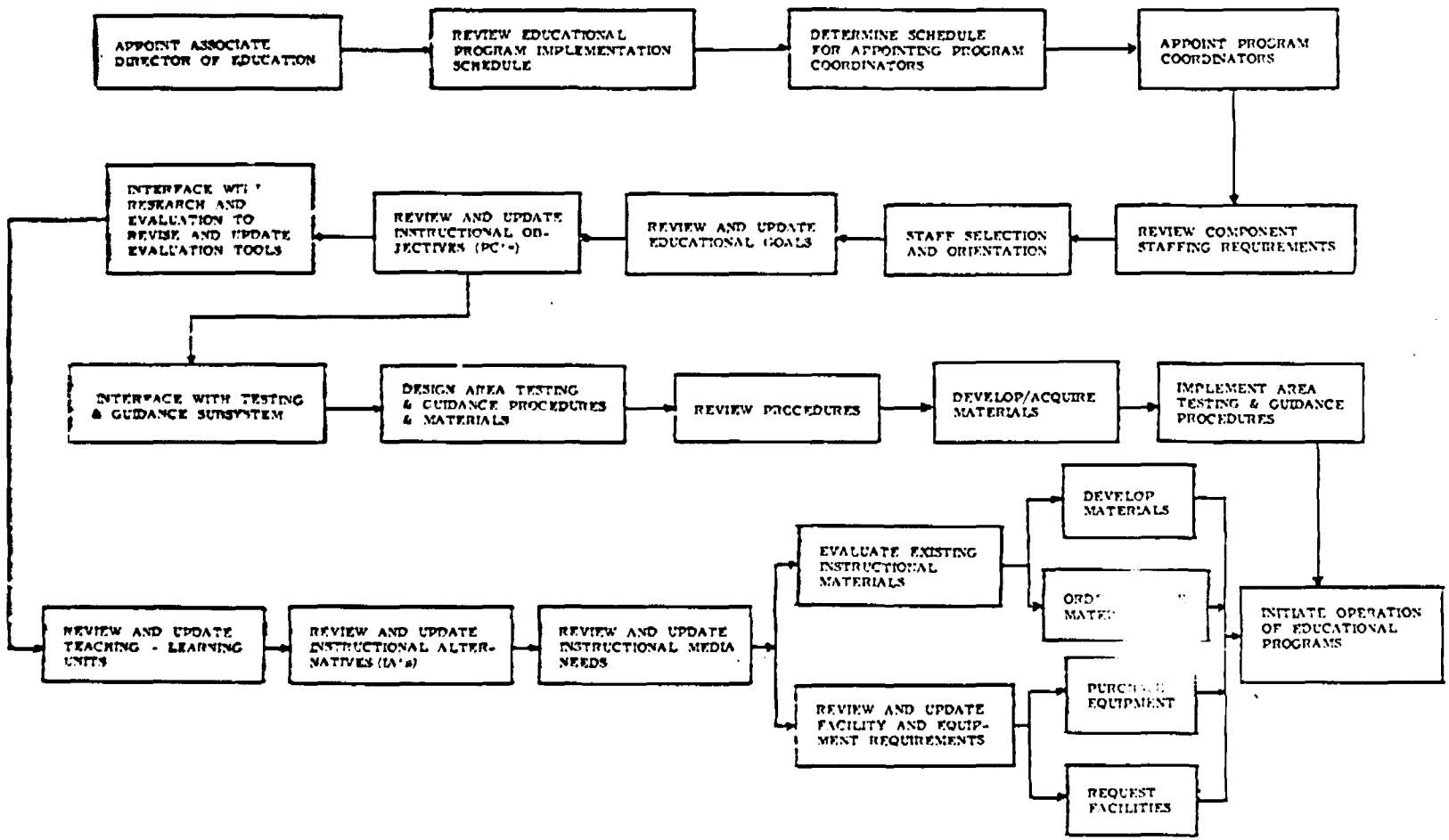


not explicitly illustrated, the evaluation and revision activities indicate the cyclic nature of the network. Activities associated with program dissemination and diffusion and client acceptability are included as elements of the management subsystem.

Activities associated with the implementation of the other METEP subsystems are outlined in subsequent sections. However, the similarity of pedagogical implementation steps does not require a network activity chart for each of the educational programs. Therefore, the activities associated with the implementation of pedagogical programs are outlined in Figure 15. The evaluation of instructional processes and materials will result in these programs being continuously refined. Hence, many of the activities listed should be considered as iterative processes.

IMPLEMENTATION ACTIVITIES:
PEDAGOGICAL PROGRAMS

FIGURE 15



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APPENDIX

Rationale for Model Elementary Teacher Education Program Programming Model

The following is a brief statement relating to the historical reasons that led to a need for the METEP Model. This section will illustrate that the Model is capable of generality not only to schools of education but to other educational systems at the local level. One of the requirements of the research project is to explore the extent to which it can be applied to other educational systems.

There are two general approaches with regard to the purchase of services. Services can be purchased on an individual and private basis or on a collective and public basis. On an individual and private basis, one has a buyer-seller relationship, wherein, if the two parties can reach a mutual agreement as to what should be delivered and what price should be asked, one can assume that one has achieved a measure of both buyer and seller satisfaction. This is essentially a free market situation. A collective purchase is made through some form of political mechanism and it is this form that we shall look at in detail.

The manner in which educational services were to be purchased collectively either through local boards of education for elementary and secondary education or through state legislators for higher education emerged during the nineteenth century. The political mechanism was divided into three functions, the Legislative, Administrative and Judiciary. The following constitutes an ideal model of the functions the Legislature was to execute. It may, in fact, not have ever worked this way, but at least this is how we believed it was supposed to operate.

One function that the legislative wing was expected to execute, was to analyze client, taxpayer or voter educational demands. It was assumed that the boards of education or state legislators would know what educational programs voters wanted. And presumably this knowledge would be of a detailed nature. Boards of education would know if parents wanted Greek taught in schools and how much Greek would be taught. Boards would also know how much voters were willing to pay for such programs. The Legislature was also to perform an engineering function insofar as it would plan detailed educational programs. Presumably it would consider text books and educational packages as to content and various pedagogical approaches to be utilized.

Another function the legislators were to perform was that of finance. They would draw up an educational budget and establish a tax rate to pay for the program and how much it would cost. Boards of education and state legislatures would also carry out the consensus function when client demands were in conflict. Finally, the boards or state legislatures would authorize the program in terms of legislation or appropriations.

Educational programs were then sent to the administrative side of government for the implementation and execution of programs developed by the legislative branch. As for implementation, the administration

would have to purchase the necessary materials, hire personnel and provide the space to carry out the educational program. In terms of operation or execution, the administration would then carry out or execute the program which the board of education has determined. Thus, if the board of education decided to use McGuffey's reader the teacher, in turn, would presumably teach the students to read with this particular book. For the most part, the accounting function was restricted to assure that there was a proper expenditure of funds in terms of the prior budget drawn up by the board of education.

The organization of the administrative segment, then, largely reflected the functions to be performed. Thus, in terms of local education under perhaps the superintendent or principal, one had two basic functions: that of implementation as to the purchase of resources, and the other, operation as to the execution of programs. In terms of execution, the educational organization was structured along academic or disciplinary lines. The superintendent or president of the university, in the main, was restricted by the legislature to carry out educational programs developed by the legislature within whatever constraints, financial or otherwise, they had decided upon. The assumption was that the board or state legislature would be in a position to perform rather detailed education programming. And, in very small communities in which the voter personally knew members of the board of education and met with them on a regular basis, there may have been reason to believe that this particular political mechanism worked on a reasonably effective basis. One of course has in mind here a rural community with a little red school house and perhaps an itinerant school teacher in very close communication with the voter. There were small numbers of children involved and local detailed direction.

In the twentieth century, as educational systems expanded in school population, and society became urbanized, legislators became increasingly divorced from the voter or their constituency. New York is, of course, an extreme example with one million children in the school system. Further, the nature of educational services became technically more complex. Obviously, as it became impossible for legislators either at the local or state level to perform the expected detailed functions, they increasingly turned to an emerging professional group inside the administrative sector - the so-called professional educators. The same phenomenon, of course, occured with other public services such as national defense, police, health and welfare. Education, then, as a service was not unique. At the local or state level, this emerging professional group might be superintendent, staff or a state educational official, faculty, professional curriculum developers, teachers themselves, and so on. This professional group assumed the legislative function in that they postulated client demands, planned and developed educational programs, drew up budgets, formulated and executed standards of evaluation, in addition to continuing their traditional function of implementing and executing educational programs. To a significant extent they took over all legislative functions except that of raising taxes. In effect, the professional educator took over the management and operation of the educa-

tional system. This was not a unique phenomenon in the twentieth century because both public and private services have been taken over by professionalism. Thus, the professional soldier determines defense needs and manages the defense establishment, the professional policeman runs the police, the professional social worker operates welfare and the professional manager administers the corporation.

The essential thrust of the professional, in a highly interdependent society is that the system with which he is concerned is technologically complex and that only he has the unique knowledge for its operation. This is true of the professional educator, physician, lawyer, minister, policeman and general, and the client should rely on the professional because he knows best.

The professionalization of education seemed to work reasonably well and with PTA groups essentially organized as a public relations device, non-professionals, such as tax payers or students seemed willing to accept any direction in which the professional want to go. Aside from occasional client revolts in the form of objecting to certain books or materials presented in the schools, it appeared to be a fairly acceptable and stable system. These objections by voters were usually viewed by the professional as the work of cranks, radicals or obstructionists.

As we have seen, however, the basic fault of a professionally directed educational system is as with any other professionally directed system, it became increasingly professionally oriented, or to a greater extent, it served professional interests. At the local level it began to serve teacher interests; at the higher level it increasingly served academic interests; until at both the local and higher levels this eventually led to a client revolt.

The METEP Model represents an attempt to reintroduce an effective legislative function. It is obvious that one cannot reasonably expect either the board of education or the state legislature to implement the detailed programming functions which were assumed in the nineteenth century model: that of client analysis, engineering, finance, evaluation and promotion. A logical approach which the METEP solution is suggesting is that these functions should be established and executed within the administrative body (superintendent, etc.) but ultimately managed by the legislative body (board of education). For example, in a large educational system, it would be hard to imagine that a member of the board of education could personally perform a detailed client analysis; yet it would not be unreasonable to assume that he could administratively manage a function that would carry out such duties. Or in like manner, he could assure that the financial management was managed properly.

If we are to solve the problems of the effective delivery of public services, a certain measure of organizational ingenuity will have to be exhibited. Unfortunately what appears to be happening is the assumption that the legislative function can be made client-responsive by either electing or attaching more clients to the present political

structure. A fundamental dilemma is that the traditional political structure has failed. The consequences of adding client representatives or undergraduates elect representatives or putting citizens on hospital boards would basically appear to be a futile undertaking. It is much like assuming that if the telephone service in New York City is ineffective, that this situation can be corrected by having the Mayor appoint two citizens to Bell Telephone's Board of Directors. Given a large complex bureaucratic operation, it is impossible to see what effect two citizens would have on Bell Telephone.

SECTION III PART II MANAGEMENT INFORMATION SYSTEM

MANAGEMENT INFORMATION SYSTEM

In this part of Section III we discuss a feasible management information system designed both to control the progress of students through the METEP structure and also to generate subsidiary management statistics for program diagnosis and analysis.

The material to follow is divided into four divisions.

Division One provides a preliminary description of general information system design principles to motivate later introduction of operating constraints which we believe necessary for the success of this project at the present time.

Division Two reduces these general principles to application for the case at hand.

Division Three describes a basic information system proposed as a bench mark for this project.

And, Division Four provides possible extensions and variations from the bench mark case to illustrate alternate cost/benefit choices.

The reader with previous knowledge of information system design may safely skip to Division Three. Readers who wish to review the principles and application of information system design to the present case should start from Division One.

Division One

To understand the motivation as well as the necessity for the information design choices proposed hereafter, it is necessary to appreciate several logical points, as well as the argument sequence described in this division. The theory expounded here is relatively simple: any information system can be evaluated on a number of dimensions; most of them involve conflicting choice trade offs; and, to reach a final set of design specifications, some compromise must be made in the mix of desired ideal extremes.

Five Important Information System Specifications. Five system parameters, or specifications, set both the cost and the performance capabilities of an information system:

1. Input/Output Volume: Usually measured by the number of input transactions and output reports required during a given time period. Detailed analysis includes the number of lines, or the number of characters of input/output volume.

2. Response Time: Usually refers to the elapsed time between the request for information and its return to the requester. The response time of an information system must be related to any control or decision-making activities the system services. Very fast response times, e.g. a few seconds versus a week, usually require special system configurations and correspondingly increased cost when compared to slow response systems.

3. Mode of Input/output: The choice of one or another form of human communication with the information system alters the equipment configuration, system programming, and user effectiveness as well as cost.

4. Human Use Constraints: In most information systems used for management purposes, human capabilities and use characteristics often limit processing performance due to input errors, limits on output volume and variety, etc. User capability assumptions thus become part of the total system specification.

5. The Variety of Information Processed: The variety of transaction types, the variety of stored file content, and the variety of analytic and extraction classifications required determine the internal structure of programs, memory media that must be used, the type of reports that can be generated, the flexibility of the system, and the generality of its application. Two important measures of system variety are the number of distinct transaction types that must be processed and the number of distinct sub-classifications by which a file record must

be identified. Similarly, the variety of system interactions (which determine system complexity) increases with the number of different file structures that must be maintained as well as with the number of cross-reference, sequential access, and status maintenance steps that must be performed to keep the system up to date.

Of the five specifications, the last is the most critical, since it will affect, or be affected by, the former four. Thus, input/output volume by itself presents few design problems. If you must write 10,000 identical payroll checks each week, you look for a simple system that will produce that number of checks at the least total cost. But, if the payroll operation must handle a variety of different cases, e.g., construction workers who may in one day be employed at different skill levels, at different site locations, at different wage rates, the same 10,000 paychecks and the associated cost analysis requires a processing system of considerably greater complexity than before.

Indeed, it is important to realize that the five specifications cited above become a related package when we talk about information processing systems of any genuine interest for management control, as indicated by the two hypothetical payroll cases. For, if an information system is to be of general use for the management of a total operation, that information system must be able to handle a variety of conditions, produce a variety of reports as needed, and service a variety of management needs.

The Need to Compromise. Moreover, in any final design selection, the specification of the five system parameters requires us to compromise.

The designer has monetary, technical, and human resource constraints that rule out many theoretically conceivable information systems as infeasible.

Within the possibilities that remain, he must now adjust the information system parameters to produce the most effective information system to serve the specified management objectives, of which we shall speak later. In any case, given specified overall constraints and system objectives, the designer may trade one system specification for one or more of the others, e.g., response time for transaction variety, to achieve his final result.

The important point is that the information system designer and his clients cannot have their cake and eat it, too.

In any real setting there is always scarcity. If funds, technical skill, or human capability do not constrain, ultimately time itself is the avenger.

A man may search for the ideal wife. He may be consistent, logical, and clear in his female specifications. But if his specifications are more than a few, and if they are related, his search may not succeed before his time has passed. If the searcher has conflicting, unstable, or unrealistic values, he is in further trouble. And even while he searches and evaluates his prospects, they themselves (or he) may change with the passing days.

To get results, most reasonable men learn to compromise. He who values blondes and also warmth may trade some of both to gain a spouse. To gain a problem's solution while the solution still has value, we may accept less precision, tolerate less quantification, and work with sketchy assumptions. We may also shift our values to get a feasible result.

Practical decision-makers, of course, know the moral of this argument: How you are willing to compromise (as well as how much) determines what you get.

The misery of it is that there is no good theory of how to compromise in specific, complex cases, nor how to compromise in time. At the moment of truth, you are on your own.

However gloomy it may seem, something--if not all--can be gained from experience; a pattern of planning and selection can be developed, even a theory. (If we cannot so plan, if the world offered no patterns to learn, education itself would be worthless.)

Classical Cost/Benefit Decision Methods. When selecting the final information system design values, you can proceed as follows:

A. State a level of constraints: monetary, technical, and human.

B. Formulate the objective of the system in terms compatible with the system parameters previously discussed. For example, how much does faster response time contribute to the information objective? How much does file variety contribute? In practice it is difficult to come up with specific numbers, and the effects are usually non-linear and non-additive as they contribute to the whole. But, for the moment, assume we have the easily combined effectiveness measures. Then, just as we compute the score for a football game by accumulating seven points for each touchdown, three points for each field goal, etc., we may compute an objective value for each proposed feasible system.

C. Select the system design parameters that maximize the objective, given the stated constraints; or conversely, given a fixed level of performance to be achieved, adjust the system parameters to achieve that performance level at the least use of resources. The results are identi-

cal in both approaches given common performance, or objective levels, a fact noted clearly elsewhere.[1]

D. Repeat the process for different constraint assumptions (or conversely different performance requirements as above). Make the final selection on the basis of the information system which has the best cost to performance relationship for the scale of enterprise at hand.

This is the now classical cost/benefit theory of selection. Usually it must be modified somewhat in practice, largely because the performance criteria measures are difficult to define, quantify, and combine. But, the procedure's hope is that the compromises made in system selection and design can be delineated and approached rationally, rather than otherwise. That philosophy is worth using--even if you must take some shortcuts to make it work.

Practical Compromise Techniques. Several practical approaches can be used to modify the above theoretical selection approach so that its spirit may be applied in the absence of detailed objective quantification. For example, both users of information systems and system designers may be able to agree upon given system parameters as constraints or requirements rather than objective measures, which must be scaled. To illustrate, we might agree that a given information system to be of any use to us must handle at least 1000 transactions of at least five distinct types per week.

This approach eliminates a non-quantifiable and possibly incommensurate objective measure by its conversion into a requirement. Thus, as a first practical approach to overall system specification we exploit the use of system constraints and requirements.

A second important practical point is that information system design choices do not offer a continuous range of opportunities. For example, we may need to consider only several major alternatives, since intermediate choices are not available. If a computing machine must be selected, we have a limited choice of perhaps half a dozen levels of capacity to consider, not an infinite number.

Similarly, comparisons of one benefit level to another may be considered in jumps. Nobody (except in rare instances and certainly not here) cares about benefit improvements of one percent--even at fixed cost. We look for order-of-magnitude improvements in cost/

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[1] C. Hitch and R. McKean, The Economics of Defense in a Nuclear Age, Harvard University Press, Cambridge, 1965; Atheneum, New York, 1967 (paper).

benefit results when comparing alternatives. If such major differences can be found, many of the measurement problems inherent in close comparisons vanish.

So, if we constrain and eliminate, we thereby simplify: the range of choice is quickly limited and the choice evaluation becomes tractable.

To continue this approach (which we advocate with enthusiasm), we can now invoke several other principles. Both of the following points constrain system variety.

. In a given information system some transactions, inquiries, and reports will be much more frequent than others. (The same principle holds true even though the events under consideration may be weighted by their presupposed importance or value for management purposes.) To illustrate, we know empirically that if a firm has 1,000 customers, it is not unlikely that 150 of them will provide 80 percent or more of total gross sales. Many of the customers on the list are of little consequence in the total picture. In designing a control or information system, the less frequent (or less valuable) volume of variety usually may be treated less seriously, or even eliminated from consideration, without a definitive percentage loss in total system performance. (An alternative to elimination of detail is its grouping for class treatment; the simplification that results is equally helpful in the resolution of system specifications.)

Similarly, it is an empirical fact that some forms of detail are of transient interest, although other forms are of permanent value. To distinguish between the two is to simplify again. There may be important special cases as time goes by, but no information system designer and few management users are smart enough to forecast them all. Moreover, no reasonable information system can be planned to hold all the information that could possibly be of interest to everyone in an organization over an extended time. By building variety and volume from those items that are required over time, those which are likely to be of lasting importance (and those that our best forecasts indicate will be of major later importance) we can adjust the variety of the information system to include those important items. The remainder of our processing may then be forgotten, grouped, or handled as special cases if they justify such treatment.

The list of practical compromise techniques may be extended, but we have cited enough to make the necessary point: it is possible to find helpful techniques that can convert an otherwise hopeless system selection problem into a decision of maximum efficiency.

How these short cut strategies are employed, remember, determines the final information system that will be chosen. Yet, in the absence of these compromise techniques (or others like them) the theory of cost/benefit choice, though challenging, is sterile.

How you compromise determines what you get; but without some compromise, no practical result will come to pass.

Division Two

The previous section was necessary to set the stage for the detailed compromises required to make the METEP information system work. We continue the previous argument, but now direct it to the case at hand.

METEP and Tolerable System Variety. From an information system designer's angle, the first striking characteristic of the METEP educational proposal is that its information needs demand greater information variety and handling volume than do current educational processing systems.

For example, one educational principle in the METEP proposal is that students have a variety of instructional alternatives (IA's) available to them for each step in a chain of instructional progress. The increments in progress, which consist of passing specified performance criteria (PC's), form an increasing student history. At some designated level of total competence, achieved by the completion of a given number of PC's (many of which are elective), the student graduates. In this progression no time limit is imposed and PC may be demonstrated by several means, including pretests which can obviate IA participation.

Without discussing the merits of this principle--designed to give the student more flexibility, involvement, more rapid progress, etc.--consider how an adjustment of the number of distinct IA's and PC's available for choice affects an associated information system and its users.

As a starting point, assume that all PC's are independent and can be selected at will, in any sequence, like items from a Sears, Roebuck catalogue. Further, suppose that any IA associated with a given PC may also be selected freely by the student. In this case each student could generate a possibly unique historical record which for counseling, testing, resource planning purposes must be cross-referenced with other files and summarized from time to time to provide management statistics on the student population.

Now consider the following extreme proposals for illustration.

Case A: Only one PC. Suppose only one PC were required for graduation, e.g., one lengthy periodically administered final examination. Suppose further that there were no choice of IA's; every student was subjected to the same treatment, at the same time, and in the same sequence. This situation is the information system designer's delight, because few if any records need be maintained

and resource planning is trivial. The METEP proposal, however, seeks to alter the possible consequences of such a scheme: total inflexibility of student choice, a fixed time in the program (and its sequential parts) for all students, and the requirement that all students progress at the same pace in all subjects, which we know empirically is not possible. Thus, even though the information system designer and facility planner would like this traditional extreme, it clearly has its educational drawbacks and the METEP educational proposal is to discard its extreme constraints.[2]

Case B: A Host of PC's. At the other extreme, suppose we now propose 25,000 PC's and associated IA's. To take a number for illustration, suppose a student must complete 1,000 PC's to "graduate". Since the number of ways 1,000 items can be picked from a list of 25,000 is more than astronomical, the information system needed to control such an operation, particularly its cross-reference and planning requirements, is of necessity a complex and expensive operation. Here are two consequences of this case.

1.) If the student (or his counselor) must make the 1,000-item choice, both must understand and know the content of the catalogue. This situation may be compared to the diner who approaches his waiter in a Chinese restaurant requesting information on what to eat. The waiter, who may have an extensive printed menu before him, usually has no idea of what all the items are--and knows the diner does not either. The waiter simplifies at once and suggests egg rolls and fried rice. If the diner should be bold enough to request an exotic dish, the cook may not know how to prepare it, or not have the necessary ingredients to do so. Empirically, humans have little tolerance for excessive variety and quickly simplify on their own; and, moreover, it is not feasible to have large reserve capacity in little used resources.

2.) As the number of PC's increases, the elapsed time for their completion necessarily decreases. For example, for the 1,000 PC completion criterion and an assumed four year duration for the student's schooling, more than one PC must be completed each day of each academic

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[2]This extreme is typical of many European university practices, in which the student and his tutor periodically confer, and in which the student is free to prepare himself for the ultimate examination as he sees fit. In this regard, even this one PC approach offers the student educational flexibility, but success by this route presupposes self motivation and student intelligence above average, as well as quality tutors. Without such an elite, the method fails, and we choose not to make the elite supposition here.

year to achieve graduation within the four-year period. If detailed PC records and associated IA choice records are maintained, not to mention testing and counseling, the time consumed in record-keeping and choice of activities becomes a large part of the student and staff day. The transaction volume against the information system explodes and the response time for counseling, resource planning, and student choice decision must drop to real time. The result is an exponential increase in information processing and staff cost, as well as a reduction in the student's effective use of time. In short, with excessive variety and volume of choice, the very purpose of METEP educational proposals is defeated. We can predict what will happen here too. Both students and staff will seek their own simplification procedures usually by grouping large PC blocks. Systems with excessive variety beyond the capacity of their users to handle it fail unless they are cut to size.

The METEP Proposal Vs. Industrial Examples. It is easy to argue that the extreme case (B) is technically feasible by citing existing information processing systems which handle even greater variety than the hypothetical case. For example, department stores like Macy's stock 500,000 items; some military warehouses stock over 2 million; and, the Internal Revenue Service keeps computer records on approximately 80 million individual tax accounts. What is done can be done. And, indeed, the information processing required to handle Case B, above, is feasible--if we set aside human and monetary constraints.

However, the differences between the cited large scale information systems and the extreme Case B are several.

1.) On-going, large scale information systems usually work on a large economic base per transaction, or file record. Even though an airline reservation may cost $1-$2 to initiate and maintain, that cost is directly offset by the ticket purchase. With detailed PC and associated IA record keeping, up to four transactions per PC might be expected. For the 1,000 PC student quota assumed in Case B, the cost of a transaction is comparable to the airline system (on a real-time basis including human input/output time). A $4,000 annual per student cost for keeping records, particularly if such records do not add to the student's effectiveness but detract from it, is not appealing. Moreover, we have no direct way to evaluate the benefit to the student or the system of an additional transaction so the case of marginal economic decision-making that obtains for, say, order processing systems, is not present here.

2.) Most large scale information systems users need not understand the total scope of distinctions contained in the total information system. The typical large scale system works in independent groupings of detail, which come together only in summary.

When this fact holds, efforts may be highly departmentalized, hierarchies of organization imposed, and system variety for individual human effort and information processing thereby constrained.

To illustrate, the furniture buyer at Macy's need not know in any detail what the cosmetics buyer is up to, nor do the chief executives of that firm need or want to know the absolute detail of each transaction in any department. The managers look at summarized financial statistics, or spot check exceptional reports. Indeed, they could not handle the excessive variety of the total detailed picture. The same argument applies to the firm's customers.

Yet, if we take seriously a high component of PC and IA variety in the METEP structure, and offer that total menu to students, counselors, and administrators to coordinate as an interrelated whole, we presuppose that both managers and customers will be able to get the total choice picture in mind so they can not only find routes through the maze but also find individually satisfying and effective paths to the completion of their respective tasks.

The nearest industrial analogue to the METEP proposal is the job shop which undertakes manufacture of many distinct products, usually in very short production runs, on many different machines. Because the machines are interrelated by the routing requirements of each item, such facilities are usually plagued with planning, sequencing, cost control, and coordination problems substantially more severe than the limited variety operation. Work in process grows due to machine interference and product queueing, or alternatively substantial excess capacity must be provided to buffer the independent operations. Either alternative adds to the cost of system variety. Yet another "buffering" that makes such systems of manufacture work is increased information handling, e.g., expediting, real-time rescheduling, etc., which is just an alternative cost-substitution for excess inventory or machine capacity.

In short, variety which cannot be simplified is an additional source of cost, and even job shops have begun to group and simplify their operations by grouping and creating independent sub-departments by product families.[3]

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[3]Business Week, "A Way to Make Diversity Pay Off", October 18, 1969, pp. 152-154. This article describes job shop planning in Europe and Russia using a "family" grouping concept of machine location and loading. Two articles, M. Tondow, "Computers in the Schools: Palo Alto", Datamation, June, 1968, pp. 57-62, and A. Grossman, "The California Educational Information System", Datamation, March, 1969, pp. 32-37 illustrates school applications that at first glance appear similar to the present case. However, although large numbers of students are involved in each reported application, the record keeping is for highly independent records and files, quite contrary to the job shop type application presented by the METEP proposal. The two forms of processing should not be confused.

Another alternative in the machine shop analogue is the use of general purpose machine tools, often with numerical computer control or semi-universal jigs and fixtures to promote flexibility. In the educational scene this approach supposes one teacher can handle a wide variety of subjects and students as effectively as a specialist in each of many areas. We must also suppose that the teacher may be scheduled to do so according to the immediate demands of the work load. There may be a few teachers who are both capable and willing to accept such a challenging assignment and attendant uncertainty, but surely such flexible requirements would limit the pool from which teaching candidates can be drawn.

3.) What is done can be done. It may be argued (setting economic arguments aside momentarily) that such information handling efforts as the control of lunar landings and automated chemical plants which surmount great apparent complexity, could equally well handle the desired variety in an educational setting. This route to success demands the relaxation, elimination, or replacement of human constraints. Thus, if we could eliminate the teacher through the use of computer assisted instruction, a multitude of PC's and IA's might present no administrative problem. The route to graduation, the diagnostics, the record-keeping, the counseling, the teaching and the testing could be reduced to computer terminal input/output interaction with the student. The teachers could devote themselves to creating teaching programs that would have great multiplicative benefits. And, it is possible that the cost per "processed" student would be less than at present if the approach were extended to a sufficient base, or student population.

Such proposals have been made for some time, and as the cost per student terminal hour drops to $1 or less (excluding course preparation) this route to variety conjures up a cornucopia of dreams--many of which will become a reality. (In some applications the cost per terminal hour is already less than $1 per hour, a fraction of the instructor's hourly cost per student in a typical class.) We can have immediate student diagnosis for detail--spelling, grammar, mathematical rules, language translation, scientific computation, simulated experience, etc. The technology will not fail us, and the economics can be made realistic if we are willing to eliminate also excessive human intervention on the teacher's part in the educational process. That is the compromise required in this last illustrative alternative.

Yet, if the educational system omits the direct human interaction required to achieve the latter form of success, it thereby relinquishes also the variety of cultural values that society transmits to its young through their association with other individual human beings. Even setting aside the problems of creating computer programs that could evaluate the quality and importance of a student's written theme or screen his other forms of creative effort, it should be clear that an automated system must standardize its procedures of selecting excellence in non-logical, non-quantifiable areas where human judgement,

intuition, compassion, and redemptive sense can admit and will accept a variety of evaluations, as well as pass that ability along. In short, although the superficial promise of automated teaching and administrative systems is the promotion of greater variety of student choice and experience, it may well turn out that such variety is an illusion. We may end up producing virtuosos who expertly generate variations on a theme; but the constant theme itself will be set by the computer program that evaluates English 1, or its equivalent.

The Law of Excessive Variety is with us still; in the latter case it just manifests itself in a more insidious and disguised form than before.

So even though it is possible to handle large-scale systems with success, we must compromise to do so. We pay more (one way or another) for increased variety and increased flexibility. That must be a foregone conclusion. We also never get around the need to make a compromise with the ultimate variety that can occur in any selection process that offers any range of alternatives. That necessity, too, is a foregone conclusion.

How shall be compromise, and how much shall we pay for variety, in the present case at hand--the METEP proposal--for increased flexibility in the educational process?

Feasible Constraints for METEP Control. Without going further into detail it should be clear that the authors of this Section are in favor of gross simplification in the degree of METEP variety--at least at the outset and under 1970 economic and human constraints. Our industrial experience as well as information handling theory can lead us to no other conclusion.

Although we are in sympathy with the aim of more flexible educational experience and a reasonable variety of PC and associated IA choices--which may offer the student more flexibility, satisfaction, and timely progress--we are also of the opinion that an excessive range of choice would be detrimental, confusing, and frustrating for the student, as well as cumbersome, costly, and possibly chaotic for administrative planning and control. We have not been able to convince ourselves that there is a direct and infinitely continuing relationship between increased educational variety (with correspondingly increased costs) and ever-increasing direct benefit to the student or to society.

Within limited ranges of variability, then, we do view the METEP proposal as beneficial and feasible. But it is within limited variety constraints that the following information handling proposals are made.

A Bench Mark. To provide a feasible design we now suggest an information processing and control system for METEP that will meet clearly feasible economic, technical, and human limits. We sketch the major assumptions here, describe the detail in Division Three. Then, in Division Four we indicate the extensions and variations that can be made from our standard of comparison.

Although our bench mark system is based upon our best experience and theoretical knowledge, it too represents a compromise--an arbitrary choice based upon what we know about information systems, the METEP program, and the limits set by both. Most standards, in fact, are arbitrary, though necessary. So is the following prototype design specification arbitrary: it is a feasible point from which to work.

Some Feasible Assumptions. In the initial view of a proposed METEP system, our pedagogical colleagues indicated an interest in record-keeping for upwards of 20,000 PC's (and the corresponding number of IA variety). It was our initial opinion, for reasons heretofore delineated, that for human, cost and technical reality, such a diversity would not be feasible in the present setting. After numerous discussions, the total list of PC's and associated IA's was reduced, for thirteen pedagogical areas, to 717 PC's and 1521 IA's, as detailed in Table 1. Such a list is clearly feasible from an information processing point of view, and by June 10, 1969, we had accepted these upper bounds for further study.[4]

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[4] In the computer simulation described elsewhere in this report the total number of PC's used was 581, and the total number of associated IA's was 948. These numbers, somewhat lower than those shown in Table 1, were for "Generalists" only, and did not include any specialization. Further, the simulation runs reported required students to complete all 581 PC's, except for those waived due to pre-tests. In this sense, the simulation focused on scheduling problems and student choices over time not to a student choice of given PC's from a larger list. The requirement that all PC's in a given list be completed was a necessary assumption in the preliminary simulation designs. However, following the METEP philosophy, later choice patterns in practice will permit selection from a larger PC list of which Table 1 is typical.

TABLE I

INITIAL SPECIFICATIONS FOR PC AND IA
VARIETY FOR A FEASIBLE BENCHMARK DESIGN

Area	PC #	IA #
Social Studies	122	297
Early Childhood	27	60
Language Arts	78	204
Human Relations	145	310
Math	76	130
Behavioral Arts	94	170
Science	175	350
Total:	717	1521

It was nevertheless our view, as discussed in Division Four, that further simplification and organization would be necessary for human understanding of the system and particularly for the scheduling of resources. Although these initial simplification arguments were later found to be a valid necessity in practice, we nevertheless proceeded to develop a bench mark information system design that would handle the required variety of PC's and IA's, as stated in Table I on a one week batch updating basis, for a volume of 800 students at approximately $100 per student annually (a cost which equals about 3% of total annual educational cost per student, and seemed to us feasible as a starting point).[5] We further presupposed that resource scheduling would be on

[5]The actual cost per student at most institutions ranges from $3,000-$4,000 per year, when all costs, both operating and capital, are considered. Thus, the $35 million operating budget of the University of Massachusetts, when divided by 15,000 students, provides an operating cost per student of over $2,000. Amortized capital costs for buildings, equipment, etc., when added to that sum easily bring the total figure into the $3,000-$4,000 range. In the financial section of this report, an annual $1,580 cost per effective student is cited for present School of Education operations, with a projection of $1,967 under the MEDEP

a manual basis at this time, but that the bench mark system must provide both historical and forecast assistance to resource planners, be they either a centralized or a departmentalized group of personnel. Within the specifications and assumptions outlined above, the information system of Division Three is feasible and may be modified, as therein indicated, to shift with later alterations in system specifications without drastic revision of our proposal.

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[5](continued) proposal. These latter figures include only the salary costs of instruction and administration, plus some allowance for special laboratory facilities and equipment directly attributable to the School, and therefore exclude all additional operating costs, as well as capital costs. Addition of the omitted costs brings both the overall figure used here and the specialized figure used later into agreement. Finally, for the sake of comparison, the net instructional cost per student at the University of Massachusetts, as reported in the AAUP Bulletin, June, 1969, p. 231, is $803 per student. This figure may be reconciled with those given above by the addition of all costs not due to professional instruction salaries. Further comparisons made in this Section are based upon the $3,000-$4,000 gross cost, first explained above.

Division Three

The current technical state of management information system art as well as current design methods have been reviewed elsewhere.[6] Briefly, major interest revolves about file structure and content, as well as how such files are tied together by processing procedures and input/output requirements. Although file accessing techniques are well developed not only in general but also for specific applications, file structure in a given case can be improved only when actual statistics of use have been obtained. Thus, most existing information systems of the type described hereafter, rely heavily on redesign of an initial test system once the facts are in.

For example, if certain transaction types, or certain file categories in fact show higher than average activity rates, the identification codes and file structure for these selected items may be altered to increase processing efficiency. If some file categories are never or seldom used, they may be eliminated or grouped with others, to reduce file complexity. Yet, to perform such refined improvements we must know how the particular users of a given system will in fact use it.

Thus, in addition to the provision of initial control, one purpose of the proposed bench mark system is to generate historical use statistics that can lead to later redesign. Since we do not now have such figures, we have used our best estimates of what will be needed for the METEP bench mark design.

File Types and Structure. The proposed system employs four files, structured initially as in Table 2. (In that table, the file content and format appear in the style of a COBOL language DATA DIVISION and

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[6]C. A. Cuadra (Ed.) Annual Review of Information Science and Technology, Vol. 4, Britannica Reviews, Chicago (October 1969). This volume, sponsored by the American Society for Information and the National Science Foundation covers progress through 1968. See especially Chapter 2, R. V. Katter, "Design and Evaluation of Information Systems", and Chapter 4, M. E. Senko, "File Organization and Management Information Systems."

See also Datamation, November 1969, "File Management Systems: A Current Summary", Carolyn J. Byrnes and Donald B. Steig, pp. 138-142.

is largely self-documenting, although we shall review the details momentarily. COBOL is a computer language widely used for file manipulation, and is in standard U. S. Government use for this purpose.)

The four files are: (1) a student record file, (2) a resource record file, (3) a PC catalog, and (4) an IA catalog. The latter two files are to be used as a unit; the separation is for technical processing efficiency rather than for logical reasons.

The student file contains a record for each student in the system. Each such record is divided into two parts; the first, a "header" containing complete student identification, test profiles at entry, etc., the second part is the historical record (which may contain a different number of entries for each student, or for a given student as time progresses). The student history details the PC progress for that student. In the file description shown, we have first assumed that the PC history will not exceed 999 items, but this may be extended as necessary. The PC record segment shows the PC chosen, the date started, and the date completed. One field has been provided for indicating the IA chosen for a given PC, should that information be of permanent interest (by student). For example, we may wish to know later if students of a certain type consistently select one IA for a given PC. The DATE-COMPLETED field will be used to record, in addition to actual PC completions, other possible outcomes of the PC encounter (withdrawals, failures, substitutions, repetitions, etc.). See later discussion of transaction types.

The resource file contains a listing of all available resources that must be planned for or scheduled, including human resources, physical space, and equipment. A historical portion of each resource record provides both for a recapitulation of which resources were used at what time, and also for a precommitment of resources, before they are consumed, for the purpose of capacity checks. For each resource, we also have "availability" figures, in terms of hours that may be committed per week. Through appropriate identification codes, the particular resource indicated may be tied to a given individual, room, or piece of equipment.

The PC file lists all PC's currently available to the educational system, with the corresponding PC code, for later statistical analysis by area, by group of PC's within an area, etc., together with a variable length cross-reference list (which ties the PC file to the IA file) to avoid repetition of IA detail in the master catalog. This is so, because in some instances, one IA may satisfy one or more PC's as well as vice versa.

The IA file contains a listing of all the IA's currently available to the system. Each IA record contains the required resources that need be committed for its completion, as well as a historical record of that IA's selection and use. Note that from a given PC record, we

TABLE 2

FILE TYPES AND STRUCTURE

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DATA DIVISION.
FILE SECTION.
FD  STUDENT-FILE RECORDING MODE IS BINARY HYPER DENSITY. LABEL
    RECORDS ARE STANDARD VALUE OF IDENTIFICATION IS @STUDENT-DATA
-   -FILE@ DATA RECORD IS STUDENT-FILE-DATA.
    01  STUDENT-FILE-DATA.
        02  HEADER-RECORD.
            03  STUDENT-NUMBER              PICTURE IS 9(7).
            03  STUDENT-LAST-NAME           PICTURE IS A(20).
            03  STUDENT-FIRST-NAME          PICTURE IS A(8).
            03  STUDENT-SEX                 PICTURE IS 9.
            03  STUDENT-LOCAL-ADDRESS.
                04  STATE                   PICTURE IS A(2).
                04  CITY                    PICTURE IS A(15).
                04  STREET                  PICTURE IS A(20).
                04  ZIP-CODE                PICTURE IS 9(5).
            03  STUDENT-LOCAL-PHONE         PICTURE IS 9(7).
            03  STUDENT-HOME-ADDRESS.
                04  STATE                   PICTURE IS A(2).
                04  CITY                    PICTURE IS A(15).
                04  STREET                  PICTURE IS A(20).
                04  ZIP-CODE                PICTURE IS 9(5).
            03  STUDENT-HOME-PHONE          PICTURE IS 9(10).
            03  STUDENT-MAJOR               PICTURE IS 9(2).
            03  STUDENT-SUB-MAJOR           PICTURE IS 9(2).
            03  STUDENT-PROFILE OCCURS 25 TIMES.
                04 STUDENT-PROFILE-RECORD PICTURE IS 9(3).
            03  STUDENT-PERFORMANCE-DATA  PICTURE IS 9(3).
        02  STUDENT-PERFORMANCE-RECORD OCCURS 1 TO 999 TIMES
            DEPENDING ON STUDENT-PERFORMANCE-DATA.
            03  DATA-RECORD.
```

TABLE 2 (Continued)

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FD  PC-FILE RECORDING MODE IS BINARY HYPER DENSITY. LABEL
    RECORDS ARE STANDARD VALUE OF IDENTIFICATION IS
    @PC-FILE@ DATA RECORD IS PC-DATA-FILE.
    01  PC-DATA-FILE.
        02  PC-CODE.
            03  PC-AREA                        PICTURE IS 9(2).
            03  PC-SUB-AREA                    PICTURE IS 9(2).
            03  PC-SERIAL                      PICTURE IS 9(2).
        02  PC-TYPE                            PICTURE IS 9.
        02  PC-EVALUATION-TYPE                 PICTURE IS 9.
        02  IA-TRAILER                         PICTURE IS 9.
        02  PC-FILE-IA-TRAILER OCCURS 1 TO 10 TIMES
            DEPENDING ON IA-TRAILER.
            03  PC-IA-CODES                    PICTURE IS 9(3).
FD  IA-FILE RECORDING MODE IS BINARY HYPER DENSITY. LABEL
    RECORDS ARE STANDARD VALUE OF IDENTIFICATION IS
    @IA-FILE@ DATA RECORD IS IA-DATA-FILE.
    01  IA-DATA-FILE.
        02  PC-IA-CODE.
            03  IA-AREA                        PICTURE IS 9(2).
            03  IA-SUB-AREA                    PICTURE IS 9(2).
            03  IA-SERIAL                      PICTURE IS 9(2).
        02  IA-CODE                            PICTURE IS 9.
        02  IA-HOURS-PER-WEEK                  PICTURE IS 9(2).
        02  TOTAL-IA-TIME                      PICTURE IS 9(2).
        02  MINIMUM-STUDENTS-REQUIRED          PICTURE IS 9(2).
        02  MAXIMUM-STUDENTS-POSSIBLE          PICTURE IS 9(3).
        02  TYPE-OF-HUMAN-RESOURCE             PICTURE IS 9(3).
        02  NO-OF-WEEKLY-CONTACT-HOURS         PICTURE IS 9(2).
        02  OTHER-HUMAN-RESOURCE               PICTURE IS 9(3).
        02  PHYSICAL-SPACE-REQUIRED            PICTURE IS 9(2).
        02  EQUIPMENT-REQUIRED                 PICTURE IS 9(2).
        02  NAME                               PICTURE IS A(12).
        02  OFFERINGS OCCURS 24 TIMES.
            03  OFFER-TIME                     PICTURE IS 9.
```

TABLE 2 (Continued)

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                04 P-C.
                    5   P-C-AREA            PICTURE IS A(2).
                    5   P-C-SUB-AREA        PICTURE IS A(2).
                    05  P-C-SERIAL          PICTURE IS A(2).
                04 DATE-STARTED.
                    05  START-YEAR          PICTURE IS 9.
                    05  START-MONTH         PICTURE IS 9(2).
                    05  START-DAY           PICTURE IS 9(2).
                04  DATE-COMPLETED.
                    05  COMPLETED-YEAR      PICTURE IS 9.
                    05  COMPLETED-MONTH     PICTURE IS 9(2).
                    05  COMPLETED-DAY       PICTURE IS 9(2).
                04  UNIQUE-IA-ID            PICTURE 9(3).
FD  RESOURCE-FILE RECORDING MODE IS BINARY HYPER DENSITY. LABEL
    RECORDS ARE STANDARD VALUE OF IDENTIFICATION IS @RESOURCE-DAT
-       A-FILE@ DATA RECORD IS RESOURCE-DATA-FILE.
    01  RESOURCE-DATA-FILE.
        02  FIXED-LENGTH-RECORD.
            03  TYPE-OF-RESOURCE            PICTURE IS 9.
            03  SERIAL-NUMBER               PICTURE IS 9(2).
            03  NAME-OF-RESOURCE            PICTURE IS A(15).
            03  CAPACITY-OF-RESOURCE        PICTURE IS 9(3).
            03  LENGTH-OF-COMMITMENT-REC    PICTURE IS 9(2).
        02  COMMITMENT-RECORD OCCURS 1 TO 20 TIMES
            DEPENDING ON LENGTH-OF-COMMITMENT-REC.
            03  COMMITMENT-RECORD-DATA.
                04  DATE-OF-COMMITMENT      PICTURE IS 9(4).
                04  HOUR-OF-COMMITMENT      PICTURE IS A(1).
                04  TOTAL-HOURS-COMMITTED   PICTURE IS 9(2).
```

may reference all the legal IA choices that a student may make, and thereby check each asserted student IA choice for a given PC against those IA's specified for its preparation. Similarly, given a number of student choices for a legal IA, we may tie that set of choices in summary to the corresponding resource record by virtue of the cross-reference between resource and IA provided in the IA records shown in Table 2.

The PC and IA files, of course, will contain the variety of entries specified in Table 1 of the last division.

File cross reference. A careful study of Table 2 will reveal that each of the four files mentioned above is even further interrelated, and that the set of files as a whole may be considered as a planning package.

To illustrate, the student file relates each student to the PC file by means of the student's choice sequence of PC's, which, if that historical category in the student record is used, also gives a student IA cross-reference.

Similarly, the PC and IA files can be related to the resource file, as previously noted, so that proposed student PC and IA choices, as obtained from the student records in summary may be expanded into specific resource projections for future planning, as well as for the development of historical statistics of actual PC/IA and resource use--by virtually any breakdown desired for management reporting.

Using the proposed file structure, for example, we may determine the efficiency of resource use by category (or by individual resource), study proposed student choices versus actual results (both by category and over time), determine the frequency of PC and IA choices and their utilization (a number useful in grouping or expanding the PC and IA offerings), and also make a number of statistical analyses of student background, history, and performance, as they are related in combination. (Appendix A to this report indicates a random selection of over fifty questions that may be answered for management purposes by a proper manipulation of the file data proposed here.)

As a technical point, note that the student file, which is here proposed for tape implementation at the present time, is easily expandable for more students as well as more PC's and more historical items per student. On the other hand, the resource file and the PC/IA combination file presents a technical limitation upon file item count, or file length. In the latter case, for processing ease, the PC/IA and resource files have been planned for storage in the computer's highest speed, and most costly form of memory device (core storage) so that processing of intermediate detail need not be detained by the need for sequential file search (as opposed to direct, or random, access to the information needed).

File format modification. The files shown in the detail of Table 2 are not supposed to be in the most efficient format that may be possible once the use statistics of PC's, IA's, and resources are known. Indeed, we fully expect that a later reformatting of all of the specified files will be both desirable and necessary to achieve the greatest processing efficiency, as well as to achieve improvements in management control of the educational system.

We should note, however, that the essential categories necessary for planning and statistical use analysis have been provided in the stated design of Table 2, and that later reformatting, reorganization of files, and requisite simplification can proceed on an automatic (i.e., computer programmed basis) if the initial data have been collected in its detailed form as shown. Thus, we may easily group, eliminate, and otherwise reorganize the detail if it is at first present, and for that reason, we have entered into the initial file design those categories which to us appear relevant to the current problem, or its forecasted sequels.

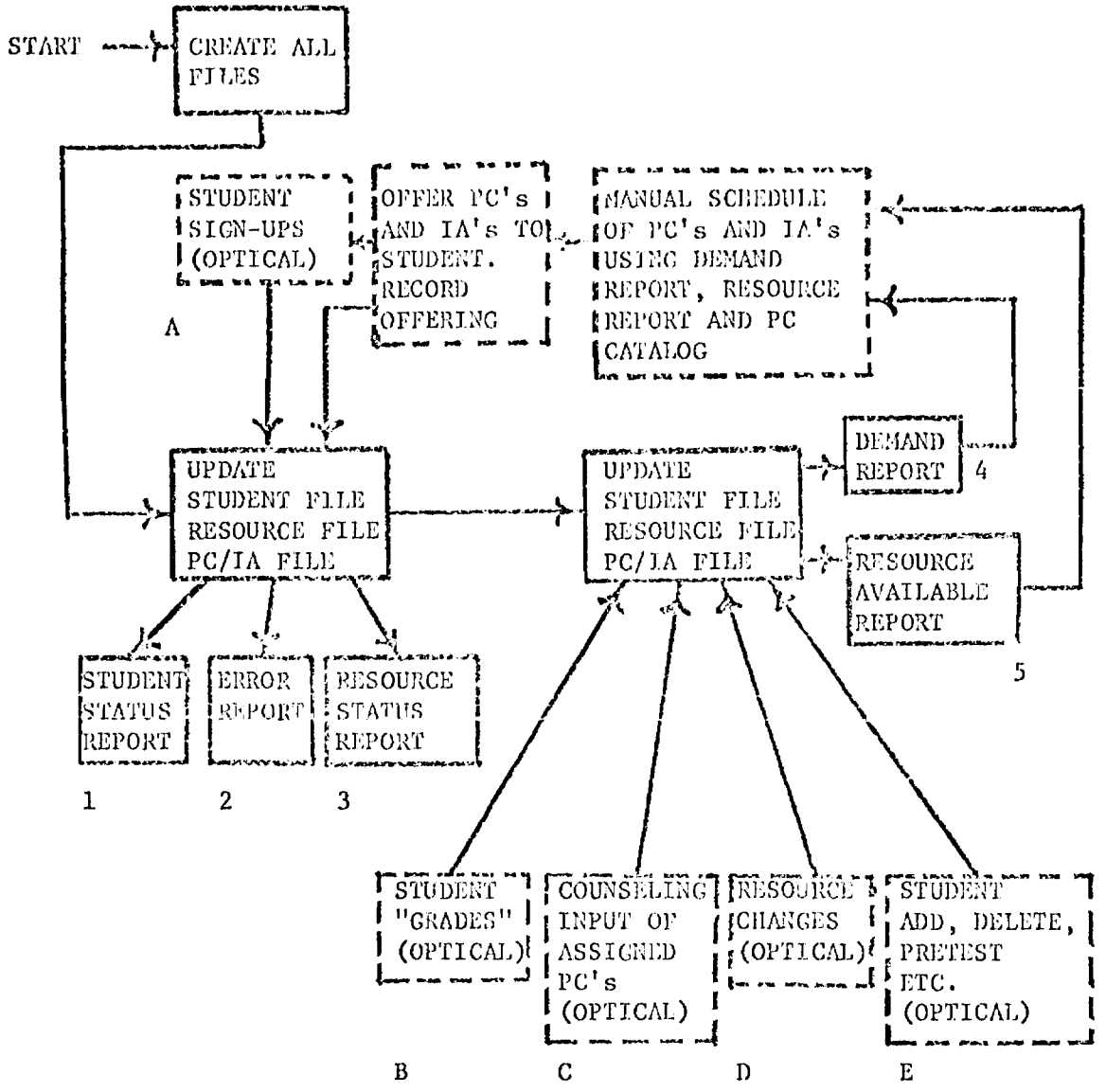
As will be evident later, however, it was our intention in specifying the files of Table 2 to provide sufficient generality of design so that later moves to, say, real time as opposed to batch processing would not necessitate complete loss of our previous work. Indeed, with relatively simple recoding and reformatting of the presently suggested files, the proposed system could be moved from a batch operation, as specified in this proposal, to its real time counterpart using remote terminals and the airline reservation analogue when such a move can be justified economically. We believe the real time alternative not to be feasible economically at present.

File Processing and System Operational Procedure. Figure I illustrates the procedural sequence for operation of the proposed management information system--using the four files described in Table 2.

First, commencing at "START" the system is initiated by the creation of the student file, the resource file, the PC file, and the IA file from current planning data (e.g., what rooms, people, and equipment are available, what PC and IA types are available) and from incoming student records.

Then, the procedure starts with an initial precommitment of students to PC's and their corresponding IA choices, either through counseling or by standard starting criteria. Once this initial assignment has been made, the system now proceeds to cycle. As reasoned later, we suggest a one-week batch processing operation for initial experimentation.

FIGURE 1



File Processing Sequence for Management Information System. Optical inputs, lettered A through E, provide file update after initial files have been created. Periodic reports, numbered 1 through 5, provide information for counseling, scheduling and management control. Detailed structure of files, input records, and reports is discussed in text.

Input Transaction Types and Output Reports. In Figure 1, we show five types of input transactions, identified by letter and indicated in the figure by dashed boxes, and five output reports, identified by number and indicated in the figure by double-lined boxes.

As a consequence of the initial student PC-IA set of combinations, we may generate (1) a student status report, showing in whole, or in part, the student's current record of assignments together with as much background data as may be desired for counseling, (2) an error report, indicating illegal PC/IA combinations, data input errors of other types, and such detail as may be needed for technical correction of procedural processing errors, and (3) a resource analysis report, indicating in summary the resource need in relation to the selected PC/IA combinations. In later cycles through the procedure, it is intended that the student be able not only to confirm certain PC/IA schedules, but also to indicate his intent to make such selections, so that the later resource reports will indicate the resources needed to fulfill future student demand.

Thereafter, the students pass through their experiences, and as a consequence of them generate a number of inputs (B-E) through counseling, through testing, or through plan alterations which may occur in the interim. Similarly, alterations in available resources are also entered here.

Thus, the next inputs are student "grades" recorded as "pass" or "fail" for a given PC, counseling input of desirable future PC and IA choices, resource changes that may be necessitated from time to time (additions, deletions, changes in capacity, etc.) and updates to the student file (student additions, deletions, pretest results, transfers, repetitions of PC's, etc.).

With this data in hand, we may then repeat the update operation, this time for planning purposes of the administration, not for the student. The secondary run, indicated in the solid box above the transaction input (B-E) produces two reports numbered (4) demand report, and (5) resource available report. The purpose of these reports is to facilitate internal resource planning, i.e., the announcement of the future availability of specific PC/IA choice categories. This step presupposes that both students and counselors are at the time aware of student "grades" in each PC, and are aware also of any individual student changes in status reports (an intermediate copy of student status report (1) can be provided on special request for individual analysis). The latter still remains on a batch basis in the present scheme.

With reports (4) and (5) in hand, we move to two unnumbered dashed boxes, which indicate manual operations of scheduling decision and PC/IA offering for the next cycle period.

We now pause in our system description to discuss the reasoning and logic behind the manual planning steps.

Scheduling and Allocation of Resources to Meet Demand. In the procedure of Figure 1, we purposefully left to manual and human operation the development of schedules and resource allocation, although it might appear that this is one step in the overall system that should have been automated. Because of that step's difficulty, we reasoned differently.

First, most existing computer programs that successfully schedule students, staff, and resources, are not algorithmic, that is, they do not proceed by a mathematically defined step-by-step sequence to a guaranteed solution. Rather, the successful procedures are highly heuristic, which is to say, they use rules of thumb or experience, however sophisticated, to generate the final plan. (For the current state of this art, see Chapter 4 of Cuadra, op. cit., which reviews applications through 1968 for both schools and job shops.) The necessity for this heuristic trend appears in most scheduling problems of any consequence, since most are too complex for present (and perhaps forseeable) algorithmic implementation: the mathematical procedures that might work in such combinational problems are not known at present, and, if they were, the computational time required for an "optimal" solution by such techniques would likely be excessive. In fact, the problem of scheduling job shops, to which the METEP educational proposal is analogous, is one of the most difficult data processing tasks that can be imagined. So we stepped around it, knowing that we faced a situation of ultimate variety and human concern.

Second, it was our hope that by leaving the scheduling problem to humans, on a decentralized basis, we might learn what heuristics might apply and be humanly acceptable in this case. We were not disappointed by this approach.

Commencing in September 1969, to the date of this report, the pedagogical team leaders at the University of Massachusetts School of Education were confronted with the problem of scheduling their resources and their students as best they could. They succeeded with their experimental groups by a variety of methods, most of which invoked the same principles of simplification previously discussed in Divisions 1 and 2.

Without going into excessive detail, here are two approaches that were used:

In the mathematics area, a four-week time horizon was developed for scheduling personnel and students, with an IA sequence of that duration which would lead to the preparation for a number of grouped PC's. To provide flexibility, however, this offering was repeated on

staggered starting dates displaced one week each in time for four offerings. Thus, although the staff and facilities could be planned for in advance, a student could place himself in any one of four groups, and pick up the progress in any one of them as he selected. This practical method provides the illusion of flexibility in combination with the actual rigidity and look-ahead required for stable planning. And, in coming to this practical result, the personnel involved began to appreciate the necessity for simplification, even when electronic computers are available for record keeping. In performing their simplification (by grouping IA's), the personnel employed their highest human talents--that of pattern recognition and the exercise of value judgments in decision-making.

In the language arts area, a completely different approach was used. Although a five-week time horizon was selected, and formal lectures developed daily for that period (with one IA experience for each PC), here too the need for advance pre-planning was recognized and exercised. To provide flexibility for this fixed segment of live presentations, this group chose to record the live material on magnetic tape, which presented an alternative set of possible experiences for students who missed or chose not to attend the live performances. The scheduling of students to the live offerings or to the alternate tape experiences was conducted within this area on a student signup basis. For example, tape playback equipment was on a signup basis, so that students themselves assumed the burden of their own commitments--even though the facilities were fixed in capacity over time. In this instance, checks of student progress were maintained manually (in fact on a large chart on the back of the supervisor's door) so that the total picture of group progress involving 125 students could be monitored. The latter record of results is easily automated, although the scheduling is not. This successful supervisor also walked around the problem of scheduling by having the students schedule themselves informally, and only retained the results of the student's own efforts for analysis and review.

With this experience in hand, we see no reason why there should not be a diversity of planning and scheduling methods in the total system, nor why this is not a beneficial policy for teacher education as well as an economy of processing and control efforts. Indeed, the only essential we see to bring these diverse methods together in the whole is to provide the departmentalized planner. ne guide to prospective student demand and resource need as well as to provide reasonably current records of individual student progress for review, as provided by the sequence illustrated in Figure 1.

In this vein, at a meeting on November 5, 1969, we agreed with the pedagogical team leaders that a one-week planning and reporting period would be more than sufficient for implementation of the present plan, and that such a data processing effort was feasible, provided the area supervisors scheduled their affairs as they had already done, of necessity in their experimental trials in periods exceeding one week.

Completion of the Processing Cycle. Returning now to the details of Figure 1, we propose that as a consequence of the administrative planning resulting from reports (4) and (5) advance offerings of PC/IA combinations be made available to students, preferably as far in advance as possible. Such offerings, when limited, can be handled on a manual basis; or, if extensive, can be checked for feasibility against the resource file as a special run. (In this step, it may be desirable to have the resource file available to a limited number of planners on a real-time basis, although not to students. One or two administrative planning terminals, even at this time, may be justified for trial-and-error utilization of resources in advance. Such intermediate administrative experimentation may reveal more effective heuristic rules for future planning, and we consider this step a potential benefit in teacher and administrator education. This possible intermediate experimental sequence is not shown in Figure 1.)

We forsee that the result of the human scheduling effort noted above will be made available to the student body as an upcoming list of offerings which may be committed, on a first-come, first-served basis. Thus, to cite one practical method of implementation, limited resources could be reserved by students by their own signup until the resource was exhausted (as noted for the language arts experience to date) or handled manually on a large display board for room and equipment assignments on a group basis.

Regardless of the method of student-resource commitment, we end up with that cross-reference for historical purposes and can now input it into the system, via the student input transaction, labeled (A) in Figure 1.

Data Input Forms and Means. We have suggested elsewhere that optical input forms be used, even for the weekly update system proposed as a starting system. This form of input is easily organized, and eliminates the intermediate cost and delay of card key-punching, presently familiar in industry. The optical form of input is natural in the educational setting, since the same equipment can be used to accept student and counselor initiated input using a pencil for both file updates and test administration. (For example, a typical device for this purpose, the Digitek optical reader, is widely employed for test scoring, and can be programmed to provide either test scores or data cards for direct computer input. A highly underutilized unit of this type happens to be available for interim experimentation at the University of Massachusetts.) For alternatives to the optical input in our proposal, see Division Four.

Data Output Forms and Means. At the start, we propose that data output reports be provided in hard copy, or paper form. Using this proven approach, each student and counselor can be provided with a permanent historical record of commitments and progress. Similarly, an easily read historical record can be made available to administrative planners. In later modifications of the proposed system, it is possible, first on a limited, then on an expanded scale to provide students and planners with access on a remote terminal basis to immediately pertinent data should that be necessary as cycle times are reduced. However, with a one-week cycle time, and hopefully a more lengthy planning horizon, we see no present necessity for a real time inquiry, with the possible exception of administrative planning--perhaps using simulated planning tests as described in the simulation section.

Some Technical Programming Details. Following the present technical trends in management information processing design, we propose that, wherever possible, programs written to implement the suggested procedures follow a "format independent" style in which data formats used for both input and output can be changed at will as possible file improvements change the data base, or file structure.

This feat is possible for input changes by providing a file-supplied record, or header, which precedes the normal data records, which itself specifies the format in which the later records will appear. Thus, although a computer program may be written generally, the precise format of each data entry may be left to the time of execution, and a standard processing procedure may by this means be made amenable to variations in entry format. This form of advanced programming is highly desirable for processing experimental files, and is suggested in this case.

Similarly, by separating the main processing program from final output editing and report generation, and by further transfer of the modified input formats to later editing modules, as is possible with advanced programming techniques, which we shall not go into here, to make output reports data-base independent in regard to shifting input file formats.

Although this approach is not widely used at present, we suggest that it is desirable, as well as feasible, for the system heretofore proposed, and that, because of the likely changes in the PC/IA files in particular, future investigators heed this point with care. (See Cuadra, op. cit., Chapter 4, summary conclusions.)

The Management Information System and Other Efforts of this Project. The management information system described in this section is tied directly to other parts of this report, especially the simulation projects and trials (see Section V) and the other management policy recommendations (see Section III).

Seldom do administrators or users of an information system appreciate the variety of questions that may be answered by specification of inquiry categories from even a limited set of those available, nor, regretfully, do they often appreciate the difficulty, both human and technical, which may be encountered in answering questions that have not been anticipated in advance of their need. Appendix A will illustrate the former ability, but only foresight can assure that the informative detail that may be wanted on a historical basis will, in fact, be available when requested.

The information system proposed in this section as a feasible design for the METEP project's implementation provides an exceedingly wide range of information. The system proposed also provides close control of short-term plans at minimal cost, a topic which is the subject of the next division. But, the system as presently outlined does not presuppose coverage of all inquiry types that could occur in management crises of the future.

Our suggested design is not for instantaneous status inquiry and instantaneous planning or for long range prognostication or control of strategic educational values. It is a bench mark system from which to work, both in cost/effectiveness evaluation and later systems analysis on an intermediate time scale basis.

Division Four

We now turn to a discussion of system costs, benefits, and suggested extensions due to future economic and technological changes. First consider the bench mark case of the last division. Then, we progress through an analysis of eight other alternatives, specified by widely differing values of student PC volume. By this procedure we reject six of the nine alternatives as unfeasible, and finally concentrate upon the three remaining feasible cases. Finally, we turn to more detailed adjustments from the bench mark.

Pricing the Bench Mark Case.[7] To provide a starting point for cost estimation, we have made the following assumptions:

1. Students in system: 800
2. Number of PC's in file: 1,000
3. Number of PC's to completion: 300
4. Number of years to completion: Two

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[7]The numbers used in this costing comparison have been selected to provide ease of computational understanding, and are somewhat different from those indicated in the simulation chapter for several reasons. As previously noted, the simulation data included 581 PC's and 948 IA's. Of the 581 PC's listed for the simulation, all were required of each student, except those pre-tested successfully. The requirement for completion of the total list was a technical requirement of the early simulation program, since no data was available on the probabilities of student elective choices of PC alternatives. After pretesting, the number of PC's required of the simulated student dropped to about 400; and, to obtain graduation in reasonable time periods, the simulation showed that only about 70% of those 400 PC's could in fact be required due to resource conflicts over time.
The net effect is that simulated students usually "took" roughly 300 PC's, as shown in this section. The authors of this Section believe that the student choice of 300 from 1,000 possible PC's will more nearly approximate operating reality than the "total" or "70%" requirement assumed in the current simulation. Moreover, the following argument and its comparisons follow from the transaction rates demanded of the information-processing system as the number of required PC's to graduation increases, so that the straight-forward arithmetic used hereafter can be modified with ease if the total number of PC's required increases or decreases. Thus, given the explanation above, the remainder of this Section is completely consistent with the simulated results, as well as with what we consider to be operating reality.

5. Number of days per academic year: 150

6. Number of PC's required per day for two year completion: 300 PC's/500 days = 1 PC per academic day

7. Number of effective transactions per PC: Two (One initiating a PC and one terminating a PC.)

8. Possible variations in Transaction input: Depending upon the advance scheduling volume and first-time scheduling success, the number of transactions estimated in (6) and (7) may vary upward, e.g., if several transactions are required to schedule for one PC, if several tests are required, if PC's are repeated, dropped, etc., the number of transactions per day could easily double or triple. On the other hand, if PC's are more tightly grouped, if students batch their transactions, say on multiple entry forms, and if mostly historical, rather than scheduling information is maintained in the files, the number of transactions could drop to less than our estimated two per day. It is our hope that every day pressures will cause the latter route to be followed by the system's students and administrators. If this is so, it is our opinion that one effect will offset the other, and that our estimate of about two transactions per day, as computed over a week or a month, will hold. It is on this assumption that our further cost estimates will be made.

9. Estimated cost per transaction: Twenty cents each. This estimate includes the cost of input forms, data conversions, computer processing, and output report generation on a weekly basis. The effective cost per input transaction may vary upward or downward from our estimated figure depending upon the frequency and variety of special reports requested and provided. Our estimated transaction cost excludes (a) those personnel costs that may be associated with test administration, (b) those personnel costs that may be associated with human analysis of output reports, e.g., for counseling purposes, (c) overhead costs associated with space requirements, and (d) costs of manual scheduling as required for the proposed system. The estimated cost of twenty cents per transaction is based on experience with similar record-keeping systems, and is not based on detailed timing of computer runs nor upon the simulated system runs of the overall system, discussed elsewhere in this report. Finally, the estimated transaction cost does not include the costs of original file construction, nor the costs of programming the proposed bench mark system. These one-time costs will be treated separately hereafter.

10. Direct cost per student per year. Based upon the above assumptions, we arrive at a cost per student per year of $60 = 2 transactions per day x 150 days per year x $0.20 per transaction. (This figure is about 2% of total educational costs with present methods of instruction, which average $3,000-$4,000 annually.)

11. Total record keeping cost annually for the bench mark system. Based upon 800 students in the system, a direct multiplication provides a direct cost of $48,000 annually for the system.

12. Added cost for overhead items. $40 per student per year. Of this total, $15 may be attributed to the creation and maintenance of student master files (including initiation of and changes to the student header record) as well as incidental maintenance of other master files not related directly to student transaction volume, and $25 may be attributed to special reports, and personnel costs required for manual scheduling.

13. Total cost per student. Thus, in total, we have $100 per student per year for the bench mark system--still excluding costs of testing and counseling. This figure now represents about 3% of the student's present educational cost, or about 2% of projected costs per student under the more flexible METEP educational philosophy. (See report section on cost feasibility.)

14. Total system cost. Again, following the line of progression above, with an 800 member student body, at a total of $100 per student, we have a total information system cost of $80,000 per year.

Benefits Associated with the Bench Mark System. The bench mark system offers a number of features not easily obtained from present methods of record keeping. Since the cross-reference between the four files (Student, Resource, PC and IA) provides flexible combinatorial analysis of results, the system provides a data base for later analysis of what was planned versus what actually occurred. This comparison forms a basis for management adjustment and control of the system as a whole. Although this feature may be enhanced or degraded by an increase or decrease in file complexity and the detail of transaction reporting, it is our belief that minor deviations from the level of detail suggested will provide little if any direct benefit changes. Moreover, the bench mark system provides continuing plan versus accomplishment records for the student so he may monitor his own progress on a more frequent basis than is usual in present academic record keeping. It is our belief that with this additional information, the student will

in many cases be his own self-correcting agent, thereby stimulating student motivation and self analysis which might not otherwise be prevalent.

Another benefit is the provision of intermediate data for short-term planning and control of resources and an analysis of their utilization, including some advance knowledge of future student demand to permit planned flexibility in the scheduling effort. Finally, the proposed system provides sufficient detail for statistical analysis of the student population versus planned offerings and the results obtained in total. This form of data will itself be useful for both educational purposes, e.g., student projects, and academic research, e.g., faculty analysis of teaching methods, sequences, and timing of modular presentation.

Possible Application Difficulties of the Bench Mark Case. Although a one week period for batching transactions may be sufficiently long to prevent major peak loading problems in the system, particularly if resource planning is carried out in longer pre-commitment blocks, say one month ahead with weekly adjustments in planning for the most forward week only, we cannot now forecast the transaction or special report load variation that may occur. This is a point to watch carefully in application, since rapidly shifting load levels may be associated with a rapid increase in the estimated transaction and report volume. This phenomena may result as both planners and students attempt to correct errors or temporary misallocation of available resources. That is to say, the stability of the total information system's operation, as is the case with all information control systems, will be dependent upon demand fluctuations, processing cycle times, and planning lead times in combination. Without some degree of system stability, planning breakdowns, and frantic efforts on a short term basis to make adjustments can defeat the system's planning value as well as generate volumes of transactions and reports which can becloud the historical patterns that would be useful for statistical analysis and future planning comparisons.

Another general problem to be monitored is that of file security and confidence. Although this problem is most severe in real time systems in which many data input units can be used to access the same file and alter it (a method we do not presently advocate), similar difficulties can also arise in even simple batch systems if transaction accuracy is not constantly checked, and if strict processing controls are not instituted as historical files are updated and reported from. Particularly at the early stages of implementation of the educational information system, we would anticipate some user confusion, and a number of errors that will demand specific implementation measures to avoid.

We anticipate, for example, that in initial file construction, and in later transaction acceptance, the implemented computer programs should themselves screen all input and maintain error statistics for later system improvement. Such an error report was built into the design of Figure 1 for this purpose. In particular, the student PC history record, which culminates in the student's graduation, must be secure. For this reason, we suggest that student test results be transactions which only a few authorized personnel may input to the system. In the absence of such a safeguard, a number of obvious abuses could occur.

Programming and Testing Costs for the Bench Mark Case. Systems of the type described here have a current price of between $10,000 and $20,000 for final system design programming and testing using hypothetical, or limited amounts of real data. The generation of special reports, of course, represents an additional programming expense.[8] The total package will be in the $30,000-$40,000 range.

Although a number of generalized file processors are currently available (see footnote 4) most are restricted on to file analysis and are not intended as control systems. Moreover, these systems (on a one-time lease basis) cost between $20,000-$100,000, and in many cases offer features which are not needed here, which require excessive high-speed memory, and which often require excessive run times.

Thus, we would prefer to have a program package written for this special case. Although such a program package should be written generally, so later alterations in file design would not destroy the programming effort, we would foresee it to be of modular form so that individual modules could be employed when needed exclusive of the others. This remark applies especially to programs involving the PC/IA catalog, which for speed will undoubtedly have to be stored in the computer's high speed memory. (Present estimates of this combined file is about 14,000 computer words, which is a substantial portion of the usually available memory.)

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[8]Current programming estimators have found from historical experience that a finished program after test and correction, costs $10 or more per statement, or program line. That figure is higher for highly interrelated program systems. (Typical supervising control programs run $20-$30 per line, and very complex systems, such as the SAGE early-warning system developed for the military cost over $60 per line.) The bench mark system, we believe, is in the $10 per line level of complexity with an estimated 1,000-2,000 lines required for the several programs necessary for the bench mark package.

A summary of the total development and operating costs over a five year period have been prepared for the bench mark case and appear in the Economic Feasibility Section of this report.

Variations from the Bench Mark Case. For the sake of discussion, Table 3 proposes several wide deviations in scope of processing from the bench mark case, which is shown at the center of a 3 x 3 cost table. The figures shown in the table are estimated cost per student per year, as outlined above, but in this instance for various combinations of PC variety (count) and student population size. Again, the figures shown are estimates, developed in the manner previously illustrated. We are not interested in the detail of each number here, but rather the reasons for the relative differences in estimated cost, as well as possible changes in system effectiveness as we move from the bench mark. (In a later section, we will discuss how the figures of Table 3 may be altered by rapidly changing computer economics.) In Table 3, we assume that a student must complete 30% of the PC's offered, implying for a fixed time period of two years that PC's will represent shorter segments of scheduled time as we move to the right from column to column.

TABLE 3

ESTIMATED COST/STUDENT PER ACADEMIC YEAR VERSUS PC COUNT AND SIZE OF STUDENT POPULATION

(Presently Feasible Selections Are Shaded for Emphasis. See Text for Details.)

	PC Count		
	100	1000	10,000
10	$10	$50	$500
800	$25	$100	$800
5000	$20	$150	$1500

Consider first row one of Table 3, which represents a 10-student population. With this small number of students, a simple manual record (a file folder for each student) is satisfactory. And, at the 100 PC level, simple manual summary and planning are both possible and most economic, even as a part-time teacher effort, although $10 per student year is shown for the sake of illustration.

As we move to the right in row one, the number of students remains at 10, but the number of PC choices increases by orders of magnitude. Thus, for 1000 PC's, of which the student must now complete 500 in two years for graduation in that time period (following our assumptions), the length of the student file increases, and the detail for planning increases also. We are on the borderline of an electronic computer application if extensive statistical analysis of PC use is desired, even though student records themselves may be maintained still by manual means. The increase in cost may be attributed to the increased manual effort required to update each student file (about two transactions per day as in the bench mark case) and the increased difficulty of either human or computer analysis of PC use and PC planning. The total number of transactions for the student body is still relatively small (about 20 per day) and it could be easily handled by one clerk on a part-time basis. The $50 per student, for example, provides $500 per year for the ten students, and is equivalent to direct costs, excluding overhead, for 20 days at $25 per day for clerical effort.

Again with ten students, but now with 10,000 PC's, of which each student must now complete 3,000 to graduate, we come to a case which, even for the few students, begins to push manual methods to their limit. For example, even with ten students, we have potentially 30,000 items in the total student history--a number which is perhaps susceptible to human analysis (considering that many of the 10,000 PC's are likely never to be selected), but which is on the face of it a student/PC combination not likely to be found in practice. Thus, although the record keeping may be feasible on a manual basis, we would expect only a very casual form of analysis on a semi-automated basis, perhaps using the librarian's form of centrally punched cards (often called "peek-a-boo" cards because they are analyzed by humanly viewing punched holes over a light source).[9] One such card per student can contain punched records for up to 10,000 items (PC's) using very simple mechanical and optical equipment (in the $1,000-$2,000 class). With a combination of such techniques and some manual notation both student and PC records could be maintained. Nevertheless, who will offer 10,000 possible choices to only ten students? The volume would not be sufficient to justify the resources necessary on any basis that we can think of. Our figure of $500 per student is the cost for one clerk to do what she could on a full time basis (at a cost of $5,000 per year for ten students, or $500 each). The number need not be exact, since this case will not come to pass; we show the figure only to indicate that a substantial increase in record keeping cost would necessarily occur, even with minimal record detail. We leave for others the problem of figuring out how to provide the 10,000 PC's to the ten students.

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[9]R. S. Ledley, Programming and Utilizing Digital Computers, McGraw-Hill, New York, 1962, pp. 501-505.

Row two of Table 3 represents the bench mark number of students. With 800 students and only 100 PC's we have a situation in which minimal computer processing efforts can be of benefit. The cost of $25 per student assumes that we will batch results only once each term or twice per year. Since only about 15 PC's need be planned for each year, resource and student scheduling may be handled in large time segments, i.e., in one term, or even half-term blocks. The PC/IA catalogue is brief, understandable, and easy to automate for record analysis. And, because of the increased student volume and the fewer PC's we have an attractive cost for record-keeping. At $25 per student and 800 students, we have available $20,000 per year. Assuming a system design similar to the bench mark case, but with less frequent batching and longer range planning, this sum is adequate to maintain the lesser bench mark system. It is little wonder, for these reasons, that the 800 student-100 PC case is the one which most nearly approximates present day educational record-keeping efforts. The shortcoming of this case, of course, is that it does not offer great student-choice flexibility, which is one of the prime proposals of the METEP proposal. It represents, essentially, the status quo.

Moving to the right in row two, we encounter the bench mark case, which needs no further discussion here.

Finally, the third column in row two, the 800 student-10,000 PC case, provides an interesting departure. At this level of PC's, assuming a two year completion period and 5,000 to complete, we have about 10 PC's to complete per day, and an expected 20 transactions per day per student (for 800 students a minimum of 16,000 per day and undoubtedly up to twice that due to repeats, drops, and schedule conflicts). This is an entirely different game, even forgetting momentarily the resource planning problem. This case demands a real time processing system with many input terminals, a computer dedicated to the single task of master file maintenance, and vastly increased clerical costs, if any form of file security is to be maintained. For example, this level of transaction volume requires at least ten input-output terminals, e.g., 1600 transactions per terminal per 8-hour day is 200 transactions per hour, a feat which is hardly possible with clerical input of any form if student transaction confirmation is immediately desired. A more realistic maximum figure is 60 transactions per hour--even assuming the most sophisticated output equipment and some conversation with the student. This easily pushes the number of needed terminals to 25 or 30 as a minimum, with supervision for their use. Such requirements present total annual costs of $640,000 (provided by 800 students at $800 per year). The per student figure of $800 annually now approximates over 25% of a student's current total educational cost, a ratio we believe to be unacceptable. For this reason, the case is not feasible in our view, particularly when the resource variety and planning required to maintain an on-going operation at this level is considered.

Now, turn to row three, column one. Here we encounter economies of scale. With the increased number of students to form an economic base, we have available $10,000 = $20 x 5000 for data processing. Since the necessary system is still simple, requiring only infrequent batch processing, simple planning, and fewer controls for security, the $20 figure is entirely realistic, and indeed generous. Moreover, we have built enough volume for our PC list of 100 to provide an average 50 students per PC--more than enough to produce economies throughout the entire system. This, then is a highly feasible combination of volume and variety, and in addition one in which automation of the planning effort can be centralized with relative ease.

The most interesting comparison is between the first and second column of row three, as we move from 100 to 1000 PC's. At this level of volume and variety, we generate a minimum of 10,000 transactions a day (5000 students x 2 transactions each as in the bench mark case). This load requires greatly increased input/output facilities, even though they need not be on a batch basis. Thus, we have greatly increased clerical costs for data preparation, with greater controls necessary to avoid gross confusion. Although this case does provide some economies of data processing, any such cost reductions per student are offset by input/output, planning, and control supervision costs which increase more than linearly. Moreover, counseling and testing (a subsidiary issue) increases also at a more than linear rate. So, our processing estimates run in this case to $500,000-$1,000,000 annually for the total record keeping system, or, say to $150 per student for illustration. This per student figure does not include testing and counseling, nor the highly possible problem of extreme load peaking which will vastly increase the cost estimated. Thus, contrary to popular belief, we do not believe that increased volume is necessarily a benefit when the number of PC choices is in the range of 1,000 or more. In fact, based on our previous discussion, we conclude as student volume goes up, it is desirable to reduce centralized PC choice detail--or take other organizational alternatives which will have the same effect, such as decentralized planning and record-keeping, with summary reports only entering the main system.

Finally, we come to row three, column three, a case which on the face of it is not feasible economically for any foreseeable educational system under present technology. Here we have 5,000 students and 10,000 PC's, of which 3,000 must be completed in a two year period under our assumptions. A simple computation, based on our previous figures for column three, indicates a transaction load of 20 per student per day, which for 5,000 students produces an average of 10,000 transactions daily. That startling figure may easily be doubled due to changes, drops, test failures, etc., so we now approach both an input/output and real time processing requirement which approaches the complexity and cost of a major airline reservation system. Again, we have some potential for processing cost reduction, compared to the corresponding

800 student case above in column three, mainly due to the economies of the larger processor that would be required. But, it is again the input/output volume and the increased supervision and clerical cost for secure input that builds the per-student figure. If we took this case seriously, and, even if we were generous, 100,000 transactions per day would require 200 terminals to generate 500 transactions each per day. Each of the 200 terminals would require an operator, which at a nominal $5,000 per year each, produces a clerical payroll alone of $1,000,000 per year. Two or three times that figure could occur if loading were not perfect. Further, a completely dedicated real time system, at a minimum cost of $1 million or more per year, would be necessary. Add in the cost of terminals, system programming and maintenance, supplies, user training, amortized installation charges, programming, etc., and it is not hard to envision a total system cost--excluding testing, counseling and space--in the $5-$10 million annual range. The $1,500 annual student cost shown in Table 3 comes from an average of this range spread over 5000 students. We believe this figure to be low at current economic levels. Even though equipment costs are rapidly diminishing, personnel costs are ever increasing (in current installations of this type personnel costs approach 50% of total operating expenditures).[10]

Data processing costs that total between $5 and $10 million annually are not necessarily undesirable--if we have a large enough economic base against which to work, as, say, the airlines do. A few million spent on planning and control seems small in the face of gross sales approaching a half billion to a billion a year. But, we do not have that case with 5000 students.

It may be argued that elementary education, and preparing teachers for it, is indeed a multi-billion dollar operation, which is true. But the population is not easily consolidated to provide the volume necessary

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[10]A simple arithmetic extension of the figures above produces an estimated cost per transaction for the real-time case of $0.50, which is $7.5 million divided by the 15 million transactions per year provided by 100,000 transactions per day times 150 academic days per year. This earlier transaction cost is not to be confused with the $1.00 per transaction stated for airline reservations, due to the elimination of telephone line charges and the possibility of more rapid clerical handling of experienced students, as opposed to the usual airline customer's reservation problems. Nevertheless, at least at present, real-time response and confirmation is more expensive per transaction than batch operation with delayed response.

without simultaneously increasing the variety of PC's which undoubtedly would arise without rigid standardization of nationwide educational offerings for all, a very unlikely possibility. So we abandon our final illustrative example as not feasible on economic grounds alone.

Some Remarks on Alternative System Benefits. As a consequence of the previous nine-case analysis, we have abandoned as unfeasible all the high PC examples of column three of Table 3. Moreover, we abandon also all those in the first row on the ground that a ten-student school, standing alone, is not a useful consideration for this project. We have remaining the four cases in the lower left hand section of Table 3, and of these we question the 5000 student-1000 PC combination as highly doubtful, for reasons previously mentioned. We now turn momentarily to the three remaining case combinations.

In the last two rows of column 1, we have two traditional forms of record keeping, which show some economies of scale, but which lack the desired flexibility of student choice evidenced by our bench mark case, at the center of the table. It is our continuing argument that as student volume increases, the PC count must drop to produce a viable system. If we turn to student benefits, as well as total system benefits, we also, in practice, foresee that the ideal case is probably one in which the PC count (for a two year program) is between 100 and 1000. We can find little benefit in increasing the PC count on a formal record keeping basis for either student or total system if such an increase begins to consume ever-increasing amount of the student, administrative, and teacher day. In other words, if the PC count is increased beyond a certain point, given a fixed number of students, our students and personnel will find themselves so involved in transaction detail that the main purpose of the system, the very flexibility of choice and method that was desired, will be diminished or lost.

It is difficult at this time to measure the direct benefits of more (or fewer) PC's in a given installation, but it is clear that such a relationship exists, at least in the limiting conditions. Only operating experience can provide this final cost/benefit measure. It has been our purpose in this Division to set forth the limits within a feasible operation that can be maintained. It has also been our purpose here to foster some thinking about alternatives to the inclusion of more PC's and therefore IA's, into the formal information system. It is, we find, an illusion to believe that a computer system is helpful, or economic, for a wide range of diagnoses of human progress without some decentralization and grouping of detail. This conclusion is based not upon technical infeasibility, but upon the necessity for excessive transaction loads and planning detail which can undoubtedly be handled informally, more congenially, and more effectively on a person-to-person basis before a plan and its history of execution enter the formal system.

Some Recommended Pre-Implementation Activities. We strongly recommend that the following steps be undertaken before a final information system is implemented, and that after implementation further adjustments of the type suggested be made:

1. Pedagogical leaders attempt to refine and cluster their area PC's and IA's as well as eliminate those which prove redundant, ineffective, or unacceptable to students at the earliest possible date. What has been done in the analysis of teacher presentations and their alternatives will not be lost; that PC-IA detail may be published and bound for departmental use by both teachers and students. Such grouping and elimination will not only simplify the information system's requirements, but also provide logically clustered sets of material which will lend some structure to an otherwise undifferentiated and therefore potentially chaotic choice menu. That is, the grouping and elimination effort can provide some hierarchy of importance and relevance to the materials and thereby aid the information system, the student, and the teacher at implementation time.

2. Administrators and teachers should continually consider the trades possible between human and information-processing resources before requesting the non-human alternative. For example, an additional $20,000 spent on data processing to handle more transactions (resulting from more PC's and IA's) will buy one highly skilled tutor, or another formal teacher who may well provide diagnostic insight, student direction, and motivation to more students than the equivalent dollars spent on formal processing manipulations. Certainly in the extreme cases cited from Table 3 we are sure this is so; and the human trade may well be a better one at the intermediate levels also. Thus, a balanced human/machine combination may turn out to be better than either taken to the extreme. We have no doubt of that.

Some Technical Notes on Information System Economics. Both computer processor and computer terminal costs are expected to drop by orders of magnitude within the next five years. For example, the cost of small computers had already dropped to one third of their former value over a three year period (1967-9). As this shift occurs, particularly in terminal design, special attention should be given to input transaction cost reduction and security problems. To illustrate, it is likely that inexpensive terminals that will accept pre-punched, premarked, or embossed cards will be widely available soon, since some are now available.[11] Such units also permit some variable information

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[11]The predetermined input for fixed information is desirable to limit input errors, and has been widely tested in both industrial and hospital applications. See *Datamation*, November 1969, p. 380, for a description of a system currently in use at Deaconess Hospital, St. Louis.

input as well as the fixed pre-determined input in various combinations. Thus, student ID cards, PC-ID cards, and counselor ID cards may all be inserted in such a machine, with variable test results, or other variable diagnostic data entered manually, yet briefly. Such equipment alternatives can shift the feasibility of PC and student volume combinations, and may do so drastically in the next five years. Although such changes will not, we believe, drastically alter our main line of argument in this Division, they may provide the possibility to improve upon the present bench mark, or to reduce the per student cost of its operation. For example, it may be possible to share improved terminals both for computer assisted instruction in some areas with some forms of short range resource planning, an area we have left to manual means at this time.

Would the Conclusions of the Division Change if We Changed Assumptions? Yes. The careful reader will note that the cost figure estimated in Table 3 comes from the assumption that with more PC's offered over a two year period, a student must complete a fixed percentage of them--not an absolute number--to graduate. This assumption, which we took to reflect current pedagogical thinking--provides a direct relation between the number of PC's offered and the number of transactions that must be processed per unit time. This inevitable transaction rate, as well as the file interaction speeds required to handle the fixed percentage assumption, produces economic and user infeasibility as the PC count increases.

On the other hand, consider the following alternative assumption: a student must complete a fixed number of PC's over a two year period to graduate, say 20--regardless of the number of PC's offered. Assume that the chosen PC's will again fill the two year period. We now have ten PC's per year; or, as before, twenty transactions per year per student to process. Moreover, even though the transactions may be voluminous, e.g., 100,000 per year for 5,000 students, the number of transactions per year is orders of magnitude less than in the fixed percentage case, e.g., 15 million per year for the 5000 student-10,000 PC case in Table 3. Student transaction volume is now virtually independent of PC count, and the time scale is completely changed.

Thus, it is possible to handle more and more students and more and more offerings--provided the transaction volume is constrained by long PC time lengths. The variety to be handled still provides complex processing problems, e.g., 10,000 PC's still presents a much more difficult management job as opposed to 1,000 but the operation is buffered by time.

It is entirely possible to plan for 50,000 students and 10,000 PC offerings, provided the number of transactions is held within reasonable limits, as with the fixed number assumption. Indeed, we would gain great economies of scale in this alternative situation. (The physical

setting corresponding to this case is that of the Great University, with its many offerings and many students--who still work out their educational regimen in modules of long time length, e.g., the traditional five courses per term. Here we have great flexibility of choice, not in time, but in combination, or in space.)

The whole problem is turned around by this alternative assumption. The per student data processing cost is reduced, and we devote our total budget to more students and the now more independent problem of management of a wide range of resources. Neither student, nor manager need know all the detail, because the choice list of, say, 10,000 PC's may be departmentalized, so one human advisor may know in detail what is in his group. The student will also specialize of necessity and direct his efforts in summary form, working through a hierarchy of choices to the ultimate detail.

So, as one would expect, the operating results, and the corresponding system feasibilities differ widely as we shift our operating assumptions. Yet, ironically, the result of the fixed PC assumption--seemingly so different from the result of the fixed PC percentage assumption--is just another example of the same thing.

In both instances we are concerned with the feasible variety and volume of transactions that can be handled in a given fixed period of time. For a given data processing dollar we may have (1) fewer students and more student choices per unit time, or (2) more students and fewer student choices per unit time. (In the latter case, the students get their variety by making their fewer choices from a larger potential list, if it is available.)

If we choose more student choices per unit time, for a fixed data processing budget, we must have fewer students, so the cost per student inevitably increases.

The METEP philosophy implies the latter route, and the reader must realize the inevitable consequences of that decision at a given economic and technological status which exists at a point in time.

The careful reader may also observe that the costing methods of Table 3 provide cost per student figures for all real-time alternatives (as opposed to batch) which are higher than might be estimated if the processing system were employed, or shared, for other than record-keeping purposes. This is a correct observation.

The costs shown in Table 3 were allocated to the single use scheme of Figure 1, or its real-time equivalent, to discourage large PC menus under the fixed percentage assumption. Our conclusions still hold--even though the costs for the real time, 10,000 PC cases be divided by three.

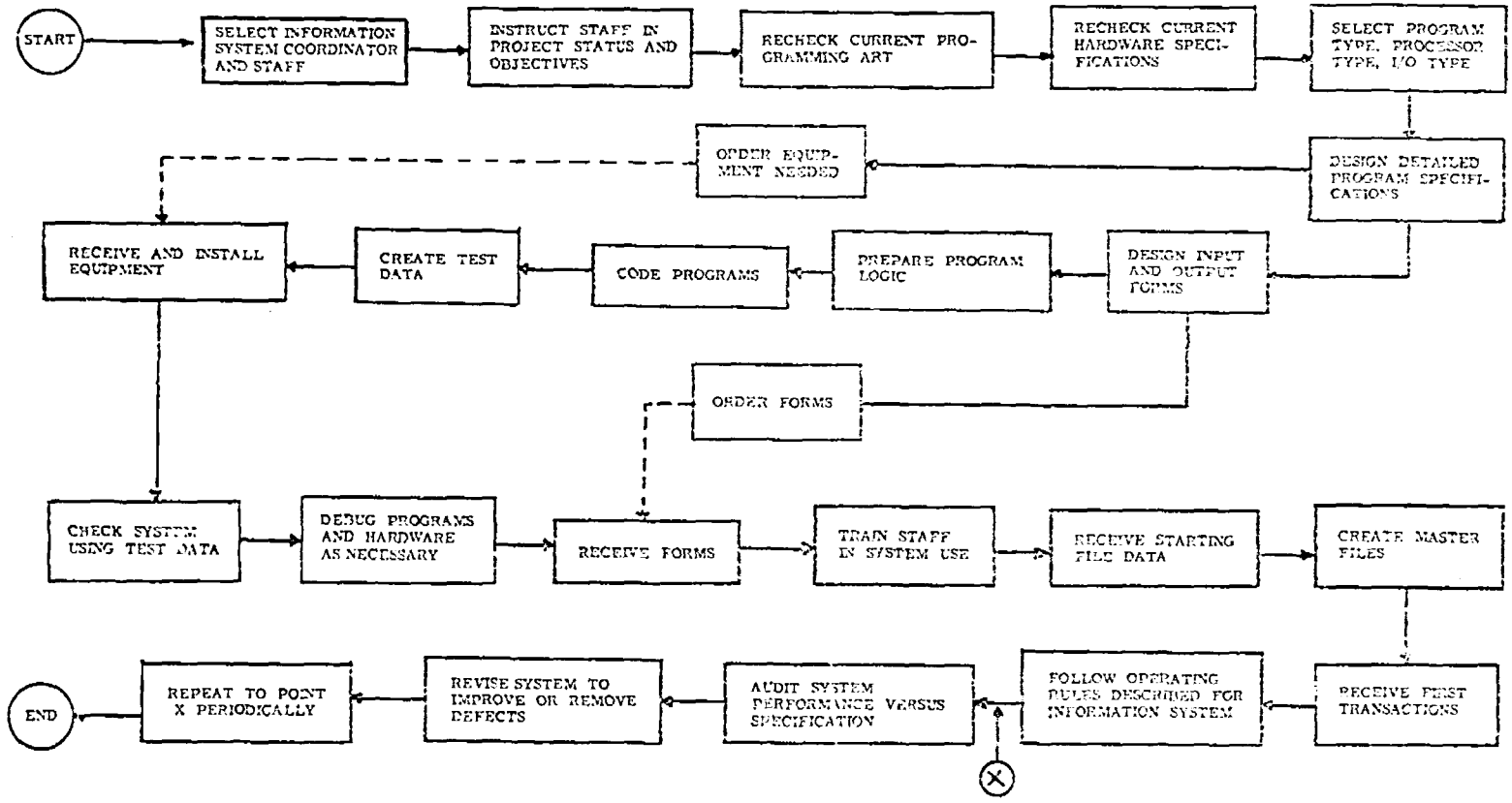
We have assumed batch, weekly processing for the bench mark case, and also cited the 5,000 student--1000 PC case (below in Table 3) as infeasible. Within the next few years, as noted before, changes in computer economics may shift our bench mark from batch to shared-terminal feasibility and show some economies of scale for more students at the 1,000 PC level, under Table 3's (the METEP) assumptions. The proposed bench mark system of Figure 1 is, however, flexible enough to make this transition with few modifications. And, we are satisfied that the high-PC alternatives will remain infeasible for at least a decade, based upon human constraints alone.

The activities required for the implementation of the information system are outlined in Figure 2. Interactions with other components of the METEP program are implicit.

Conclusion. In this Section, we have set forth an argument which follows a straight line, based upon an analysis of information system parameters and specifications as they affect system cost and performance. Our thesis is that system variety and volume interact strongly, usually more quickly than the average person appreciates, to create undesired system effects, or in extreme cases to produce system designs which are clearly not feasible on one or more grounds. We proposed a feasible bench mark case, then described variations, both feasible and unfeasible, that could be taken from it. In this way we concluded that our proposed bench mark case was, with minor modifications, a system which provided a reasonable improvement over present methods of educational record-keeping, bearing in mind the philosophy of the METEP proposal. Detailed cost/benefit adjustments in that system were, of necessity, left to the guides to be gained from later operating experience.

INFORMATION SYSTEM

FIGURE 2



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APPENDIX A

APPENDIX A--POSSIBLE SPECIAL REPORTS

1. Names and addresses of all students for mailings.
2. Geographical analysis.
3. Profile of entrance exams in summary or by breaks.
4. Analysis of accumulated student hours in the system.
5. Analysis of failures and drops for each student.
6. Analysis of student population by major and sub-major.
7. Analysis of elapsed time in system vs. sex.
8. Conditional analysis of profile scores by sex.
9. Distribution of major areas and sub-areas by sex.
10. Distribution of PC's and IA's by sex.
11. Analysis of elapsed time in system by home address (town).
12. Analysis of resources consumed per student by area.
13. Analysis of student load per time period.
14. Analysis of student withdrawals from system by area.
15. Analysis of student withdrawals vs. PC's completed and failed.
16. Percent self-study IA's taken by area.
17. Distribution of IA duration selected by area (not self-study).
18. Current PC vs. IA catalogue.
19. Profile scores vs. elective IA type selected.
20. Utilization of maximum special IA size.
21. Historical trend of IA type selected by area.
22. Historical trend of area transfers.
23. Analysis of PC's assigned but dropped by area change.

24. Analysis of reliability of student demand projection.

25. Analysis of student demand by semester month.

26. Analysis of resource demand by semester month.

27. Analysis of sub-area specialization vs. major area.

28. Analysis of illegal transactions entered into system by source.

29. Analysis of area selected vs. home location.

30. Count of popularity of PC's and associated IA's.

31. Analysis of failures and drops by major.

32. Analysis of pass by major.

33. Analysis of failures and drops by diagnostic code.

34. Analysis of resource utilization survey.

35. Analysis of resource utilization vs. IA's or PC's.

36. Analysis of PC and IA offerings during term.

37. Frequency of PC and IA's waived due to pretest.

38. Analysis of PC failures, repeats, drops, vs. resources used.

39. Analysis of average elapsed time to pass each PC.

40. Survey analysis of elapsed time in system by area.

41. Analysis of assigned vs. completed PC's.

42. Analysis of estimated maximum student time to completion by student.

43. Analysis of evaluation type by area.

44. Analysis of failure by evaluation type.

45. Analysis of elective PC's chosen by specialist area.

46. Analysis of average IA's taken to pass each PC.

47. Entering profile scores vs. time to completion.

48. Analysis of human resources vs. student group size.

49. Equivalent number of credit points completed to date by student.

50. Number of pretests taken and passed.

SECTION III PART III TESTING AND GUIDANCE OPERATIONS

No better primer could be found for an introduction to this section than Sherman Kent's Strategic Intelligence, a work directed to secret agents and their managers.*

This somewhat obscure, but important book, contains a clear exposition in non-technical terms of the steps intelligence organizations use to collect, process and evaluate information.

Briefly put, the most striking result of this study is that information systems fail, not because insufficient amounts of accurate information are available but because patterns of importance may be misinterpreted, may not be recognized until too late, or if recognized correctly, may not be believed. From such failures we have a Pearl Harbor, a Bay of Pigs, a Pueblo Incident.

In an attempt to avoid such blunders, the intelligence services of the world have developed an almost common form of organization. Data coming from the field passes first through specialized "desks" where local conditions are summarized, and where the ultimate detail of a local situation is analyzed. Thus, there is a "Cuban Desk," a "Laotian Desk" etc. But the local picture is not the whole story; An isolated fragment of information, which might not seem important at the specialized, local level, may when combined with other fragments collected across the board point to a pattern of strategic importance. So, the intelligence services also employ specialists who seek to integrate patterns, not locally, but internationally. We have the aircraft technology expert, the expert in gold smuggling, the individual who monitors movements of political figures from one scene to another, etc. and coordinating the whole we have generalists who look for larger patterns in this vertical and horizontal input. Even with this form of organization, which has proved to be better than most others, some of the fragments that could form a meaningful pattern will be lost, or misinterpreted. That is a fact of the intelligence business, an inevitable consequence of the variety and

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*S. Kent, Strategic Intelligence for American World Policy, Princeton. University Press, Princeton, N.J., 1949. A Yale historian, Professor Kent was in charge of OSS operations in southern France and North Africa during World War II. His book, written on a Guggenheim fellowship, discusses the organization, operation, and management of intelligence services. The observations made have general value; the same information-handling and evaluation problems plague the Russians, Standard Oil of New Jersey, and the CIA as well as the HEW proposals.

volume of information transactions which must be, or might be, evaluated. The hope is to reduce such errors to a minimum by careful designs.

Although this diversion into the James Bond world may appear irrelevant to the subject at hand, what has been learned about intelligence system organization is precisely applicable to the METEP Testing and Guidance Operations and its supporting Information system. That is because the METEP Testing and Guidance functions provide strategic intelligence which guides the total educational effort, including diagnosis of student difficulties, guidance for specific pedogogical development and teacher aid, and overall planning for resources, methods, and schedules.

Testing and Guidance: The METEP Intelligence Service. Like an international intelligence system in miniature, the METEP information operations involve many areas of specialization, in which detailed data must be known. We have, in fact, a "Mathematics Desk," a "Language Arts Desk," etc., where the intimate detail of those specialties and their operation will be best known.

For example, for detailed counseling within the mathematics area, it is clearly desirable to talk to the mathematics expert.

On the other hand, we also have another form of specialist who looks across the disciplines: the expert in testing method, the counselor who follows an individual student rather than a subject area, the resource scheduler who must avoid conflicts in commonly used facilities and between assignments of students to activities.

And, finally, we have the generalized administrative functions of policy development, evaluation of overall plans, and the anticipation of future needs.

In addition, as is the case with most intelligence systems, the METEP Testing and Guidance functions confront a range of data input types from the "hard" results that may be obtained say, in the Mathematics Area, from pencil and paper tests organized by item to evaluate detailed segmented objectives,* to the less structured eva-

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*William P. Gorth and Lawrence Wightman, "CAM: The New Look in Classroom Testing," Trend, Spring, 1969, pp. 56-7. CAM is an abbreviation for "Comprehensive Achievement Monitoring" a technique which tests in detail for educational objectives related to achievement, attitudes, or perceptions.

luation of human behavior, as in the Language Arts. And, in the hierarchy of testing and counseling efforts, we have various forms of pretests, current tests of detail (for student self-help), and post-tests.

Since the information gathered by the testing and counseling process is of both immediate and historical interest, the inputs and outputs needed by the Testing and Guidance operations directly influence the Management Information System and vice versa.

For example, as noted previously, when the number of testing segments becomes larger for a given educational activity, the transaction load placed upon the system's users and the information system itself quickly increases, and so it is not feasible to maintain excessively detailed records on a continuing basis for all students or activities without eventually degrading the entire intelligence effort, or even the objective of the METEP proposal, regardless of cost considerations. If, in addition, the cost of record-keeping, testing, and counseling is introduced, excessive segmentation of the testing, counseling, and achievement-monitoring effort soon drives data processing costs beyond reasonable bounds. Where such detail is needed for research purposes, devices such as statistical sampling have been employed successfully to adjust costs and benefits.* But for everyday operation, the design of the intelligence system must be adjusted to provide what realistically can be obtained.

The Decentralized/Centralized Testing and Guidance Operation. To hold down transaction rates while at the same time maintaining the desired vertical and horizontal intelligence levels, we propose a combination of both decentralized and centralized counseling and testing. In some areas such as Language Arts, the more decentralized form of effort will predominate, whereas in others, such as Mathematics, a more centralized approach will be natural. We see no reason why such flexibility of organization is not desirable, particularly when the data input characteristics of such areas differ so widely.

To illustrate the form of organization proposed, we now cite two cases: (1) Language Arts, and (2) Mathematics. In each case, we look at the Counseling and Testing efforts that can be decentralized versus those which may be centralized beneficially. In striking this comparison, it should be noted that the terms "decentralize" and "centralize" do not, in our present context, mean necessarily

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*See Gorth and Wightman, op. cit.

a physical dispersal or congregation of individuals or efforts, but refer instead to the manner in which information is handled. In each case, we will comment upon the Counseling, Testing, and Information System variations the alternate approaches suggest.

Language Arts: Case I. Here is a description of the feasibility study results from Language Arts, taken from the notes of that Area's supervisor. The routine noted has been applied successfully to 120 students during Fall, 1969, in a highly decentralized effort.

> The Performance Criteria may be attempted in any order, and may be spaced in any way the candidate wishes. If the present time arrangement continues, lectures and discussions in the classroom will be available only during a specified five week period, but all other instructional alternatives will be available through out the semester.
>
> The procedures are:
>
> 1. List of all Language Arts performance criteria is handed out to each candidate.
>
> 2. List of suggested and available instructional alternatives is handed out to each candidate.
>
> 3. Candidate may attempt the PC whenever he feels ready.
>
> 4. PC candidate completes a questionnaire to be handed in with each PC, indicating which, if any, instructional alternatives have been used.
>
> 5. PC is rated by one of a group of pre-trained raters. Rating scales are available for each PC.
>
> 6. Pass, no-pass charts are kept for each PC indicating date(s) of each attempt, and information on whether or not candidate has passed.
>
> 7. A master chart is kept listing each PC and each student. The chart is filled in only when student has successfully passed the PC.
>
> Counseling procedures:
>
> 1. A general information sheet is handed out to

each student.

2. Discussion hours open to all candidates will be held at various times during the week. Raters will preside over these discussions.

3. Bulletins will be issued regularly, reminding candidates of the PC's they have yet to complete.

4. Part of the rating process will include individual comments made by raters on each candidate's PC.

    1) Raters will attend a workshop in Language Arts so that their training and information will be consistent.

    2) Questionnaires include evaluative information by the candidate, concerning the value of the PC's and IA's. These questionnaires will be analyzed by computers.

Although the form of human behavior monitoring described above lends itself most easily to decentralized testing and evaluation using human raters, and although much on-the-spot counseling can take place at the time of evaluation on an individual basis, some centralized extensions of this scheme are also envisioned by the Language Arts supervisor. For example, she sees eventual use of video tape facilities in centralized testing and evaluation, if only on a sample basis to aid in setting standards of performance which may serve as a model for later candidates as well as standardization tools for rater consistency tests. Further, although counseling may still be highly individualized, this supervisor sees some merit in having a Language Arts counselor physically located at a central location for physical convenience of students and staff. By and large, however, testing in this area will continue to be decentralized because of its nature.

Note also that the decentralized Pass-Fail record keeping, the flexibility of back-up materials for student self-study, and the five-week plan for blocking out human resource allocation, greatly simplifies the potential information processing inputs from this area. For example, here it is possible to batch for historical purposes a number of completed PC's together with a few simple details on each. The main function of an automated information system for this Area would be to alleviate clerical workloads, such as

preparation of typed status reports for students - and even such apparently trivial, yet burdensome detail as the preparation of mailing lists on envelopes for student information distribution. In addition, the combination of summary PC detail in batched form may be combined with other student-file data to provide research data for Language Arts use, e.g., entering test profiles versus Language Arts success.

Mathematics: Case II: Turn now to a different scene in which detailed segmentation, item testing, and detailed PC/IA combinations can be generated with ease. Here we have "hard facts" - the candidate either knows how to obtain the correct answer or he does not.

Note, however, in the description of feasibility study experience below, that the supervisor of this area found it necessary to group instructional alternatives and highly segmented PC's into "books" of detail which could be used to aid the student and the Mathematics staff, but which need not necessarily clutter the permanent information processing system with transactions. Note also that this counseling and testing activity is potentially one which could largely be centralized, with a partial decentralized counseling effort specialized to the remedial needs uncovered through the centralized test procedure. Also, we have here the ideal subject for detailed test item development and evaluation, following the Comprehensive Achievement Monitoring (CAM) technique previously cited. The number of students involved in this area's feasibility test was 96.

Here are the Mathematics Area's procedures, as reported by the Area supervisor:

> The class mode of instructional alternative for each performance criteria module would be available on a regularly scheduled (every fourth week) basis, while the other instructional alternatives would be available at any time in the mathematics learning center laboratory A full time professional and at least one graduate student with expertise in math education would always be available at the mathematics learning center laboratory.

The testing program for the mathematics component of METEP is partitioned into three phases, A. The pre-test phase on each performance criteria module. B. The self-evaluation phase on each performance criteria module. C. The post-test phase on each performance criteria module.

A. Students wishing to pretest on any performance criteria module could do so in one of two ways: 1) by taking a regularly scheduled pre-test as one of a group prior to the corresponding class mode of instructional alternative for the performance criteria module in question. 2) By reporting to the mathematics learning center laboratory to take a pre-test on an individual basis at the convenience of the student.

B. After some exposure to one or more of the instructional alternatives available to the student, he may self-evaluate his progress in the performance criteria module by reporting to the mathematics learning center laboratory to take a self-evaluation test on the performance criteria module, complete with detailed solutions to each problem or task. These self-evaluation tests can also serve in affect as an additional instructional alternative.

C. Once a student feels confident enough to take and pass the post-test on the performance criteria module, he may take the post-test in one of two ways: 1) by taking the regularly scheduled post-test as given subsequent to the completion of the scheduled class mode of instructional alternative for the PC module in question. 2) By reporting to the mathematics learning center laboratory to take the post-test on an individual basis at the convenience of the student.

The above outline would apply to all of the mathematics content performance criteria modules and many of the mathematics pedagogy modules. Those pedagogy modules which require actual demonstration of teaching ability to children would only be tested on a regularly scheduled (every fourth week) basis. The mathematics "expressive experience" modules have no testing program as such.

Little need be added to that description to indicate the difference in testing and counseling needs between Mathematics and Language Arts. It is also interesting to note here that the main input to the Management Information System would be pre-test and post-test results which have been proposed on a periodic basis of four weeks, staggered in one week intervals. Although the problem of test security becomes important in this area, various devices, such as the random generation of test items, possibly by a computer from a stratified list of possibilities, can be used to overcome any statistical difficulties.

A Counselor's Opinion: Case III: Turning from the special areas to the counseling specialist, it is interesting to see that here, too, the idea of both decentralized and centralized efforts emerges.

Our counseling expert reports as follows. His notes have been edited for brevity.

It is necessary to have a counseling function on three discrete levels.

The first is informational. The function here is to aid the student in the selection and implementation of the PC's within a given area. Such counseling would be a part of the pedagogical area's effort, not centralized. The counselor at this level will also serve to provide sources for referral for the instructor as well as for the

student. In other words, problems that are beyond the scope of the individual teacher, or beyond the scope of the student or his counselor will be referred to a counseling function outside of each individual pedogogical area.

The second discrete counseling function is the provision of resource persons for the faculty member who is involved in working with students on their PCs and IAs. What is meant here is that where a faculty member feels bogged down in his relationship with students, or where he feels that his PCs and IAs are beginning to run him, counseling may help that faculty member to see new ways of attacking PCs and IAs that are both more relevant to him as a teacher and more relevant to the interaction between teacher and student.

The third level of counseling function is to see students on a long term basis, to know them as individuals - apart from their area of specialization and the PC-IA detail. This form of counseling requires a much broader perspective of the METEP program generally, and of individual emotional and vocational objectives in particular than will be required at the other levels.

The latter two functions, as described above, fall into a centralized pattern. In addition to the specific day-to-day counseling suggested above, another by-product of the centralized effort is the evaluation of testing methods, their validation through counseling feedback, and the suggestion of test items, both unobtrusive and obstrusive, which may aid students and faculty in their work.

The Management Information System provides the counselors at all levels a variety of working tools, for instance: 1) student records updated periodically, 2) current listings of PC/IA availability, 3) complete cross-reference of data in student files for research studies, 4) evaluations of PC/IA popularity, satisfaction, and demand, 5) evaluations of material retention by means of historical records of student performance on detailed test results, duplicated PC's, and similar test modules, and 6) assistance in the day-to-day details of information handling, such as generation of lists of delinquent students, drops, PC changes, over and under-utilized resources, and anticipated schedule changes. Similarly, the counseling effort provides input to the Information System, either through the student's signup for a PC group and his completion of that segment, or directly through counselor input to the system in the form of anticipated PC demand, and similar detail.

The Mechanics of Testing and Guidance. The three cases above which provide a sample of PC/IA handling experience during the feasibility study lead us to believe that a combination of decentralized and centralized testing and counseling will be desirable, economic, and satisfying to both students and staff.

The decentralized testing and guidance reduces the transaction rate

against the information system, thereby greatly reducing its design requirements and costs. Moreover, the same transaction rate reduction eases the centralized testing load and its associated problems of security, paper generation, and student traffic. The benefits accrue to the counseling effort: decentralized counseling provides the area detail; centralized counseling provides the student continuity of association, width of vision, and summary research data on the program as a whole. But, the formal counseling transaction rate is reduced by the dual approach.

The details of a decentralized testing and guidance operation may be left to each area's supervisor. In general, such efforts will be on a personal basis, and the tests given on a decentralized basis will be student self-tests, the results of which need not be universally recorded. The decentralized counseling and testing efforts will be coordinated with the centralized efforts, of course, by virtue of the common records provided by the Management Information System on students, PC/IA offerings, and summarized resource allocation.

At the centralized effort, the METEP proposal suggests a definite and permanent set of individuals who will provide both clerical assistance and at a higher level continuity of guidance during the student's period in the system. In addition to this permanent general staff, the centralized physical location will also provide space for decentralized counselors who wish for physical reasons to meet periodically at a given place and time with students and other staff members.

The detailed staffing, space and fixture budget for the centralized Testing and Guidance Center associated with the METEP proposal may be found in the Economic Feasibility section of this report.

The form of test administration and data input into the Management Information System arising from either decentralized or centralized sources has been planned for optically read forms. The same equipment may be used for test scoring and other forms of transaction input. A typical form, such as Optical Scanning Corporations Utility DS 1109-4, or its equivalent, may be specialized to handle both initiations and completions of PC's, and other transactions which may enter the system from students or counselors. The same form may be used for optical test grading in those instances where such an approach is pedagogically desirable. We have not designed detailed optical forms at this time, since the technology of input devices and their economics is shifting rapidly. Alternate input methods may be considered more desirable than 8 1/2 x 11 inch sheets at implementation time, although the general principle of key-board avoidance is to be maintained.

The generation and administration of tests on a centralized basis, either for pre-test or post-test presents some mechanical problems. As the volume of testing increases, and in particular as the variety of

testing employed at the centralized location per unit time increases, the problem of generating test schedules which are uniformly difficult as well as secure passes beyond human productive ability, and requires the use of mechanized effort.

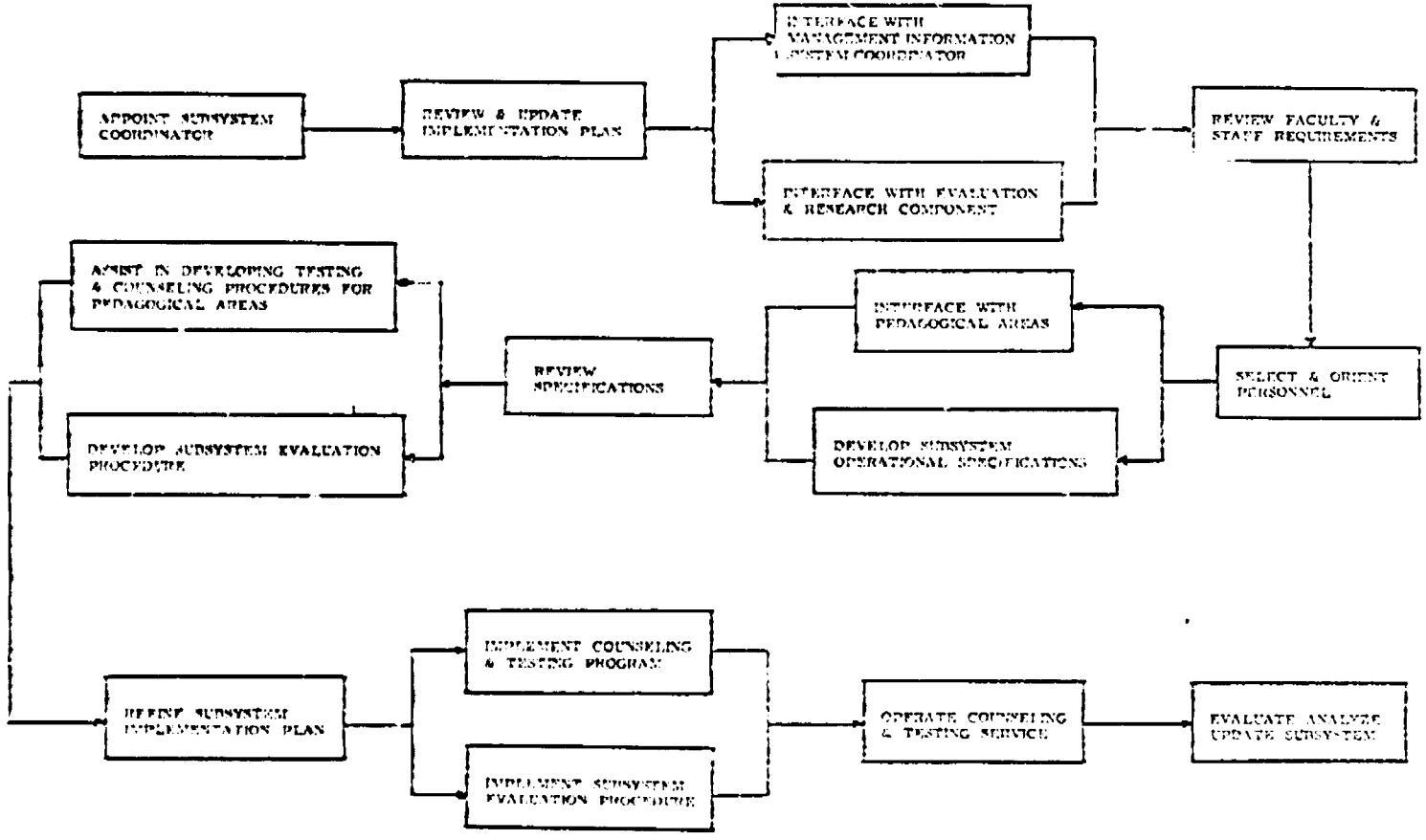
Although we have not estimated nor planned for the computer generation of individual test schedules in addition to automated grading and item analysis, we anticipate that such schemes may be needed if the test transaction rate at the centralized center cannot be held to modest propositions. This is another argument for the decentralization of as much Counseling and Testing as possible in this system. The arguments of the Information System Section of this Report apply with equal vigor to the Counseling and Testing schemes proposed here.

METEP Testing and Guidance Prediction and Control. Most intelligence systems provide information of three types: 1) facts which change slowly, the descriptive element; 2) new facts which update the old, the reportorial element, and 3) generation of predictive results, the speculative element. The proposed combination Testing, Guidance and the Management Information System provides each of these intelligence outputs. The student record file contains not only the history of student progress, but also the record of facts which will for a given student change slowly. The results of Testing and Guidance provide the update, or reportorial function. From the combination of these two, analyses of classes of students, PC/IA selection and success patterns, and counseling and testing methods may be made to predict the success of future students entering the system. The same predictive results may also be used to design improved PC/IA detail and groupings in the continued improvement of the METEP plan. This, of course, is the purpose of the management system which rests upon the data available from the Counseling-Testing-Information Systems package.

Implementation. Figure 1 illustrates the steps necessary in implementing the testing and guidance subsystem. The evaluation, analysis, and updating step implies the cyclic nature of the listed activities.

TESTING AND GUIDANCE SUBSYSTEM

FIGURE 1



SECTION IV ECONOMIC FEASIBILITY

ECONOMIC FEASIBILITY

Introduction

The economic feasibility of a proposed purchase by a family is usually determined by answering:

1. Is this the best use of our money?
2. How much will it cost?
3. Can we afford it?
4. Do we have sufficient financial controls to insure the expenditure of funds according to a planned program for payment of the purchase?

The family's answer to the first question is usually based on subjective and emotional data. The cost is usually determined by "shopping around" for the best buy and the ability to purchase is based on current and/or anticipated resources. The control of resources for paying for the purchase normally consist of the family budget and fiscal decision processes used by the family member who is responsible for the expenditure of family income.

Many aspects of the four questions overlap, therefore, the feasibility of the purchase is not normally determined by one pass through the list of questions. For example, an increase in the financial commitment necessary for purchase may negatively effect the desire (need) of the purchase or if the desire is strong, an overly optimistic projection of anticipated income may occur to make the purchase appear feasible.

The determination of the economic feasibility of the family purchase is an iterative process. The complexity of the process increases with the cost and time commitment associated with the purchase.

The economic feasibility of the METEP project is determined by using a similar but more complex approach.

"Is this the best use of our money?" The appropriateness of the expenditure of funds for implementing and operating this experimental program can be determined by examining:

1. the need for a new training program for elementary teachers,

2. the objectives of the program, and

3. the pedagogical feasibility of the instructional design.

These items, the rationale, objectives, and pedagogical feasibility, are discussed in sections I and II. An affirmative conclusion to the appropriateness of this experimental program may be derived from examining these sections of the report.

"How much will it cost?" A five-year cost projection indicates that the operational cost of a program serving 800 students will be approximately $1,575,500.00 per year. This would be an annual per student cost of $1,967.00. The five-year projection of the program cost is subsequently presented and discussed.

"Can we afford it?" The USOE provides financial support for the development and implementation of exemplary educational projects. The funds which have already been granted for the development of the Model Elementary Teacher Education Programs are examples. The USOE has also indicated a willingness to aid in the implementation and initial operation of some of these projects which are shown to be feasible. However, it is not the responsibility of the USOE to provide the funds necessary for the continuing operation of the program. This is a responsibility of the institution and its sponsoring organizations, e.g. the School of Education at the University of Massachusetts, and the State of Massachusetts. The intention of the institution to provide necessary funds for the continuation of the program is therefore a criteria for determining economic feasibility. The Federal government cannot afford to provide funds for "permanent" programs where there is little or no intention of continuing the program past the federally funded period.

Although the intention of the school and state to continue the program may be explicit, it is also necessary to demonstrate their ability to do so. This is a second criterion for determining economic feasibility. One way in which this criterion may be satisfied is to demonstrate that the student cost per year in the proposed program for training elementary teachers does not appreciably exceed the current cost allocations. The ability to facilitate the effective use of funds is a third criterion in determining "can we afford it." An institution cannot afford to waste "education dollars."

Cost-effectiveness analysis provides administrators (decision-makers) with data which relate the cost and effectiveness of alternative courses of action.[1]

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[1] E.S. Quade, Cost-Effectiveness: An Introduction and Overview. Santa Monica, Calif.: The Rand Corp., 1965, p.2.

The alternative courses of action may be implicit. For example, cost and student achievement may be related in analyzing the instructional alternatives associated with a performance criterion. The resulting data, complemented with other information about the students and program, may be used in scheduling, deleting or altering the availability of instructional alternatives.

The criterion of program cost-effectiveness can be satisfied by presenting plans for implementing techniques for performing cost analyses and stating how cost-effectiveness data will be used in evaluating and refining the proposed program.

The above three criteria are used in determining "can we afford it." They address the question of the feasibility of the investment of Federal funds, the ability of the school to continue the program after Federal funding is phased out, and the ability of the school to effectively allocate funds. Information provided in subsequent parts of this section will indicate that the proposed program successfully satisfies these criteria.

"Do we have sufficient financial controls to insure the expenditure of funds according to a planned program for payment of the purchase?" The fiscal subsystems of the project are designed to provide the necessary budgeting and accounting procedures to insure the efficient fiscal operation of the program. These subsystems are described later in this section.

PLANNING-PROGRAMMING BUDGET DESIGN

Introduction

The METEP budget is a financial reflection of the project's objectives. It is a dollar statement of values and priorities, indicating both direction and speed of movement toward goals. The work of each METEP member and the development of each subsystem or program are directly affected by the budget and the budgeting process. Every member of the METEP team should understand and be appropriately concerned with the development of the METEP budget.

In order for METEP to wisely and effectively utilize its resources, budget making must be based on: a) a clear statement of objectives; b) procedures for generating programs of teaching, repricing, comparing, evaluating and assigning priorities to such activities. The METEP project's budgeting activity will be successful only to the degree that the responsibilities, procedures and sources of authority in the budgeting process are understood and used. Conversely, to the degree that the budgeting process is misunderstood, and/or ignored, the METEP budgeting activity will be unsuccessful; when budgeting is increasingly unsuccessful, the METEP project will be in danger of finding its objectives and programs determined by the politics and mechanism of dollar allocations rather than be educational philosophy.

Planning-programming budgeting is a technique which, if used effectively, will escape mechanistic allocations. It is a technique which emphasizes optimum allocation of resource among competing ends according to the 'objectives' of the organization. It lays stress on controlling the outputs of the project by managing the effective use of inputs. Analysis of outputs of the project by managing the effective use of inputs. Analysis of outputs and input usage in the PPB system is extremely important. In the profit-seeking organization, problems of measuring success or failure are facilitated by income and balance sheet statements. These tools have little value in measuring the results of projects like METEP. Success or failure in METEP is not measured explicitly in dollars, but rather by the degree to which structured goals are achieved. Analysis related to achievement is aided by a program-oriented budget because each program's output can be analyzed in relation to its budgeted inputs. For these reasons the METEP budgeting process will utilize the planning-programming-budgeting technique.

What Is A Program? Essential to planning-programming-budgeting is the concept of a program. There exists no clear-cut definition of

a "program" and there are ambiguities and inconsistencies at all levels of usage. However, the concept has special significance to the understanding of METEP's planning-programming budget. This budget has as its foundation a number of component programs, which, in total, represent the entire METEP effort.

Definition. A program is here defined as an entity consisting of various components designed to achieve specified objectives with variable time constraints by utilizing and transforming identifiable resources into end products. These end products will result from the utilization of complementary programs within a specified scope of activity. These activities, which will be carried on by the program components, exist over an uncertain time period. Some activities are short-lived, while others will continue for the life of the project.

The components of METEP also satisfy the above definition. Each of these components represents an activity or function which has its own specific objectives, scope of activity and distinguishable outputs. These elements can be classified under two general headings: administrative subsystems and education programs. The education programs produce the end products of METEP, the administrative subsystems produce only supportive, intermediate products which are used and shared by all education programs. These two general categories are the initial building blocks of the METEP planning-programming-budget system.

Administrative Subsystem.

1. Management
2. Information System
3. Evaluation and Research
4. Testing and Guidance

Education Programs.

1. Human Relations
2. Behavioral
3. Language Arts
4. Pre-school
5. Science
6. Social Studies

7. Mathematics	12. Technology
8. Urban Education	13. Evaluation
9. Aesthetics	14. Supervision
10. Inservice	15. Foreign Language
11. Media	16. METEP Orientation

In themselves none of these programs or subsystems can attain the total specified objectives of the METEP project. Each element does influence the credibility and effectiveness of the project; therefore each plays an integral role in the success of the total project effort. Each is in competition with the other elements for available scarce resources within the project. These programs and subsystems are critical success factors of METEP, and are incorporated in the METEP planning-programming-budget.

What Is A Planning-Programming Budget (PPB)? There is no standard definition of a PPB. For this reason, a narrative approach is used to expand understanding of a PPB as it will be viewed in METEP. The planning-programming budget differs from the line-item control budget in which detailed classification of objects of expenditure (inputs) and control of these items are emphasized. The conceptually newer PPB places emphasis on the end objectives (outputs) and the control of costs needed to achieve these objectives. PPB uses budgetary techniques to emphasize and facilitate explicit consideration of pursuing policy objectives in terms of their economic costs (opportunity costs) and the total dollar costs, both in the present and in the future.

PPB is used as a multi-purpose approach to overall budget control. It focuses on the budget decision-making process, particularly on the problems relating to resource control, allocation and use. It is intended to bring about a more efficient and effective allocation of resources (staff, space, equipment, etc.). This is achieved through a careful appraisal of the program's needs in light of the program's objectives and outputs.

PPB promotes comparisons between the resource requirements of competing programs. This is possible because resource alternatives and programs are expressed in a common denominator: the dollar. Program budgeting facilitates the utilization of both "cost benefit" and "cost effectiveness" analysis. PPB uses cost benefit analysis to determine the potential and the actual contributions programs make to the projects' end objectives in terms of output and cost.

On the other hand, PPB uses "cost effectiveness analysis" to determine if an effective and efficient usage of inputs is being attained by programs in the production or distribution of outputs.

On the basis of the appraised needs, the comparison of alternatives, and the evaluation of contribution to the end objectives, METEP's central management can strategically plan, program, or coordinate the project's present and future financial needs. The characteristics of a PPB system suggest that it is a better management tool than the conventional budget.

Operated correctly a PPB system should provide METEP with better program and subsystem planning, management, and control than the conventional procedures.

A Comparison of Conventional Accounting and PPB Accounting. All educational accounting systems are primarily concerned with the legal and fiduciary responsibilities which result from the receipt and expenditure of state, federal, and other funds. The conventional accounting functions within an educational system are those that concern themselves with keeping detailed financial records. The following are typical activities:

1) Recording source and amounts of all funds.

2) Controlling the receipt and expenditures of these funds.

3) Aggregating total expenditures by line-item (object).

4) Aggregating total expenditures by activity (purpose).

5) Projecting budgets for two years at most.

With the introduction of PPB accounting system to the METEP project, the above functions of accounting are greatly expanded. The following functions are added to the finance officer's scope of accounting-budgeting functions.

1) Assist in the determination of the general and specific objectives of the METEP project.

2) Design, manage, and implement financial procedures and forms which will help to achieve the end objectives.

3) Develop new categories of object and activity accounts for all programs in the METEP project.

4) Assist in the long-range projection of resource requirements for each program.

5) Assist in the programming of the acquisition of these resources.

6) Assist in the preparation of a PPB on the basis of the above projections and programming.

7) Assist in the development of criteria needed for the evaluation of program performance and progress.

8) Develop financial contingency plans in case of funding changes.

9) Assist in the determination of the long-run "economic costs" and dollar costs of alternative within a program as well as the cost of each program.

10) Assist in the measurement and evaluation of the contribution of various alternatives and programs to METEP's end objectives.

11) Communicate the above information to decision-makers.

12) Coordinate METEP's financial system with the university's and school's financial systems.

METEP's Internal Budget Cycle. The budget cycle for the METEP project contains all essential stages and procedures necessary to the employment of a PPB system. It provides not only for the development of a project PPB, but also for the development of programs of subsystem PPBs.

The budget cycle is designed to eliminate shortcomings which have been noted in other instances where the PPB system has been used. Specifically, the design hopes to prevent the following deficiencies:

1) Misunderstood or undefined program objectives.

2) Insufficient time periods for program review and decision making.

3) Inadequate investigation of program accomplishments or lack of accomplishments.

4) Over emphasis of budget analysis related to expansions, and new programs while current services are practically ignored.

5) Too little emphasis on developing and comparing alternatives.

6) Inadequate determination of future costs associated with present decision.

7) Failure to integrate operating and capital budgets.

8) Deficient utilization of cost benefit and cost-effectiveness analysis when appropriate.

The cycle emphasizes and provides central management with centralized control over the budgeting process. Centralized control is initially desirable in METEP because of the experimental nature of the project. It is felt that centralized control of funding requests, resource allocation, and educational evaluation and research will enhance efficiency, effectiveness and success in the METEP project.

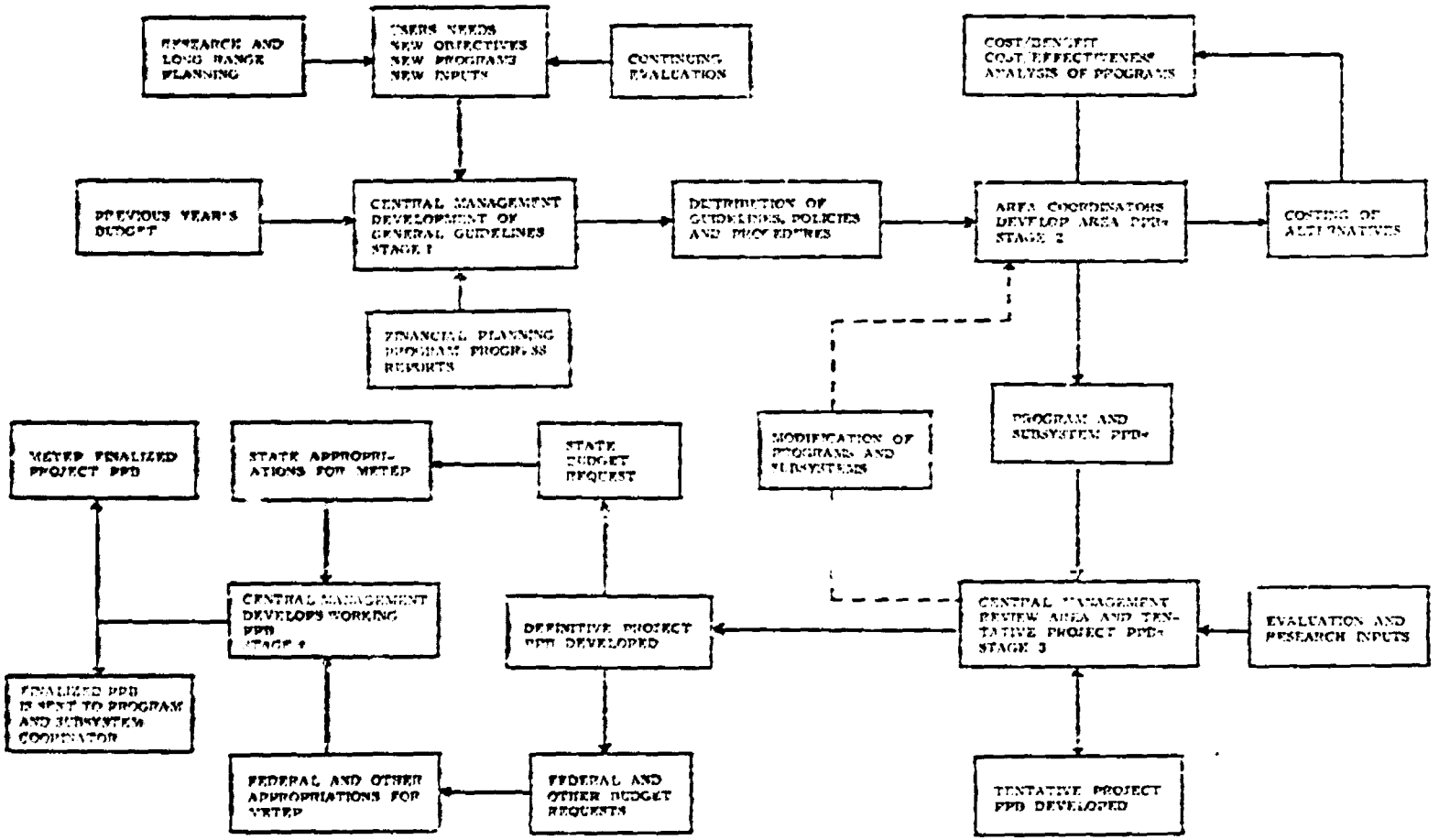
The cycle provides for incorporating traditional school and state fiscal procedures with those found in a PPB system. Since METEP seeks funding through the university and state, the integration of traditional budgeting procedures with PPB procedures is both desirable and necessary.

The internal budget cycle is divided into four distinct stages as well as specific time periods. Each stage plays an important part in the development of funding requests and the project PPB. Since deficiencies in any stage are likely to cripple the overall effectiveness of the budget system, the time tables and procedures associated with each stage need to be given proper support by central management. Figure 1 is a flow diagram of METEP's internal budget cycle without dates. Figure 2 is a flow diagram of METEP's total budget cycle, from budget design to funding, with dates.

The first stage is essentially a review of project objectives and the development of project guide-lines for the budgeting process. This involves gathering and organizing all information needed by program coordinators for the creation of program PPB's. Central management coordinates this intelligence activity. After the intelligence activity is complete, central management sends out appropriate information to both subsystems and program coordinators. Along with this inofrmation goes a detailed policy and procedure guide which relates to the development of PPB's for the educational and adminstrative components.

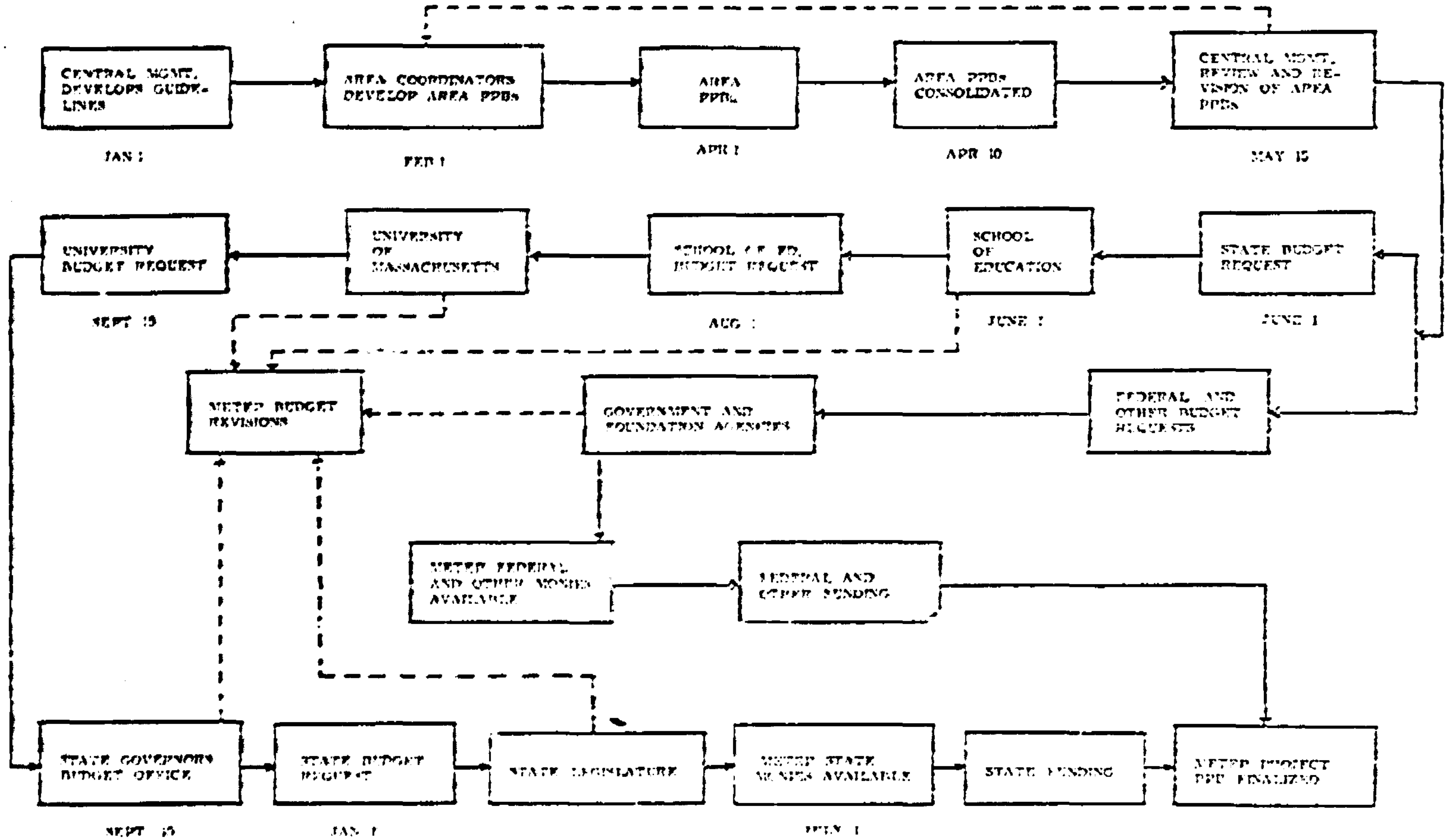
METEP INTERNAL BUDGET CYCLE

FIGURE *



METEP'S 18 MONTH BUDGET CYCLE

FIGURE 2



------the broken dotted line indicates sources of potential METEP budget revisions.

The second stage gives rise to the development of subsystems and program PPB's. Each coordinator works with his personnel to create a PPB for his area. This involves the analysis and interpretation of the intelligence provided by central management in light of the program's objectives and present activity. Such analysis and interpretation leads to the projection of future activity levels and related needs. With this information, program or subsystem changes are planned and programmed. Where significant changes are contemplated, their effect on future program output and cost should be analyzed. Once a coordinator is satisfied with plans made, alternatives chosen, and has reviewed last years PPB for overlap, a tentative area PPB is developed. The area PPB is then sent to central management for review and eventual consolidation with other area PPB's into the tentative project PPB.

In the third stage central management reviews each area PPB. If obvious deficiencies are apparent the area PPB is sent back for revision. If it is not sent back in the first review, it is consolidated with other PPB's. Eventually a project PPB evolves from this consolidation. Once the tentative project PPB is complete, central management, working with updated financial constraints and having evaluated the contributions of particular subsystems and programs to the success of the METEP project, will begin reviewing in detail the budget requests of each area. At this point, central management interjects its decisions pertaining to the overall direction of the METEP project. Working with information derived from the educational research subsystem and other sources, central management can add, cancel, or modify programs to increase the efficiency and effectiveness of the METEP project. Where modification is appropriate, central management will consult with one or more of the area coordinators to develop an acceptable PPB. This task often involves returning area PPB's for revision until consensus is attained.

The definitive project PPB is developed from revised area PPB's. This budget is the basis for future funding requests in the appropriate fiscal year. In the last phase of the third stage of the budgeting cycle various funding requests are sent to proper agencies for further processing. Likely, the definitive project PPB will undergo additional modification as the various funding agencies examine and act upon the original request. Stage four gives rise to the working or finalized project PPB. Once it is apparent exactly how much funding is available to METEP, a finalized project PPB is developed.

When this budget is complete it is sent to each subsystem and program. Coordinators are now able to draw upon the funds available

according to their budgeted amounts. This working PPB provides a basis for regulating and coordinating area expenditures.

Central management consists basically of the following core personnel: 1) project director, 2) associate director of education, and 3) associate director of administration. It also, at times, includes those individuals who are specifically required to serve in an advisory capacity when particular expertise is required during the budgeting process.

This arrangement is suitable to METEP requirements in that it can provide for a high degree of flexibility and expertise as circumstances in the budgeting cycle change. The core triad is adequate for most decision making in the budgeting process. It is sufficiently large to provide diverse points of view, and yet small enough to act decisively on matters requiring decisions.

METEP Budget Responsibilities and Procedures. Budge responsibilities in the METEP project are distributed among the following ranked individuals:

1. project director
2. associate director of education
3. associate director of administration
4. subsystem and program coordinators.

These individuals have certain responsibilities and authorities in the budgeting process.

Foremost among the responsibilities of the METEP's project director is that of establishing policies governing the scope and activity of administrative subsystems and educational programs. This responsibility is executed by the anticipative design approval or negation of program an' subsystem plans, their associated budgets, their administrative organizational patterns and other matters of general applicability. The director will determine and implement general policies needed for the initiation of the project. The need for policy revisions and/or additions will rest within the workings of the total organization. The need for a particular policy statement or decision will first become apparent to the administrative officers, faculty, or general staff. Their recommendations would then move upward through the organizational channels to the project director for appropriate action.

This points to the fact that the project director is primarily concerned with general policy. He is not only indirectly concerned with policies related to the methods by which the subsystems and programs budget proposals are conceived, developed and presented, the project director is also directly involved in the preparation of the definitive project's PPB. From this point of view, it is evident that the project director plays a vital role in nearly all the stages of the budgeting cycle. First, he helps to establish project objectives and guide-lines necessary to the development of subsystems and program PPB's. Second, he participates in the creation of the tentative project PPB. He provides the overall leadership necessary for directing the future of the METEP project. This involves him in decisions relating to the addition, cancellation, and modification of subsystems and programs within the immediate organizational structure. Third, he heads the team responsible for the preparation and submission of the definitive project PPB and funding requests. It is he who has the responsibility of supporting, defending, and if need be, modifying the definitive PPB. Forth, he is ultimately responsible for the financial control of funds provided to support the METEP project. This means the working METEP PPB is an extension of his responsibility.

In summary, the following functions are performed by the project director in the budgeting process:

1. Determination of general policies to control the sphere of activities in subsystem and program.

2. Establishment of fiscal plans and policies.

3. Alteration and modification of overall project direction.

4. Execution of project's PPB and related funding requests.

5. Execution of other budgetary procedures which he deems desirable or necessary.

The associate director of education is directly responsible to the program director in the budgeting process. His scope of activi is largely limited to directing and coordinating the development of the educational program budgets. He directs the evaluation of educational programs. He supervises educational research. He also acts in the capacity of advisor to the project director.

In this advisory capacity he can greatly affect the future direction of the METEP project. This ability makes him a key figure in the development of a project PPB.

In the absence of a project director he assumes the director's budgeting responsibilities.

The associate director of administration is directly responsible to the project director. When the project director is not present, he is responsible to the associate director of education. This officer's responsibility in the budgeting process is more detailed than either the project director or the associate director of education. His efforts are concentrated in the administration and coordination of the administrative subsystems. In this role he has the responsibility of directing and coordinating the development of subsystem PPB's.

He is also the financial officer of the METEP project. He is responsible in this function for the overall supervision of accounting activities and budgeting procedures within the METEP project. This means he regulates the technical and timing aspects of the budgeting process. In addition, he is charged with determining and promulgating accounting policies and procedures, maintaining the adequate form the accounting records of the project, preparing and interpreting financial reports as the need arises, making recommendations for executive or other action indicated as necessary or desirable by the reports, soliciting funds for the METEP project, administering financial controls with respect to receipts and expenditures, including budgetary control, supervising internal audits of the METEP project, and performing other financial functions as required.

More specifically, his budget respnsibilities are:

1. Formulation of the budget time schedule and necessary budget forms.

2. Preparation of guide-lines and procedure directives as to the design, development, justification, and submission of the area PPB's.

3. Direction of cost analysis of existing programs and proposed alternatives.

4. Initial analysis of area PPB's.

5. Consolidation of area PPB's into the tentative project PPB.

6. Supervision of central management's review of the tentative PPB and the related subsidiary area PPBs.

7. Initiating modification of area PPBs as a result of central management's review decisions.

8. Restructuring the tentative PPB into the definitive project PPB.

9. Organizing, structuring, coordinating, and submitting state-line item, federal, and other funding requests with appropriate supportive information.

10. Supplying any other budget justification as directed by the project director or funding agencies.

11. Supervision of modification to the definitive project PPB as resources are made available by the funding agencies.

12. Presenting the working or finalized project PPB to area coordinators as a fiscal guide.

13. Administration of expenditures and other details associated with the project PPB.

Subsystem and program coordinators are responsible to their respective supervisors, either the associate director of education, or administration. Each is responsible for directing, organizing, coordinating, and administrating the activities found in his particular area of responsibility. Their role in the budgeting process is to formulate their area PPB. This entails analyzing central management guide-lines for their effect on the future operations of their area. It also involves planning and programming future area funding requirements once guide-line analysis is complete. When the area's future requirements are analyzed and detailed in the area PPB, coordinators are required to submit justification of their funding requests along with the PPB. They will, when required, modify their budget proposals and resubmit them.

In essence, these individuals will:

1. Cooperate with the associate director of administration by following established policies, procedures, and guide-lines pertaining to the budgeting process.

2. Analyze present area operations and future needs.

3. Perform "cost-benefit" and "cost-effectiveness" analyses when appropriate.

4. Develop and submit area PPBs and supporting justifications.

5. Cooperate when they are requested to modify their area budgets.

6. Provide any additional help in the budget process at the request of the project director or one of the associate directors.

The Eighteen Month Budgeting Cycle Time Schedule. The total METEP budgeting cycle (Figure 2) is complex because METEP must seek funding from many sources. Each source prescribes and requires essentially different procedures for funding requests. Each source also has the ability, in funding, to materially alter METEP's financial plans. The METEP budget is in a constant state of flux until funding actually takes place; once funded, a finalized budget can be developed.

The time schedule for the METEP budgeting process continues over a period of eighteen months. The first date of importance is January 1. It signals the start of the initial stage of the budgeting cycle. Shortly after January 1, the associate director of administration begins to collect guide-line materials from established channels. Through the month of January, he constructs a set of instructions which will be used as a guide in the development, preparation, submission and justification of subsystem and program PPB requests. Once complete, these instructions will be included in a kit which contains time schedules, procedures and forms.

On or about February 1, these materials are transmitted to various subsystems and programs for appropriate action. For the next sixty days coordinators will work to develop their area PPB's. Once their PPBs are developed, they are sent to the associate director of administration for review and further processing. All area PPBs must be in the associate director's office on or before April 1.

April 1 signals the preparation of a tentative project PPB. This entails reviewing area PPB's before they are consolidated into the tentative project PPB. Any found obviously unsatisfactory are returned to the appropriate coordinator for modification. The target date for completion of the tentative project PPB is April 10th. From April 10th to May 15th central management in consultation with area coordinators, can modify the overall tentative project PPB. Also during this time the tentative project PPB will be presented to the Assistant Dean for Administration, School of Education.

The Assistant Dean will be requested to review the budget and to recommend which portions would be appropriate to include in the school's budget request.

By May 15th a definitive project PPB should be developed. The associate director of administration and his staff will determine how the project PPB will be broken down into funding requests. Funding requests will be prepared, reviewed and submitted by June 1.

By June 1 the project director will have acquainted himself with every facet of the project's PPB. The project director and his staff will have the responsibility of maintaining working contacts with various school, university, state, federal, and other funding agencies until funding for the budgeted year is completed. This means that the project director and his staff are to be available to explain and justify the original request and, when necessary, submit and explain any alterations in budgeted needs which may be reflected in changing METEP requirements during the remaining twelve months of the budge cycle.

When the total amount of funding available to METEP becomes known, the project director and the associate director of administration will supervise the preparation of the working project PPB. This should occur as near as possible to July 1 the beginning of the fiscal year to which the working PPB is to be applied.

Implementation Comments. When the implementation of the METEP is funded, the five-year budget and financial time schedule (developed in the feasibility study) will be evaluated in terms of the available funds and designs of the various pedagogical programs. The result of this evaluation will be a finalized five-year budget and plan for raising any necessary funds to support the METEP during this period. The associate director of administration will be charged with the responsibility of implementing the financial and PPB systems. It is anticipated that the proposed PPB system will require modification because of varying start-up conditions that may be encountered. However, for efficient operation of the system, emphasis must remain on the function of long-range planning because of the eighteen month budgeting cycle that will be encountered.

It is impossible to anticipate any changes that may develop in the financial and budgeting system of the University of Massachusetts. At this point in time, several changes appear in the making and should be considered at implementation to insure a proper interface between the METEP and the University's system.

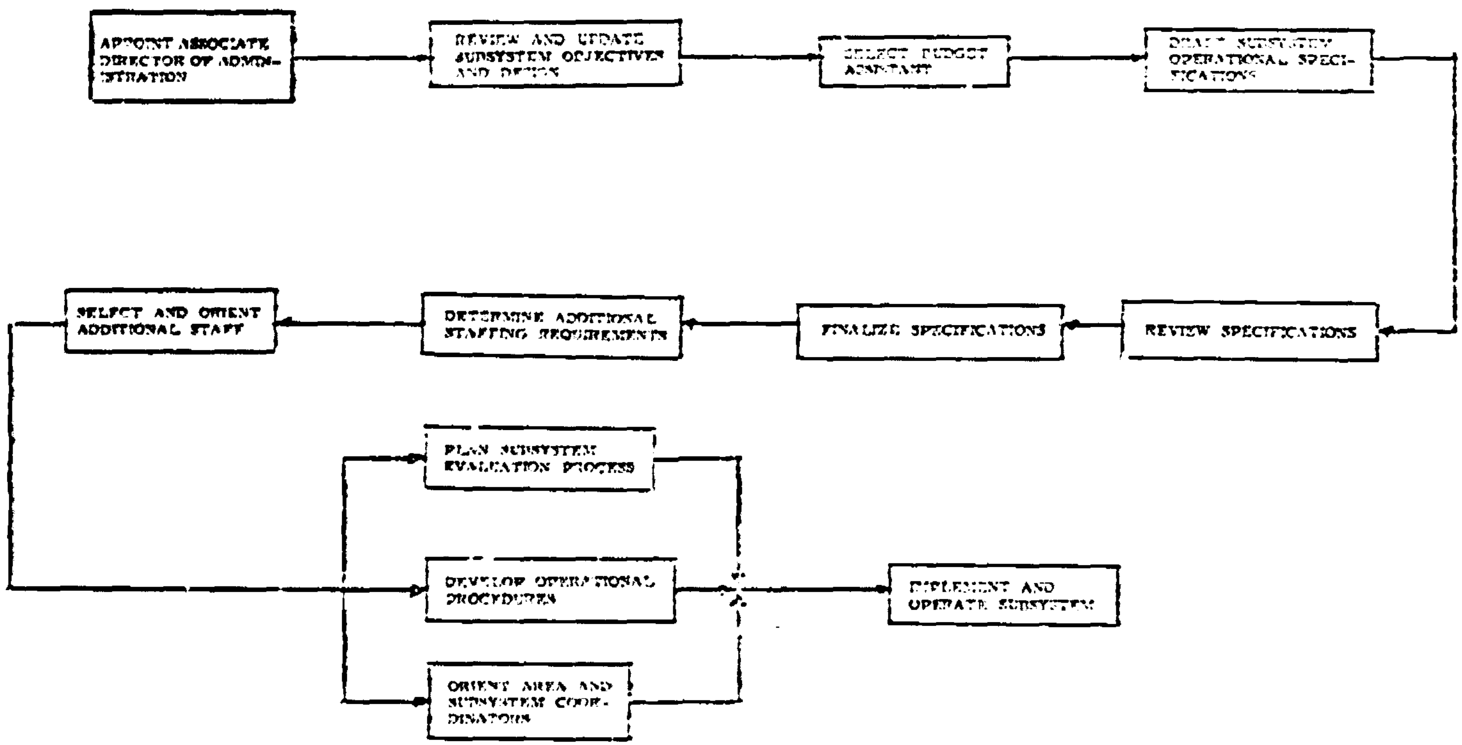
The School of Education is presently in the early design stage of developing a revised budgeting and accounting system. The interface between the project's and school's fiscal systems is discussed in the description of the HETLP accounting subsystem.

Figure 3 is a network activity diagram of the implementation of the budget subsystem. Although not explicitly illustrated, there are implicit feedback loops and cycles of activities. For example, data derived from the evaluation of the budgetary process will be used to update the objectives and design of the subsystem. Hence, many of the steps in the network will be repeated.

Most of the expenses of implementing the proposed budgetary subsystem are included in the budget estimates for the administrative subsystem. Some costs associated with the automation of the fiscal subsystems are included in the management information system budget.

BUDGET SUBSYSTEM

FIGURE 3



Accounting Subsystem

The Treasurer, the chief financial officer of the University, is accountable for the control and disbursement of all University funds. One of the functions of the Treasurer's office is to maintain all official accounting records. This task is centrally performed.

The Assistant Dean for Administration, School of Education, acting for the Dean of the School, is responsible for initiating official forms notifying the Treasurer's Office to encumber and expend funds which have been allocated to the School.

Trust fund, i.e., federal and foundation grants and contracts, are administered similar to the state allocated funds. Each trust fund is administered as a separate entity. The assignment of accounting categories is more flexible for non-state funds. This allows accounts to be established for compliance with federal and foundation guide-lines.

The University provides a weekly report to the School noting expenditures and balances. The processing time between the initiation of an action and the reported completion is normally three or four weeks. Therefore, the weekly University report is approximately a month out of date when received by the School. Hence, the School has found it desirable to set up a ledger system which maintains the current balances of all accounts. Encumbrances, their liquidations, expenditures, and cash balances are maintained.

The present accounting systems, both University and school, are line-item accounts. (The School is presently in the early design stage of developing a program approach to budgeting and accounting.) The METEP budgetary subsystem implies an accounting system which will provide more data than either the present university or school systems. The only constraint placed on the project's accounting subsystem will be the requirement of creating line-item financial reports using the University account structure. This requirement is necessary for comparing official university records and the project's "working" records.

The disbursement and accounting of METEP funds will follow the University system with the following exceptions. The METEP associate director of administration will initiate the forms necessary for encumbering and expending funds. These forms will be forwarded to the Treasurer of the University through the Assistant Dean for Administration, School of Education. The working ledger

will be maintained by the project's associate director of administration. The official accounting record will remain the responsibility of the Treasurer.

Accounting records maintained by the project will be used for the financial control of METEP. These records will provide critical inputs for cost-effectiveness analyses and PPB preparations. The associate director of administration will provide area and subsystem directors with financial reports when requested.

The associate director will be responsible for reviewing the financial status of the project with the director and the associate director of education on a regular monthly basis.

The accounting subsystem proposed for METEP will provide fiscal reports for:

(1) Each educational area and administrative subsystem - program codes.

(2) Control accounts by object codes - the present University account structure.

(3) Coded activity accounts, e.g., instruction, administration, program diffusion and dissemination, program evaluation.

The general framework of the proposed accounting subsystem follows from the proposed PPB subsystem. It incorporates the current public school practice of the utilization of a "Federal Accounting System" with program accounting. The following Figure 4 is used to illustrate the proposed subsystem.

The three dimensions of the cube are: activity, object, and program codes. Each fiscal transaction is coded to:

1) indicate the purpose of the expenditure or action - the activity.

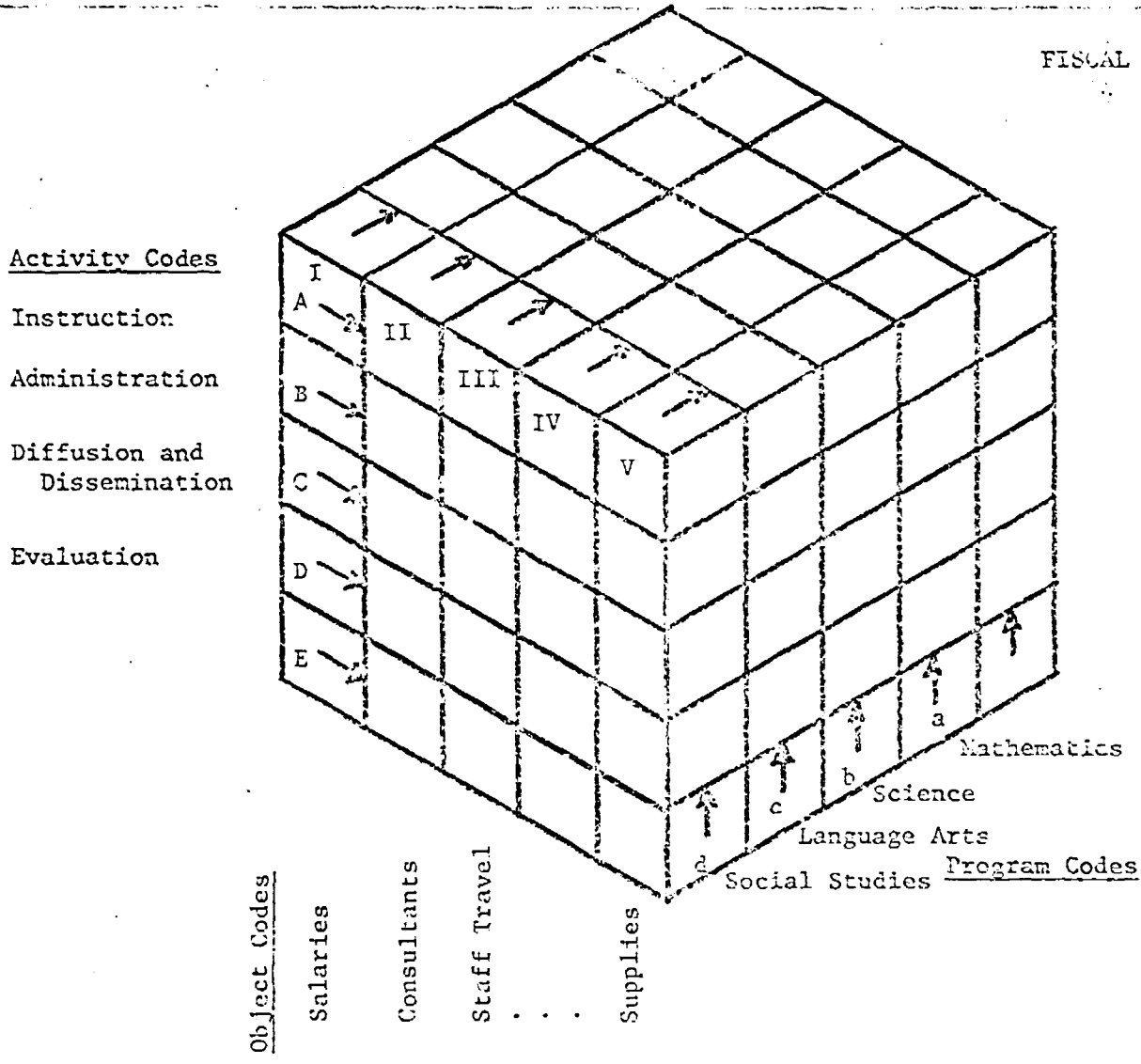
2) describe the materials or services acquired - the object.

3) indicate the area or subsystem of the activity - the program.

This three dimensional accounting subsystem will provide cost data necessary for PPB preparation and control. The comparison of expenditures permitted by this design is also beneficial in cost-effectiveness analysis.

FISCAL ACCOUNTING MODEL*

FIGURE 4



* credit MSD rpt

Some of the comparisons possible using this design are:

1) Supplies in science instruction (cube A-V-b) to supplies in language arts instruction (cube A-V-c)

2) Total instructional cost (entire layer A) to total administrative cost (entire layer B)

3) Total mathematics program cost (entire slice a) to total science program cost (entire slice b).

The object codes will agree with the account structure set up by the Treasurer's office. Activity and program codes will be determined by the METEP associate director of administration. The activity codes will be reviewed by the School's Assistant Dean for Administration.

A three dimensional accounting system is sufficient for a program that derives all of its funding from the same source. Funding for METEP is anticipated from several sources. Therefore, although not included in the graphical illustration at the accounting subsystem, a fourth dimension is necessary. Codes will be established to indicate the source of the funds being used in a financial transaction. The coding requirements will be determined by the METEP associate director of administration. The design of the METEP accounting subsystem will be revised, if necessary, to insure proper interface with the new accounting system now being developed at the School of Education.

The Management Information System described in section III does not include an accounting subsystem. Any computerization of the accounting procedure will require additional computer program design, implementation and operation.

Although the University maintains the official accounting records, a METEP accounting subsystem should not be considered redundant. Rationale for the accounting subsystem has been previously presented. The relationship between the School of Education's accounting procedures and METEP has also been described. However, there is one point which must be considered.

Reference has been made to the development of a new budgeting and accounting system within the School. It is reasonable to assume that procedures will be appropriately automated. Therefore, is it feasible for METEP personnel to design and implement a separate system?

It is recommended that the METEP fiscal subsystems be implemented. The final design of the systems should be determined in cooperation with the School's Assistant Dean for Administration. But, the size of the METEP operation and its experimental nature dictates the requirement of an autonomous fiscal subsystem.

Also the stage of the development of the School's accounting system does not indicate that it will be operational in the near future. The assumption cannot be made that the School will be in a position to provide the necessary accounting support, i.e., automated program accounting procedures, when required for the implementation and operation of METEP.

It is not unrealistic to predict that the design and implementation of the METEP fiscal subsystems will provide valuable experience upon which the School will draw in designing and implementing its budgetary and accounting system.

The cost of the initial program design and implementation is estimated at $16,000 (not including overhead expenses). Most of the cost of the operational system is included in the cost of the administrative subsystem. The main additional expenses are program maintenance (revisions, updates, additions) and computer time. $4,000 is included in the operational budge for these items.

Activities necessary in the implementation of the accounting subsystem are graphically illustrated in Figure 5. The operation of the subsystem includes the evaluation and updating of accounting procedures.

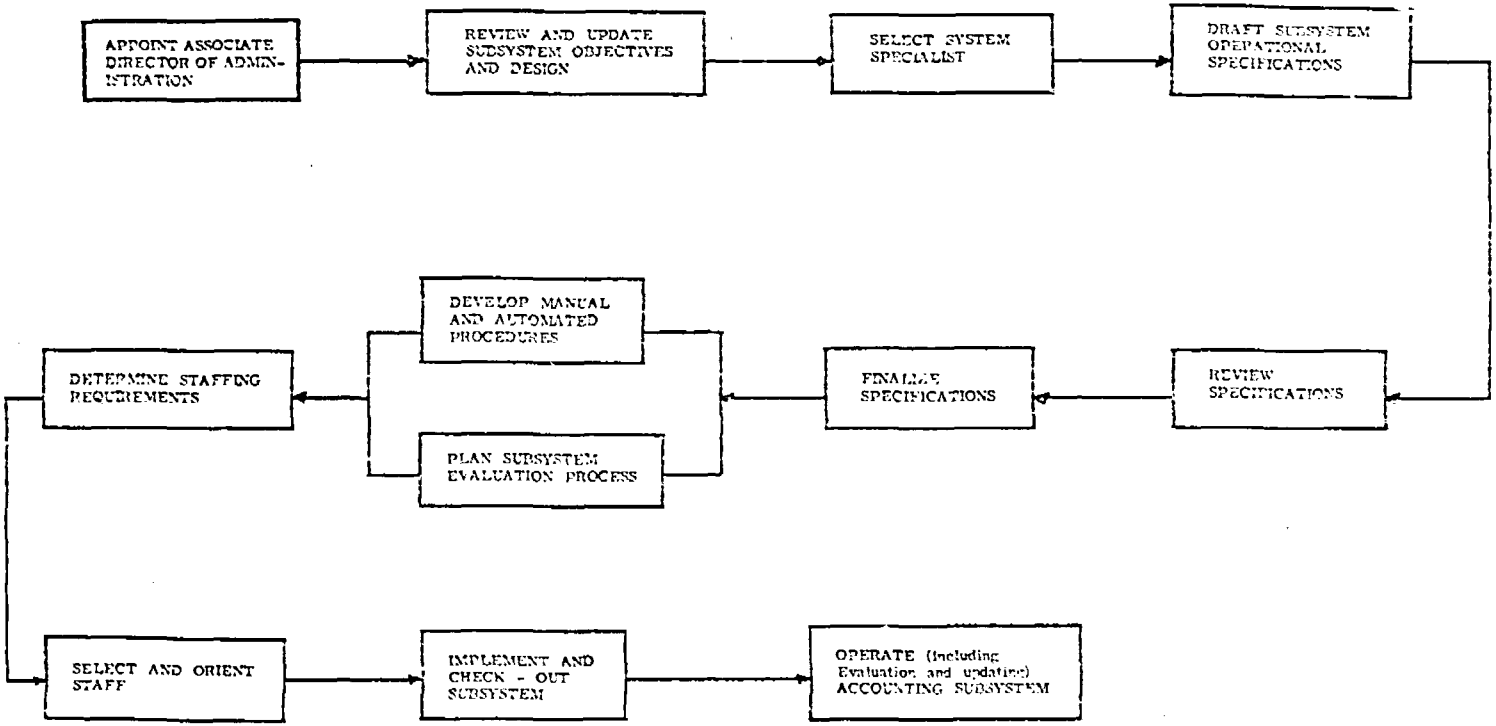
Procurement Procedure. The METEP associate director of administration will be responsible for procuring items and services required for the implementation and operation of the project. He will familiarize himself with the procedures established by the university for purchasing materials, equipment, supplies, and services. He will be responsible for initiating all METEP procurement actions.

Area and subsystem coordinators will be responsible for informing the associate director of procurement needs. (The area and subsystem PPBs will provide the planning documentation required for anticipating most requirements.) The associate director will then determine the appropriate procurement action necessary to meet each need.

The following is a general description of the university procurement model.

ACCOUNTING SUBSYSTEM

FIGURE 5



The Assistant Dean for Administration, School of Education, is authorized to prepare departmental purchase orders for the direct purchase of articles and repair services. Direct purchases may not exceed $100.00. Orders totaling more than $100.00 must be submitted on a purchase requisition to the university procurement office unless there is only one source of supply, then departmental purchase orders may be submitted up to a limit of $500.00. Justifiable emergencies, not in excess of $500.00, may also be submitted on departmental purchase orders. All emergency purchases must be approved in advance by the university procurement office.

Departmental purchase orders and purchase requisitions are submitted to the procurement office for approval. Approval must be obtained prior to the purchase of all itmes and services. The procurement office has the responsibility of contacting and negotiating with vendors.

The University distinguishes between purchases which use state funds and purchases which use trust funds, e.g., Federal and foundations monies. The general regulations remain the same. Projects supported with trust funds request "direct" purchases by submitting a Trust Fund Purchase Order.

The University maintains a stock of supplies which may be obtained by submitting an interdepartmental purchase order. This service provides departments and projects with an economic method of obtaining supplies.

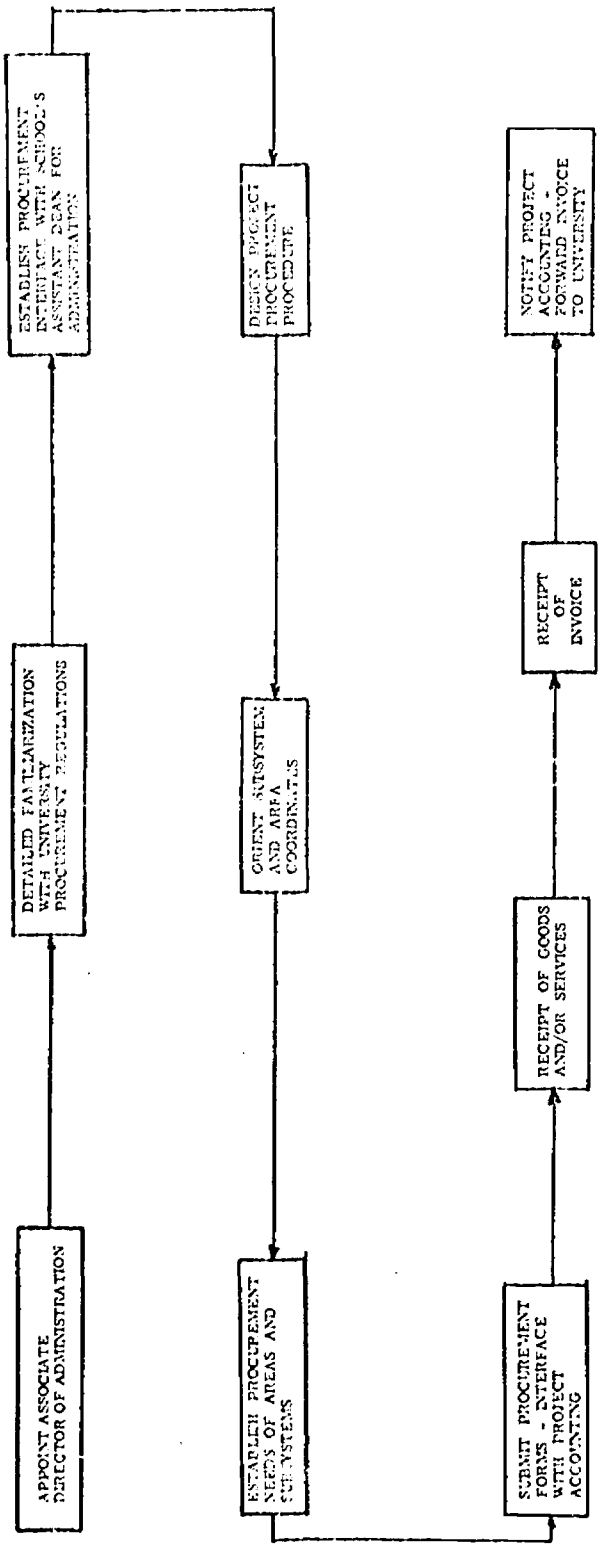
Departments and schools maintain a record of the receipt of all purchased items and services. The Treasurer's Office normally receives all invoices. Invoices are sent to the School or department for approval of payment and are then returned to the Treasurer's Office for payment. Invoices directly received from a vendor by a department or school are approved for payment and then forwarded to the Treasurer's office for payment.

The METEP associate director of administration is responsible for interfacing the project's accounting and procurement activities. He is also responsible for procurement interface with the Assistant Dean for Administration, School of Education.

The steps necessary in the implementation of the procurement procedure are outlined in Figure 6. The associate director of administration will provide procurement support to all program and subsystem coordinators during the implementation and operation of all components of the METEP system.

PROCUREMENT PROCEDURE

FIGURE 5



Cost-Effectiveness Model. Cost-effectiveness analysis is a process which relates cost and effectiveness (achievement) data for alternative courses of action. The cost and effectiveness data is presented in the same format for each alternative being analyzed. The format for relating and presenting data is determined by the needs of the person(s) who will use the data in his decision-making process. There is no specific algorithm for decision-making using cost-effectiveness data. Decisions should be based on all pertinent data available and should not be limited to the cost-effectiveness data. The following cost-effectiveness data will be used in developing area PPBs and in evaluating the design of the system.

The cost of each educational area is included as a separate section within the total program budget. These costs may be further broken down to be associated with instructional alternatives. The cost of some instructional alternatives may be easily identified, while the assignment of cost to some IAs may be highly subjective. Therefore, the process used for determining the cost becomes significant in the later analysis of the cost data. Hence, the process should be documented and available when cost-effectiveness analyses are reviewed.

Cost will also be assigned to area facilities, e.g., the cost of operating a learning lab will be calculated. These costs will be divided into two parts - fixed and variable. Fixed costs are not effected by the student utilization rate while the variable costs are determined by the utilization rate. For example, if the lab requires faculty or staff personnel to be present when the lab is open for students, then the salaries of the personnel will be considered a fixed cost. The cost of the replacement of expendable supplies and materials are examples of variable costs

The cost of a lab will be divided among the instructional alternatives which require the utilization of the lab. The varying requirements for utilization of the lab for different IAs does not permit the generalization of a formula for allocating lab cost. These allocations will be treated as separate cases. Note: The cost of operating a lab does not include the capital cost associated with the purchase of permanent equipment and nonexpendable items.

Personnel and staff cost are also assigned to instructional alternatives for experiences other than lab. These costs may be both fixed and variable.

The management information system will provide the following data:

1. Number of students signing up for an IA
2. Number and % of students pre-testing out of an IA.

3. Number and % of students post-testing in an IA.
4. Number and % of students post-testing out of an IA.

The cost and utilization data will be presented in the following format (See Figure 7). Each IA for a PC will be represented by a dual linear bar graph. The top bar will represent the cost of providing the IA. The bar will be subdivided into fixed and variable cost. The cost scale will be found at the top of the illustration. The bottom bar for each IA will represent the number of students who selected the IA. This bar will be subdivided into three parts: the number of students who pre-test out of the IA, the number of students who post-test out of the IA, and the number of unsuccessful attempts in completing an IA. The number scale will be found at the bottom of the illustration. The cost per student for each IA will be presented in parenthesis at the end of each dual-bar graph.

This graphical representation of cost and achievement data will be beneficial in the cost-effectiveness analysis of the operating program.

The same technique can be used in presenting data for explicit alternative courses of action where the cost and achievement data are either historical or anticipated. Therefore, the cost-effectiveness data can be used in making decisions pertaining to the deletion, addition, and/or alteration of instructional alternatives. It is extremely important to point out that the cost-effectiveness data is a necessary but not sufficient base for making decisions. For example, an instructional alternative may have a low utilization rate and a high per student cost while other IAs for the same PC may have high utilization rates and low cost. Based entirely on the cost/utilization data, consideration would probably be given to deleting the high cost alternative. However, examination of the type of student who successfully completes the high cost alternative may provide additional data which would indicate the desirability of maintaining the high cost alternative. One of the inherent dangers of using cost-effectiveness analysis in education is the misuse of data by cost-oriented instead of student-oriented administrators.

COST-EFFECTIVENESS DATA
for
(name of educational program)

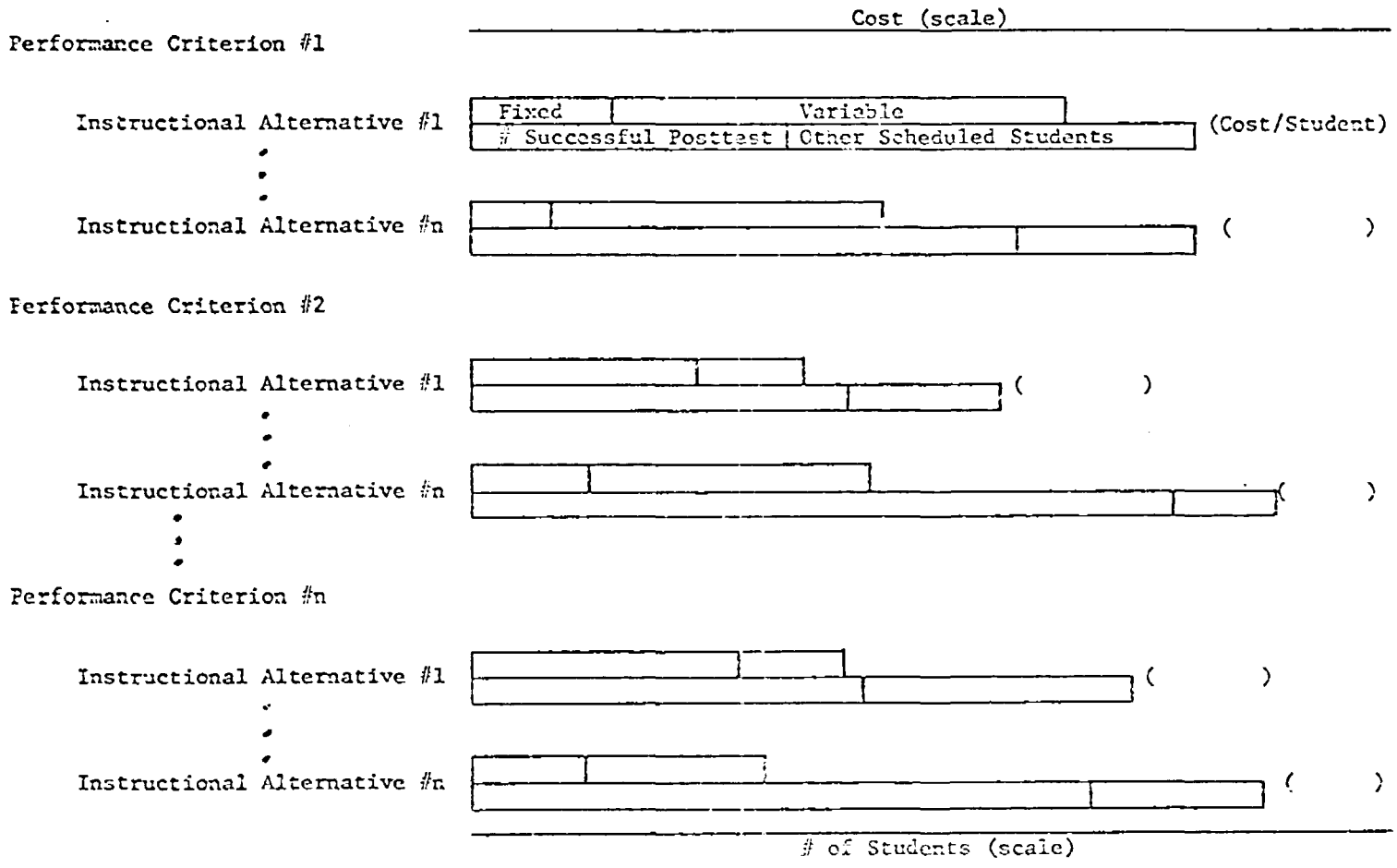


Figure 7

METEP Five-Year Financial Budget

The budget is a projection of the estimated costs of the continued development and implementation of the METEP Program. The budget contains in summary form the total estimated costs of the four support subsystems and 16 educational programs which make up METEP. (See Appendix A.) Subsidiary budgets are also provided for each of the subsystems and educational programs which further delineate the estimated costs of development and implementation. (See Appendix B.) Proposed sources of revenue are indicated on the summary and subsidiary budgets. Federal support is phased out by the end of the fifth year with the State of Massachusetts assuming financial responsibility of the program. The budget also assumes that some funds will be available from other sources during the second and third years of the project, e.g., foundation support in the development of the urban education program.

Costs are based on an achieving an enrollment of 800 full-time equivalent students, including both pre-service and in-service, in the system during the fifth year. All costs are estimated in 1970 dollars and the summary budget in the final section includes a 4% inflation factor in order to estimate more accurately costs in the latter four years.

A financial time schedule for planning, research, capital outlay, and operation of the various subsystems and programs over the five year period is presented in Figure 8.

The master budget lists four accounts.

(1) Planning/Research: Includes the estimated cost of identifying additional performance criteria and the development of the related instructional alternatives. Planning also includes the development cost of instructional material for the instructional alternatives. Planning in the Testing and Guidance subsystem includes the cost of developing and evaluating the pre and post tests. Planning in the research subsystem includes the development of a monitoring system to evaluate the operation of METEP and a total system of evaluation during the fifth year. Planning personnel costs are included in this account.

(2) Operations: Includes supplies, maintenance and other estimated costs to be incurred in daily operation of the system.

METEP FINANCIAL TIME SCHEDULE

FIGURE 8

		Year 1	Year 2	Year 3	Year 4	Year 5
Full Time Equilvent Students			100	200	500	800
No.	Subsystem					
1	Management	.....				
2	Information	.....				
3	Research	.....				
4	Testing Guidance	.....				
	Program					
1	Behavioral	.....	.....			
2	Pre-School	.....	.....			
3	Human Relations	.....	.....	.....		
4	Language Arts	.....	.....			
5	Mathematics	.....	.....			
6	Media	.....	.....	.....		
7	Science	.....	.....	.....		
8	Social Studies	.....	.....			
9	In Service	.....	.....			
10	METEP Orientation					
11	Aesthetics			.....		
12	Evaluation				.....	
13	Foreign Language		.....	.....	.....	
14	Supervision				.....	
15	Technology				.....	.....
16	Urban Education			.....		

_____ Planning ..... Capital Outlay ---------- Operations

(3) Capital: Includes the estimated costs of all the equipment and material with an estimated life of longer than one year.

(4) Personnel: The estimated cost of all professional and non-professional employees required by METEP.

The line items listed in the subsidiary budgets are aggregates of specific items and their estimated costs. The lengthy specific information is not listed in the report but is available.

The first seven educational program of the METEP system are proposed for implementation during the first year. These programs are in the final design phase and have been evaluated during the current feasibility study. The capital expenditures of these particular educational programs include the cost of establishing learning laboratories that will be used by the students while studying in the various areas. These laboratories include audiovisual equipment and other devices that will be utilized by the students while engaged in self study and formal classroom instruction.

These laboratories must meet space utilization standards if they are to be considered economically feasible. The University uses the following utilization standards.

Classrooms. The average room is expected to be scheduled for 36 hours per week. The station (seat) utilization is expected to average 60%. For example, a room with 30 stations scheduled for 36 hours would provide 1080 station hours per week. Applying the 60% station utilization rate indicates that the room is expected to be used for a total of 648 student utilization hours per week.

Laboratories. (Chemistry, physics, etc.) The average lab is expected to be scheduled for 24 hours per week. The station utilization is expected to average 80%. Applying these standards to a lab with 30 stations would indicate the expected use to total 576 student utilization hours per week.

The type of laboratory proposed for the METEP project presently does not have a university utilization standard. These will not normally be scheduled for group experiences. They are designed for individual activities.

The space required for establishing METEP labs will come from existing regular classroom space. Therefore, a case can be presented for setting the utilization standard of the labs the same as for a classroom. However, the lab will be serving individuals instead of scheduled groups, hence, the following method of determining if the labs meets university standards is proposed.

Let N_{cs} denote the number of student utilization hours per week required to meet the University standards prior to the conversion of the regular classroom space. Let t_i denote the time that a student spends in a visit to a lab. The summation of these times, $\sum t_i$, is the total time of student utilization. Therefore, to meet the University standard: $\sum t_i \geq N_{cs}$, for each learning laboratory.

Results from the simulation model indicated that most of the proposed labs met this criterion of space utilization. Updating simulation input data and refining the design of pedagogical programs and laboratories has resulted in an increase in the projected utilization of laboratories. Therefore, those labs for which the projected utilization rate did not meet the standard are now considered to be feasible.

The following utilization standards are used in determining personnel requirements.

A major portion of a faculty member's time should be spent in research and development oriented activities. Therefore, an average of 7.5 student contact hours per week is considered appropriate for planned instructional experiences.

METEP staff members are expected to work 35 hours per week. Graduate students financially supported by METEP assistantships are expected to participate in project activities 20 hours per week.

The student/faculty ratio set by the State of Massachusetts is fifteen to one. Hence, the proposed project, designed to serve 800 full time students, should have approximately 54 full time faculty members.

This number would be substantially increased with the implementation of the remaining nine educational programs. Hence, the results of the simulation indicated that the design of the project was not feasible when the student/faculty ratio standard was applied.

A review of the type of personnel required to perform instructional tasks uncovered an error in the simulation input data. Graduate students in the School of Education are considered as part of the instructional staff. Several pedagogical areas had indicated that certain tasks were to be performed by members of the instructional staff without distinguishing between faculty and graduate students. This was misinterpreted as solely a faculty responsibility. Hence, the number of required faculty was increased while the number of graduate students was negatively effected.

The staffing requirements generated by the simulation of the program were adjusted to reflect the correct utilization of faculty and graduate students.

The staffing pattern used in determining the budget for year-5 is presented in Table 1. Forty-two full time faculty members are utilized solely in the instructional aspect of the program. Twelve faculty members will have both instructional duties and responsibilities in the management, information, and research subsystems. Forty-six graduate students financially supported by the project will be utilized in instructional activities, including supervision of learning laboratories. Seventeen graduate students will be utilized in various administrative functions. The budget also includes seven positions for laboratory supervisors. These individuals will be responsible for the maintenance and supervision of the laboratories. The budget also includes funds for four psycho-metricians in the research subsystem and forty affiliated teachers in the in-service program. Table 2 indicates student faculty ratios, faculty to secretary ratios, and faculty to graduate student ratios.

The proposed sources of revenue are illustrated in Figure 9. The phase out of Federal support is graphically presented. A compilation of the total cost of the project is presented in Table 3. Cost are presented in terms of 1970 dollars.

Table 4 is a comparison of the present cost of the elementary teacher education program and the cost of the proposed system.

The current operating budget of the School of Education does not reflect the total cost of the elementary teacher education program. The University does not allocate some funds at the department or school level. For example, the funds required to furnish heat are not allocated to the school. Other examples are the cost of student services, central administration, and university security. Therefore, the cost per student presented in the projected budget are not total cost.

The cost of the proposed METEP program is presented in a format comparible to the existing budget of the elementary teacher education program. Cost not considered to be relevant to the decision of replacing the current elementary teacher education program with the proposed project are not included. The accounts and subaccounts of the projected budget are comparable to the present accounts of the elementary teacher education program.

The current expenditures for the elementary teacher program is approximately $1,580 per student. This is the cost used in the comparison presented in Table 4.

TABLE 1

YEAR-5 STAFFING REQUIREMENTS

	Full Prof. Equiv.	Assoc Prof. Equiv.	Asst. Prof. Equiv.	Lab. Tech. Equiv.	Sec. Equiv.	Grad. Student	Other	
Table B- 1 Mgt. System	1	2	1	0	3	4	0	
Table B- 2 Inf. System	0	1	1	0	1	2	0	
Table B- 3 Res. System	1	2	3	0	4	3	4	Psychometrician
Table B- 4 Test. System	0	0	0	0	4	8	0	
Totals:	2	5	5	0	12	17	4	
Table B- 5 Bhvr. Prog.	0	1	3	1	1	3	0	
Table B- 6 Pre-Sch. Prog.	0	1	2	1	1	7	0	
Table B- 7 Hum. Rel. Prog.	1	1	2	0	1	11	0	
Table B- 8 Lng. Arts Prog.	0	1	3	1	1	3	0	
Table B- 9 Math. Prog.	0	1	3	1	1	7	0	
Table B-10 Media Prog.	0	1	2	1	1	3	0	
Table B-11 Sci. Prog.	0	1	3	1	1	4	0	
Table B-12 S. Sci. Prog.	0	1	3	0	1	3	0	
Table B-13 Inserv. Prog.	0	0	1	0	1	3	40	Affiliated Teachers
Totals:	1	8	22	6	9	44	40	
Table B-14 Orient. Prog.	0	0	2	0	1	0	0	
Table B-15 Aesth. Prog.	0	0	1	0	0	0	0	
Table B-16 Eval. Prog.	0	0	1	0	0	0	0	
Table B-17 For. L. Prog.	0	2	0	1	0	0	0	
Table B-18 Superv. Prog.	0	0	1	0	0	0	0	
Table B-19 Tech. Prog.	0	0	2	0	0	0	0	
Table B-20 Urban Ed. Prog.	0	0	2	0	0	0	0	
Totals:	0	2	9	1	1	0	0	
Grand Totals: Year 5	3	15	36	7	22	51	44	

TABLE 2

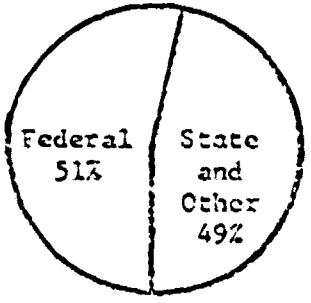
FACULTY RATIOS
YEARS 1 TO 5

Year		Ratios	Ratios	Ratios
1	Programs 1-8			
	200 Students 18 Faculty Members	9 Professional Staff		
	Faculty: Student	1 : 11		
	Faculty & Staff: Student	1 : 7		
	Faculty: Secretary		2 : 1	
	Faculty: Graduate Students			1 : 1
2	Programs 1-10			
	300 Students 22 Faculty Members	10 Professional Staff		
	Faculty: Student	1 : 14		
	Faculty & Staff: Student	1 : 10		
	Faculty: Secretary		2 : 1	
	Faculty: Graduate Students			1 : 1
3	Programs 1-14			
	400 Students 30 Faculty Members	10 Professional Staff		
	Faculty: Student	1 : 13		
	Faculty & Staff: Student	1 : 10		
	Faculty: Secretary		3 : 1	
	Faculty: Graduate Students			1 : 1

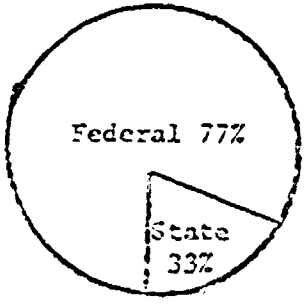
TABLE 2--Continued

Year		Ratios	Ratios	Ratios
4	Programs 1-16			
	600 Students 39 Faculty Members	11 Professional Staff		
	Faculty: Student	1 : 16		
	Faculty & Staff: Student	1 : 12		
	Faculty: Secretary		4 : 1	
	Faculty: Graduate Students			1 : 1
5	Programs 1-16			
	800 Students 42 Faculty Members	12 Professional Staff		
	Faculty: Student	1 : 19		
	Faculty & Staff: Student	1 : 15		
	Faculty: Secretary		4 : 1	
	Faculty: Graduate Students			1 : 1

All Amounts in Thousands of Dollars



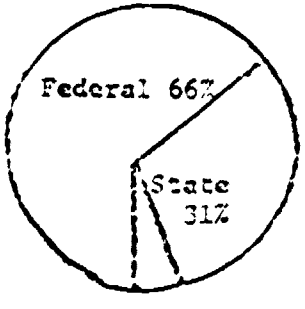
Year 1-5	$ 4952.5	Federal
	4473.5	State
Total	140.0	Other
Project Cost	$ 9568.0	



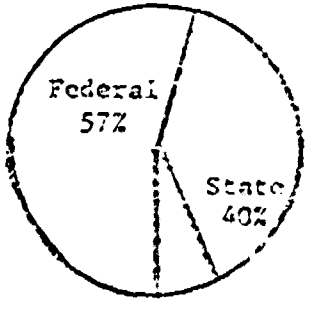
METEP FIVE-YEAR FINANCIAL SUPPORT SCHEDULE

Figure 9

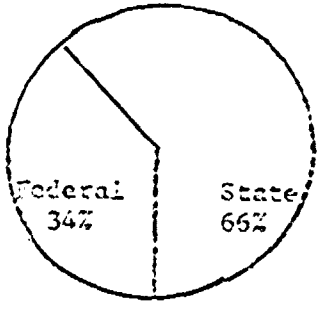
	Year-1
Federal	$ 1372.4
State	409.0
Other	.0
Totals	$ 1781.4



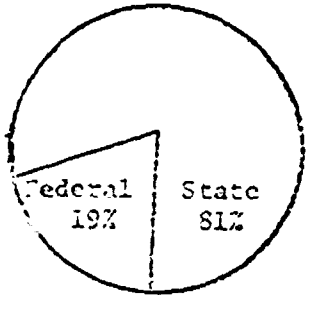
	Year-2
Federal	$ 1352.2
State	618.7
Other	70.0
Totals	$ 2040.9



	Year-3
	$ 1246.5
	873.0
	70.0
	$ 2189.5



	Year-4
	$ 638.0
	1129.5
	.0
	$ 1867.5



	Year-5
	$ 343.5
	1418.0
	.0
	$ 1761.5

TABLE 3

COMPILATION OF TOTAL COSTS
(ALL IN 1970 DOLLARS)
(ALL AMOUNTS IN THOUSANDS OF DOLLARS)

No	Subsystems	Total Cost	% Total	Total Federal	% Fed	Total State	% State	Total Other	% Other
1	Management	522.0	5.4	282.0	5.7	240.0	5.4		
2	Information	543.0	5.7	227.0	4.6	316.0	7.1		
3	Research	898.5	9.4	381.0	7.7	517.5	11.7		
4	Testing & Guidance	340.0	3.6	215.0	4.3	125.0	2.8		
	Subsystems Total	2,303.5	24.1	1,105.0	22.3	1,198.5	27.0		
	Programs								
1	Behavioral	611.0	6.4	242.0	4.9	369.0	8.3		
2	Pre-School	704.0	7.4	353.0	7.1	351.0	7.9		
3	Human Relations	579.5	6.2	231.0	4.7	348.5	7.8		
4	Language Arts	930.0	9.7	527.0	10.7	403.0	9.1		
5	Mathematics	446.5	4.7	161.5	3.3	285.0	6.4		
6	Media	870.5	9.1	527.5	10.7	343.0	7.7		
7	Science	579.0	6.1	254.5	5.1	324.5	7.3		
8	Social Studies	406.0	4.2	121.0	2.4	285.0	6.4		
9	Inservice	408.5	4.3	136.0	2.7	272.5	6.1		
10	Orientation	227.5	2.4	227.5	4.6		0.0		
11	Aesthetics	152.5	1.6	110.0	2.2	42.5	1.0		
12	Evaluation	84.0	.9	75.0	1.5	9.0	.2		
13	Foreign Language	538.5	5.6	321.5	6.5	117.0	2.6	100.0	71.4

TABLE 3—Continued

No	Sybsystems	Total Cost	% Total	Total Federal	% Fed	Total State	% State	Total Other	% Other
14	Supervision	84.0	.9	75.0	1.5	9.0	.2		
15	Technology	390.0	4.1	365.0	7.4	25.0	.6		
16	Urban Education	225.0	2.3	120.0	2.4	65.0	1.4	40.0	28.6
	Programs Total	7,236.5	75.9	3,847.5	77.7	3,249.0	73.0	140.0	100.0
	Total	9,540.0	100.0	4,952.5	100.0	4,447.5	100.0	140.0	100.0

Cost Category	Total Cost	% Total	Total Federal	% Fed	Total State	% State	Total Other	% Other
Planning	295.0	2.8	295.0	5.6	0.0	0.0	0.0	0.0
Research	639.0	6.2	599.0	11.5	0.0	0.0	40.0	26.9
Operating	1,151.0	11.2	245.0	4.7	906.0	18.5	0.0	0.0
Equipment	1,833.0	17.9	1,726.0	32.9	7.0	.2	100.0	67.4
Personnel	5,307.0	48.7	1,472.5	28.1	3,534.5	72.2	0.0	0.0
Facility Mod	615.0	6.0	615.0	11.7	0.0	0.0	0.0	0.0
Unadjusted Total	9,540.0	92.8	4,952.5	94.5	4,447.5	90.9	140.0	94.3
4% Price Adjustment	743.6	7.2	287.5	5.5	447.6	9.1	8.5	5.7
Total	10,283.6	100.0	5,240.0	100.0	4,895.1	100.0	148.5	100.0

TABLE 4

COMPARATIVE COSTS
ALL 1970 DOLLARS - YEAR 5

I.	Current Systems 500 F.T.E. Students		
	Total Cost 1970 Dollars	$ 790,000	(State) Operations & Personnel (Only)
	AVG./Student Cost 1970 Dollars	$ 1,580	
II.	Proposed METEP System 800 F.T.E. Students*		5 Year
		$ 254,500	(State) Operations
		1163,500	(State) Personnel
		25,000	(Fed.) Operations
		132,500	(Fed.) Personnel
	Total Cost 1970 Dollars	$1575,500	
	AVG./Student Cost 1970 Dollars	800/ 1,575,500	1,969
	Comparison (Old)	$ 1,580	
	(New)	1,969	
	Difference	$ 389	
	% Increase	24%	

The indicated increase in enrollment from 500 to 800 F.T.E. students will partially result from the implementation of the in-service program. This program, closely interfaced with project diffusion, should result in the enrollment of many in-service elementary teachers.

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[1] Although the present accounting system is not program oriented, it is possible to estimate the cost of the elementary teacher education program.

Economic Feasibility: Conclusion

The concept of economic feasibility was introduced by posing four questions a family usually considers in deciding the economic feasibility of a purchase. These four questions were then applied to the proposed METEP project.

Processes for determining cost and controlling expenditures were presented in response to the questions:

1) How much will it cost?

2) Do we have sufficient financial controls to insure the expenditure of funds according to a planned program for payment of the purchase?

The program cost and sources of revenue were presented in a five-year budget. The key cost data are the projected developmental (including initial capital outlay) cost and the operating cost.

The five year unadjusted total for developmental expenditures is $3,382,000. This number includes expenditures for equipment, facility modifications, and the funds allocated for the research and development of processes and materials. Not included are personnel and operational costs.

The projected operating cost after the implementation of the program is $1,969 per student. This includes the cost of evaluating, reviewing, and updating the program. This is not the total per student operating expenditure of the University. The distinction between the program and University operating expenses is explicit in the discussion of the proposed budget. The per student operating cost of the present program adjusted for comparison with the operating cost of the fifth year of the proposed program is estimated to be $1,580. Assuming that the adjusted non-program operating cost would remain constant, the incremental pre-student cost of the proposed program is $389.

The budget, accounting, and procurement procedures were designed to insure appropriate fiscal planning and controls.

Several criteria were suggested for determining - "Can we afford it?" The first of these criteria is related to the appropriateness of Federal support of the program. The point was made that the Federal government cannot afford to provide funds for "permanent" programs where there is little or no intention of continuing the program past the Federally funded period. The phasing out of

Federal support as illustrated in the proposed five year budget demonstrates the intentions of the School. Letters of commitment to the METEP concept will be provided in the Phase III proposal.

An appreciably small incremental cost per student program was the second criterion for determining the School's ability to support the program. The incremental cost of $389 per student does not meet this criterion. This negative result will be subsequently discussed in the concluding remarks.

The ability to facilitate the effective use of funds is a third criterion in determining "can we afford it." The application of cost-effectiveness analysis and the PPBS approach to fiscal planning and control complemented with a strong pedagogical evaluation component are designed to satisfy this criterion.

The answer to the first of the four original questions is the most subjective. "Is this the best use of our money?" can be answered only by reviewing the rationale and goals of the project.

The rationale for the METEP project can be summarized as follows:

1) For education to be truly responsive to the changing needs of both society and individuals, educational goals and their criteria must be an integral part in the initial planning and operation of learning experiences.

2) The process of change must be institutionalized so that it becomes an integral part of the education structure.

3) The criterion of time currently used to measure the educational progress of a student is at best only incidentally relevant to the student's ability to perform.

4) Optimal individual learning situations may be created if educators learn to correctly match teachers, materials, structures, and students.

5) A flexible teacher education structure is required if new alternatives for improving instructional and learning experiences are to be conceived, implemented, and evaluated.

The METEP project represents a concerted attempt to face the challenges of institutionalizing change, social relevance, and individualized instruction within the framework of a teacher education program.

Although the project at the University of Massachusetts is primarily a research and development program, the modular design will allow the training aspects of the program to be duplicated at other institutions. The operating cost of the training portion of the program would be dependent upon the size and intensity of the program. The faculty utilization standard of 7.5 contact hours per week used to cost the proposed program is not a realistic standard for a teachers' college. Personnel cost is the major item in the operating expenses of the program. Therefore, a faculty utilization standard of 12-18 contact hours per week would have a sharp effect on the cost of the program. This reduction in cost could be partially offset if the college does not have a graduate program. Additional faculty and staff would have to be added to replace the graduate students utilized in the proposed system. Hence, the cost of duplicating the program is highly dependent upon the existing educational programs of the recipient institution.

Is the implementation and operation of the proposed research and development project the best use of available money? The School of Education, University of Massachusetts, submits that it is. The rationale and goals of the program support this conclusion. The projected increased operating cost is justified by the innovative and evaluative potentials of the program.

The METEP project will also provide certain benefits to the community and university. The new in-service program will involve elementary school teachers from area schools. These teachers will also participate in this program and be exposed to the latest teaching methods. The urban education program will make student teachers aware of the problems that exist in teaching in urban areas and will hopefully encourage some of them to commit themselves to a teaching career in these areas. The research subsystem will also perform research and evaluation for public schools. The language arts program includes a reading clinic where the latest techniques will be used to improve the skills of children who have difficulty in reading. The technology program includes a computer with remote terminals. These terminals will be used in problem solving in the areas of technology, mathematics, and science. They will also be available for use in the other educational programs. Learning laboratories, e.g., mathematics, science, and social studies, will be available on a limited basis to other students of the University. The METEP project will also support graduate students. This financial support will make it possible for deserving students to further their education

These benefits are important, however, they should be a secondary consideration in determining the merits of the METEP project. It is the concept of a flexible structure for institutionalizing change integrated with the concepts of formative and summative evaluation, PPB, cost-effectiveness analysis and simulation modeling that supports the economic feasibility of the proposed teacher education program.

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APPENDIX A

TABLE A-1

SUMMARY METER BUDGET
SUPPORT SUBSYSTEMS
(ALL AMOUNTS IN THOUSANDS OF DOLLARS)

METER SUBSYSTEMS	FED 1	STATE 1	OTHER 1	FED 2	STATE 2	OTHER 2	FED 3	STATE 3	OTHER 3	FED 4	STATE 4	OTHER 4	FED 5	STATE 5	OTHER 5	FED Sub-totaled	STATE Sub-totaled	OTHER across
[illegible]-1																		
Planning	10.0															10.0		
Operating Exp.		9.0			9.0			9.0			9.0			9.0			45.0	
Equipment	22.0															22.0		
Personnel	60.0	10.0		70.0	20.0		70.0	25.0		50.0	45.0			95.0		250.0	195.0	
Facility Mod.																		
Sub Total	92.0	19.0		70.0	29.0		70.0	34.0		50.0	54.0			104.0		282.0	240.0	
[illegible]-2																		
Planning	10.0															10.0		
Operating Exp.	30.0	17.0		30.0	30.0		20.0	40.0		10.0	20.0			61.0		90.0	198.0	
Equipment	30.0															30.0		
Personnel	43.0			18.0	25.0		18.0	25.0		18.0	25.0			43.0		97.0	118.0	
Facility Mod.																		
Sub Total	113.0	17.0		48.0	55.0		38.0	65.0		28.0	75.0			104.0		227.0	316.0	
[illegible]-3																		
Planning	20.0			10.0			10.0			10.0			75.0			125.0		
Operating Exp.	10.0	5.0			15.0			15.0			15.0			20.0		10.0	70.0	
Equipment	12.0			10.0												22.0		
Personnel	60.5	33.0		83.0	38.0		52.5	78.5		20.0	128.5			169.5		221.0	447.5	
Facility Mod.																		
Sub Total	120.5	38.0		103.0	53.0		62.5	93.5		30.0	143.5		75.0	189.5		481.0	517.5	
[illegible] & Control																		
Planning	30.0			30.0			30.0			30.0			30.0			150.0		
Operating Exp.		5.0			10.0			10.0			10.0			10.0			45.0	
Equipment	10.0															10.0		
Personnel	10.0	7.5		10.0	10.0		15.0	10.0		10.0	25.0		10.0	27.5		55.0	80.0	
Facility Mod.																		
Sub Total	50.0	12.5		40.0	20.0		45.0	20.0		40.0	35.0		40.0	37.5		215.0	125.0	

TABLE A-1 (Continued)

MESP EDUCATIONAL PROGRAMS	FED 1	STATE 1	OTHER 1	FED 2	STATE 2	OTHER 2	FED 3	STATE 3	OTHER 3	FED 4	STATE 4	OTHER 4	FED 5	STATE 5	OTHER 5	FED Sub-totaled	STATE Sub-totaled	OTHER across
BEHAVIORAL-1																		
Research PC/IA	15.0			10.0			10.0									35.0		
Operating Exp.		12.0			12.0			13.0			13.0			14.0			64.0	
Equipment	58.5			36.0			15.0									109.5		
Personnel	32.5	23.0		7.5	48.0		7.5	63.0			85.5			85.5		47.5	305.0	
Facility Mod.	25.0						25.0									50.0		
SUB TOTAL	130.0	35.0		53.5	60.0		57.5	76.0			98.5			99.5		241.5	369.0	
EARLY CHILDHOOD-2																		
Research PC/IA	8.0			9.0			8.0									25.0		
Operating Exp.		4.0			10.0			9.5			9.5			10.0			43.0	
Equipment	26.0			27.0			200.0									253.0		
Personnel		50.0			52.5			55.0			72.5			78.0			308.0	
Facility Mod.	25.0						50.0									75.0		
SUB TOTAL	59.0	54.0		36.0	62.5		258.0	64.5			82.0			88.0		353.5	351.0	
HUMAN RELATIONS-3																		
Research PC/IA	12.0			10.0			7.0									29.0		
Operating Exp.		5.0			5.0			5.0			5.0			5.0			25.0	
Equipment	39.0			16.0			9.5									64.5		
Personnel	17.5	36.0		17.5	51.0		15.0	53.5		12.5	81.5			96.5		62.5	323.5	
Facility Mod.	50.0			25.0												75.0		
SUB TOTAL	118.5	41.0		68.5	56.0		31.5	63.0		12.5	86.5			101.5		331.5	348.5	
LANGUAGE ARTS-4																		
Research PC/IA	20.0			12.0			7.0									39.0		
Operating Exp.		10.0			20.0			30.0			22.0			22.0			134.0	
Equipment	36.0			202.0			200.0									438.0		
Personnel	7.5	40.0		10.0	40.0		7.5	63.0			70.5			85.5		25.0	299.0	
Facility Mod.	50.0			50.0			25.0									125.0		
SUB TOTAL	113.5	50.0		274.0	60.0		239.5	93.0			92.5			107.5		627.0	433.0	
MATHEMATICS-5																		
Research PC/IA	15.0			15.0			13.0									43.0		
Operating Exp.		4.5			5.5			6.0			6.0			6.0			28.0	
Equipment	19.0			7.6			5.5			2.5						34.6		
Personnel	43.0			15.0	38.0			50.0			73.0			93.0		58.0	297.0	
Facility Mod.	15.0															15.0		
SUB TOTAL	102.0	4.5		37.6	43.5		18.5	56.0		2.5	79.0			99.0		160.6	325.0	
MIDLA-1																		
Research PC/IA	20.0			10.0												30.0		
Operating Exp.	20.0	5.0		20.0	10.0		10.0	22.0		10.0	25.0			20.0		60.0	95.0	
Equipment	80.0			120.0			35.0									235.0		
Personnel	32.5	38.0		17.5	53.0		17.5	53.0		17.5	53.0		17.5	53.0		102.5	250.0	
Facility Mod.	60.0			40.0												100.0		
SUB TOTAL	312.5	43.0		207.5	63.0		62.5	75.0		27.5	78.0		17.5	73.0		607.5	345.0	

TABLE A-1 (Continued)

MSTEP EDUCATIONAL PROGRAMS	FED 1	STATE 1	OTHER 1	FED 2	STATE 2	OTHER 2	FED 3	STATE 3	OTHER 3	FED 4	STATE 4	OTHER 4	FED 5	STATE 5	OTHER 5	FED Sub-totaled	STATE	OTHER across
SCIENCE-7																		
Research PC/IA	9.5			12.5			12.0			9.0						42.0		
Operating Exp.		3.5			7.0			8.0			8.0			10.0			36.5	
Equipment	51.0						30.0			5.0						136.0		
Personnel	12.5	35.0		49.0	35.0		2.5	62.5			67.5			88.0		27.5	288.0	
Facility Mod.	50.0			12.5												50.0		
SUB TOTAL	123.0	38.5		74.0	42.0		43.5	70.5		14.0	75.5			98.0		256.5	364.5	
SOCIAL STUDIES-8																		
Research PC/IA	9.0			10.0			8.0									27.0		
Operating Exp.		5.0			7.0			6.5			7.0			8.0			33.5	
Equipment	21.0			33.0												54.0		
Personnel	7.5	30.0		7.5	30.0			58.0			58.0			75.5		15.0	251.5	
Facility Mod.	25.0															25.0		
SUB TOTAL	62.5	35.0		50.5	37.0		8.0	64.5			65.0			83.5		121.0	285.0	
IN-SERVICE-9																		
Research PC/IA	12.5			8.5			9.0			8.0			6.0			44.0		
Operating Exp.		1.5			2.0			2.0			3.0			4.5			13.0	
Equipment	1.5			5.5				4.0			3.0					7.0	7.0	
Personnel	27.5	20.0		27.5	30.0		20.0	47.5		10.0	67.5			87.5		85.0	252.5	
Facility Mod.																		
SUB TOTAL	41.5	21.5		41.5	32.0		29.0	53.5		18.0	73.5		6.0	92.0		136.0	272.5	
MSTEP ORIENTATION-10																		
Research PC/IA	10.0			5.0			5.0									20.0		
Operating Exp.				15.0			20.0			20.0			20.0			75.0		
Equipment	2.5															2.5		
Personnel				25.0			35.0			35.0			35.0			130.0		
Facility Mod.																		
SUB TOTAL	12.5			45.0			60.0			55.0			55.0			227.5		
AUSTRETICS-11																		
Research PC/IA				20.0			20.0			5.0						45.0		
Operating Exp.								2.5			5.0			5.0			12.5	
Equipment							25.0			10.0						35.0		
Personnel							15.0				15.0			15.0		15.0	30.0	
Facility Mod.							15.0									15.0		
SUB TOTAL				20.0			75.0	2.5		15.0	20.0			20.0		110.0	42.5	
EVALUATION-12																		
Research PC/IA				10.0			10.0			5.0						25.0		
Operating Exp.								1.0			3.0			5.0			9.0	
Equipment										5.0						5.0		
Personnel							15.0			15.0			15.0			45.0		
Facility Mod.																		
SUB TOTAL				10.0			25.0	1.0		25.0	3.0		15.0	5.0		75.0	9.0	

TABLE A-1 (Continued)

METEP EDUCATIONAL PROGRAMS	FED 1	STATE 1	OTHER 1	FED 2	STATE 2	OTHER 2	FED 3	STATE 3	OTHER 3	FED 4	STATE 4	OTHER 4	FED 5	STATE 5	OTHER 5	FED sub-Totaled	STATE Totaled	OTHER Across
FOREIGN LANGUAGE -13																		
Research PC/IA	30.0			20.0			20.0									70.0		
Operating Exp.					5.0			7.5			10.0			10.0			32.5	
Equipment				50.0		50.0	50.0		50 0	25.0			10.0			125.0		100.0
Personnel				33.0			33.0	18.0		25.5	25.5			41.0		101.5	84.5	
Facility Mod.				25.0												25.0		
SUB TOTAL	30.0			128.0	5.0	50.0	103.0	25.5	50.0	50.5	35.5		10.0	51.0		321.5	117.0	100.0
SUPERVISION-14																		
Research PC/IA				10.0			10.0			5.0						25.0		
Operating Exp.								1.0			3.0			5.0			9.0	
Equipment										5.0						5.0		
Personnel							15.0			15.0			15.0			45.0		
Facility Mod.																		
SUB TOTAL				10.0			25.0	1.0		25.0	3.0		15.0	5.0		75.0	9.0	
TECHNOLOGY-15																		
Research PC/IA				5.0			15.0			10.0						30.0		
Operating Exp.										5.0	5.0		5.0	10.0		10.0	15.0	
Equipment										150.0			75.0			225.0		
Personnel										30.0			20.0	10.0		50.0	10.0	
Facility Mod.							25.0			25.0						50.0		
SUB TOTAL				5.0			40.0			220.0	5.0		100.0	20.0		365.0	25.0	
URBAN EDUCATION-16																		
Research PC/IA				30.0		20.0	30.0		20.0	10.0						70.0		40.0
Operating Exp.								10.0			10.0			10.0			30 0	
Equipment							10.0									10.0		
Personnel							15.0			15.0	15.0		10.0	20.0		40.0	35.0	
Facility Mod.																		
SUB TOTAL				30.0		20.0	55.0	10.0	20.0	25.0	25.0		10.0	30.0		120.0	65.0	40.0
SUMMARY																		
Planning	70.0	0.0	0.0	40.0	0.0	0.0	40.0	0.0	0.0	40.0	0.0	0.0	105.0	0.0	0.0	295.0	0.0	0.0
Research PC/IA	161.0	0.0	0.0	197.0	0.0	20.0	183.0	0.0	20.0	52.0	0.0	0.0	6.0	0.0	0.0	599.0	0.0	40.0
Operating Exp.	60.0	86.5	0.0	65.0	147.5	0.0	50.0	199.0	0.0	45.0	218.0	0.0	25.0	254.5	0.0	245.0	906.0	0.0
Equipment	412.4	0.0	0.0	556.1	0.0	50.0	480.0	7.0	50.0	202.5	3.0	0.0	75.0	0.0	0.0	1726.5	7.0	100.0
Personnel	359.0	322.5	0.0	354.0	470.5	0.0	353.5	670.0	0.0	272.5	908.0	0.0	132.5	1163.5	0.0	1472.5	3534.5	0.0
Facility Mod.	310.0	0.0	0.0	140.0	0.0	0.0	140.0	0.0	0.0	25.0	0.0	0.0	0.0	0.0	0.0	615.0	0.0	0.0
Sub Total 1969 dollars	1372.4	409.0	0.0	1352.1	618.0	70.0	1246.5	876.0	70.0	608.0	1129.5	0.0	343.5	1418.0	0.0	4952.5	4447.5	140.0
4% price adjustment	0.0	0.0	0.0	50.1	24.7	2.8	102.2	71.6	5.7	77.8	140.2	0.0	57.4	241.1	0.0	287/5	477/9	8.5
TOTAL	1372.4	409.0	0.0	1402.2	642.7	72.8	1348.7	944.6	75.7	715.8	1269.7	0.0	400.9	1659.1	0.0	5240.[illegible]	4925.1	148.5

APPENDIX B

TABLE B-1

MANAGEMENT BUDGET
(ALL AMOUNTS IN THOUSANDS OF DOLLARS)

Source: Year:	FED 1	STATE 1	OTHER 1	FED 2	STATE 2	OTHER 2	FED 3	STATE 3	OTHER 3	FED 4	STATE 4	OTHER 4	FED 5	STATE 5	OTHER 5	FED Sub-totaled	STATE Sub-totaled	OTHER Sub-totaled
PLANNING																		
Consulting	3.0															3.0		
Development	5.0															5.0		
Travel	1.0															1.0		
Misc.	1.0															1.0		
SUB TOTAL	10.0															10.0		
OPERATING EXP.																		
Supplies	3.0				3.5			3.5			3.5			3.5			17.0	
Maint.	.5				.5			.5			.5			.5			2.5	
Startup	.5																.5	
Misc. & Rentals	5.0				5.0			5.0			5.0			5.0			25.0	
SUB TOTAL	9.0				9.0			9.0			9.0			9.0			45.0	
EQUIPMENT																		
Viewing																		
Sound	1.0																1.0	
Reproduction	1.0																1.0	
Graphic																		
Furniture	3.5																3.5	
Misc.	.5																.5	
Acct. Software	16.0																16.0	
SUB TOTAL	22.0																22.0	
PERSONNEL																		
Fu & Prof.	20.0			20.0			20.0				20.0			20.0		60.0	40.0	
Associate	35.0			35.0			35.0			35.0				35.0		140.0	35.0	
Assistant				15.0			15.0			15.0				15.0		45.0	15.0	
Lab Super.																		
Secretaries		10.0			10.0			15.0			15.0			15.0		5.0	65.0	
Grad Students	5.0				10.0			10.0			10.0			10.0			40.0	
SUB TOTAL	60.0	10.0		70.0	20.0		70.0	25.0		50.0	45.0			95.0		250.0	195.0	
FACILITY																		
Modification																		
TOTAL:	92.0	10.0		70.0	29.0		70.0	34.0		50.0	54.0			104.0		282.0	240.0	

TABLE B-2

INFORMATION SYSTEM BUDGET
(ALL AMOUNTS IN THOUSANDS OF DOLLARS)

Source: Year:	FED 1	STATE 1	OTHER 1	FED 2	STATE 2	OTHER 2	FED 3	STATE 3	OTHER 3	FED 4	STATE 4	OTHER 4	FED 5	STATE 5	OTHER 5	FED Sub-totaled across	STATE Sub-totaled across	OTHER Sub-totaled across
PLANNING																		
Consulting	3.0															3.0		
Development	3.0															3.0		
Travel	2.0															2.0		
Misc.	2.0															2.0		
SUB TOTAL	10.0															10.0		
OPERATING EXP.																		
Supplies	5.0			4.0				4.0			4.0			5.0		9.0	13.0	
Maint.	3.0			4.0				4.0			4.0			5.0		7.0	13.0	
Startup	2.0			1.0				1.0			1.0					3.0	3.0	
Misc. & Rentals	20.0	17.0		21.0	30.0		20.0	31.0		10.0	41.0			51.0		71.0	170.0	
SUB TOTAL	30.0	17.0		30.0	30.0		20.0	40.0		10.0	50.0			61.0		90.0	198.0	
EQUIPMENT																		
Viewing																		
Sound																		
Reproduction																		
Graphic																		
Furniture	2.5															2.5		
Misc.	5.0															5.0		
Acct. Software	22.5															22.5		
SUB TOTAL	30.0															30.0		
PERSONNEL																		
Full Prof.																		
Associate	18.0			18.0			18.0			18.0				18.0		72.0	18.0	
Assistant	15.0				15.0			15.0			15.0			15.0		15.0	60.0	
Lab Super.																		
Secretaries	5.0				5.0			5.0			5.0			5.0		5.0	20.0	
Grad Students	5.0				5.0			5.0			5.0			5.0		5.0	20.0	
SUB TOTAL	43.0			18.0	25.0		18.0	25.0		18.0	25.0			43.0		97.0	118.0	
FACILITY																		
Modification																		
TOTAL:	113.0	17.0		48.0	55.0		38.0	65.0		28.0	75.0			104.0		227.0	316.0	

TABLE 5-3

RESEARCH BUDGET
(ALL AMOUNTS IN THOUSANDS OF DOLLARS)

Source: Year:	FED 1	STATE 1	OTHER 1	FED 2	STATE 2	OTHER 2	FED 3	STATE 3	OTHER 3	FED 4	STATE 4	OTHER 4	FED 5	STATE 5	OTHER 5	FED Sub-totaled across	STATE Sub-totaled across	OTHER Sub-totaled across
[illegible]																		
Contracting	4.0			2.0			2.0			2.0			60.0*			70.0		
Development	7.5			5.0			5.0			5.0						24.0		
Travel	[illegible]			1.0			1.0			1.0			10.0			13.0		
Misc.	2.0			2.0			2.0			2.0			5.0			13.0		
[illegible]	[illegible]			10.0			10.0			[illegible]			[illegible]			[illegible]		
[illegible]																		
Supplies	3.0				4.0			3.0			6.0			8.0		3.0	21.0	
[illegible]	1.0				2.0			3.0			3.0			3.0		1.0	11.0	
Startup	6.0				5.0			4.0			3.0			2.0		6.0	14.0	
Misc. & Rentals		5.0			4.0			3.0			3.0			7.0			22.0	
[illegible]	10.0	5.0			15.0			15.0			15.0			20.0		10.0	70.0	
[illegible]																		
Viewing	4.0															4.0		
Sound				3.0												3.0		
Reproduction	5.0															5.0		
Graphics				1.0												1.0		
Furniture	2.0			1.5												3.5		
Misc.	4.0			4.5												8.5		
[illegible] Software																		
[illegible]	15.0			10.0												25.0		
[illegible]																		
Full Prof.														21.0			21.0	
Associate	13.0	16.0		18.0	18.0			25.0			36.0			36.0		[illegible]	[illegible]	
Assistant	15.0	15.0		15.0	15.0			30.0			45.0			45.0		[illegible]	[illegible]	
[illegible]	20.0			30.0			40.0			[illegible]0.0	20.0			40.0		120.0	60.0	
[illegible]	[illegible]			15.0	5.0		10.0	10.0			20.0			20.0		35.0	55.0	
[illegible]	2.5			5.0			2.5	2.5			7.5			7.5		10.0	17.5	
[illegible]	[illegible]	[illegible]		83.0	38.0		52.5	78.5		[illegible]0.0	124.5			169.5		[illegible]	447.5	
FACILITY Modification																		
TOTALS	110.5	38.0		103.0	53.0		62.5	93.5		[illegible]0.0	143.5		75.0	189.5		331.0	517.5	

*Project 5 year Evaluation

TABLE 5-4

TESTING & GUIDANCE BUDGET
(ALL AMOUNTS IN THOUSANDS OF DOLLARS)

Source: / Year:	FED 1	STATE 1	OTHER 1	FED 2	STATE 2	OTHER 2	FED 3	STATE 3	OTHER 3	FED 4	STATE 4	OTHER 4	FED 5	STATE 5	OTHER 5	FED Sub-totaled	STATE Sub-totaled	OTHER across
PLANNING																		
Consulting	10.0			20.0			10.0			10.0			10.0			50.0		
Development	15.0			15.0			15.0			15.0			15.0			75.0		
Travel	3.0			3.0			3.0			3.0			3.0			15.0		
Misc.	2.0			2.0			2.0			2.0			2.0			10.0		
SUB TOTAL	30.0			30.0			30.0			30.0			30.0			150.0		
OPERATING EXP.																		
Supplies		3.0			6.0			6.0			6.0			6.0			27.0	
Maint.		1.0			1.5			2.0			2.0			2.0			8.5	
Startup		.5															.5	
Misc. & Rentals		.5			2.5			2.0			2.0			2.0			9.0	
SUB TOTAL		5.0			10.0			10.0			10.0			10.0			45.0	
EQUIPMENT																		
Viewing																		
Sound	1.0															1.0		
Reproduction	2.0															2.0		
Graphic																		
Furniture	6.0															6.0		
Misc.	1.0															1.0		
Acct. Software																		
SUB TOTAL	10.0															10.0		
PERSONNEL																		
Full Prof.																		
Associate																		
Assistant																		
Lab Super.																		
Secretaries	10.0			10.0			15.0			10.0	10.0		20.0	10.0		55.0	20.0	
Grad Students		7.5			10.0			10.0			15.0			17.5			60.0	
SUB TOTAL	10.0	7.5		10.0	10.0		15.0	10.0		10.0	25.0		20.0	27.5		55.0	80.0	
FACILITY																		
Modification																		
TOTAL:	50.0	12.5		40.0	20.0		45.0	20.0		40.0	35.0		40.0	37.5		215.0	125.0	

TABLE 8-5

BEHAVIORAL PROGRAM BUDGET
(ALL AMOUNTS IN THOUSANDS OF DOLLARS)

Source: / Year:	FED 1	STATE 1	OTHER 1	FED 2	STATE 2	OTHER 2	FED 3	STATE 3	OTHER 3	FED 4	STATE 4	OTHER 4	FED 5	STATE 5	OTHER 5	FED Cumulative	STATE Cumulative	OTHER Cumulative
RESEARCH COSTS																		
Consultant	3.0			2.0			1.5									6.5		
Development	7.0			5.0			5.0									17.0		
Travel	3.0			2.0			1.5									6.5		
Misc.	2.0			1.0			2.0									5.0		
[illegible]	15.0			10.0			10.0									35.0		
OPERATING EXP.																		
Supplies		2.0			3.0			3.5			4.0			5.0			17.5	
Maint.		4.0			5.0			6.5			7.0			7.0			29.5	
Station		4.0			2.0			1.0									7.0	
[illegible] Rent		2.0			2.0			2.0			2.0			2.0			10.0	
[illegible]		12.0			12.0			12.0			13.0			14.0			[illegible]	
EQUIPMENT																		
Typing	10.4			5.0			2.0									20.4		
Chairs	7.6			5.0			5.0									17.6		
Reproduction	3.0															3.0		
Computer																		
Furniture	10.5			9.0												19.5		
Misc.	12.0			10.0			6.0									28.0		
[illegible] Software	12.0			8.0			4.0									20.0		
[illegible] TOTAL	58.5			36.0			19.0									113.5		
PERSONNEL																		
Full Prof.																		
Associate		18.0			18.0			18.0			18.0			18.0			72.0	
Asst. Prof.	15.0			15.0			30.0				45.0			45.0		15.0	135.0	
Lab Supv.	10.0			10.0			10.0				10.0			10.0		10.0	40.0	
[illegible]		5.0			5.0			5.0			5.0			5.0			25.0	
[illegible] Assts.	7.5			7.5			7.5				7.5			7.5		22.5	15.0	
[illegible]	32.5	23.0		7.5	68.0		7.5	23.0			80.5			85.5		47.5	267.0	
FACILITY																		
Modification	33.0						35.0									20.0		
TOTAL	131.0	35.0		53.5	60.0		57.5	76.0			98.5			99.5		242.0	369.0	

TABLE B-6

PRE-SCHOOL PROGRAM BUDGET
(ALL AMOUNTS IN THOUSANDS OF DOLLARS)

Source: / Year:	FED 1	STATE 1	OTHER 1	FED 2	STATE 2	OTHER 2	FED 3	STATE 3	OTHER 3	FED 4	STATE 4	OTHER 4	FED 5	STATE 5	OTHER 5	FED Sub-totaled across	STATE Sub-totaled across	OTHER across
[illegible]																		
Consulting	2.0			2.0			1.0									5.0		
Development	4.0			4.0			4.0									12.0		
Travel	1.0			1.0			1.0									3.0		
Misc.	1.0			2.0			2.0									5.0		
[illegible] TOTAL	8.0			9.0			8.0									25.0		
OPERATING EXP.																		
Supplies		1.5			3.0			3.0			3.5			4.0			15.0	
Maint.		1.0			1.5			2.5			2.5			2.5			10.0	
Startup		1.0			3.5			1.0			1.0			1.0			7.5	
Misc. & Rental		.5			2.0			3.0			2.5			2.5			10.5	
[illegible] TOTAL		4.0			10.0			9.5			9.5			10.0			43.0	
EQUIPMENT																		
Viewing	13.0			13.0												26.0		
Sound	2.0			3.0												5.0		
Reproduction	3.0			6.0												9.0		
Graphic	1.5															1.5		
Furniture	5.0			2.5												7.5		
Misc.	1.5			2.5			200.0									4.0		
Misc. Software																200.0		
[illegible] TOTAL	29.0			27.0			200.0									253.0		
PERSONNEL																		
Full Prof.																		
Associate														18.0			18.0	
Assistant		30.0			20.0			30.0			45.0			30.0			165.0	
Lab Super.		10.0			10.0			10.0			10.0			10.0			50.0	
Secretaries		5.0			5.0			5.0			5.0			5.0			25.0	
Grad Students		5.0			7.5			10.0			12.5			15.0			50.0	
[illegible] TOTAL		50.0			52.5			55.0			72.5			78.0			308.0	
FACILITY																		
Modification	25						50.0									75.0		
TOTAL:	59.0	54.0		36.0	62.5		258.0	64.5			82.0			88.0		353.0	351.0	

TABLE B-7

HUMAN RELATIONS PROGRAM BUDGET
(ALL AMOUNTS IN THOUSANDS OF DOLLARS)

Source: / Year:	FED 1	STATE 1	OTHER 1	FED 2	STATE 2	OTHER 2	FED 3	STATE 3	OTHER 3	FED 4	STATE 4	OTHER 4	FED 5	STATE 5	OTHER 5	FED Sub-totaled across	STATE Sub-totaled across	OTHER Sub-totaled across
RESEARCH PERSONNEL																		
Consulting	3.0			2.0			2.0									7.0		
Development	5.0			5.0			2.0									12.0		
Travel	2.0			2.0			2.0									6.0		
Misc.	2.0			1.0			1.0									4.0		
SUB-TOTAL	12.0			10.0			7.0									29.0		
OPERATING EXP.																		
Supplies		2.0			2.0			2.0			2.0			2.0			10.0	
Misc.		.5			2.0			2.0			2.0			2.0			8.5	
Startup		2.0			.5			.5			.5			.5			4.0	
Misc. & Rentals		.5			.5			.5			.5			.5			2.5	
SUB-TOTAL		5.0			5.0			5.0			5.0			5.0			25.0	
EQUIPMENT																		
Viewing	25.0			9.0			8.5									42.5		
Sound	1.5															1.5		
Reproduction	3.0			2.0												5.0		
Graphic	4.0			2.0												6.0		
Furniture	2.5			2.0												4.5		
Misc.	3.0						1.0									4.0		
Acct. Software				1.0														
SUB-TOTAL	39.0			16.0			9.5									64.5		
PERSONNEL																		
Full Prof.		21.0			21.0			21.0			21.0			21.0			105.0	
Associate											18.0			18.0			36.0	
Assistant		15.0			30.0			30.0			30.0			30.0			135.0	
Sub Super.																		
Administration	3.0			5.0			5.0			5.0				5.0		20.0	5.0	
Grad Students	12.5			12.5			10.0	7.5		7.5	12.5			22.5		42.5	42.5	
SUB-TOTAL	15.5	36.0		17.5	51.0		15.0	58.5		12.5	81.5			96.5		62.5	328.5	
FACILITIES																		
Modification	30.0			22.0												52.0		
TOTAL:	113.5	41.0		68.5	56.0		31.5	63.5		12.5	86.5			101.5		231.0	368.5	

TABLE B-8

LANGUAGE ARTS PROGRAM BUDGET
(ALL AMOUNTS IN THOUSANDS OF DOLLARS)

Source: / Year:	FED 1	STATE 1	OTHER 1	FED 2	STATE 2	OTHER 2	FED 3	STATE 3	OTHER 3	FED 4	STATE 4	OTHER 4	FED 5	STATE 5	OTHER 5	FED Sub-totaled across	STATE Sub-totaled across	OTHER Sub-totaled across
RESEARCH [illegible]																		
Consulting	5.0			2.0			1.0									8.0		
Development	10.0			8.0			4.0									22.0		
Travel	2.0			1.0			1.0									4.0		
Misc.	3.0			1.0			1.0									5.0		
SUB TOTAL	42.0			12.0			7.0									39.0		
OPERATING EXP.																		
Supplies		2.0			3.0			4.0			5.0			5.0			19.0	
Maint.		3.0			5.0			8.0			10.0			12.0			38.0	
Startup		3.0			10.0			15.0			5.0			3.0			36.0	
Misc. & Rentals		2.0			7.0			3.0			2.0			2.0			[illegible]	
SUB TOTAL		10.0			25.0			30.0			22.0			22.0			109.0	
EQUIPMENT																		
Viewing	10.0			15.0												25.0		
Sound	10.0			15.0												25.0		
Reproduction	3.0															3.0		
Graphic	3.0			2.0												5.0		
Furniture	3.0			3.0												6.0		
Misc.	5.0			15.0												20.0		
Dial Access Sys.	3.0			132.0			100.0									[illegible]		
SUB TOTAL	37.0			182.0			100.0									319.0		
PERSONNEL																		
Full Prof.																		
Associate								18.0			18.0			18.0			54.0	
Assistant		30.0			30.0			30.0			30.0			45.0			165.0	
Lab Super.		10.0			10.0			10.0			10.0			10.0			50.0	
Secretaries	5.0			5.0				5.0			5.0			5.0		10.0	15.0	
Grad Students	2.5			5.0			7.5				7.5			7.5		15.0	[illegible]	
SUB TOTAL	7.5	40.0		10.0	40.0		7.5	63.0			70.5			85.5		25.0	329.0	
FACILITY																		
Modification	30.0			30.0			25.0									85.0		
TOTAL:	113.5	50.0		274.0	60.0		139.5	93.0			92.5			107.5		527.0	403.0	

TABLE 3-9

MATHEMATICS PROGRAM BUDGET
(ALL AMOUNTS IN THOUSANDS OF DOLLARS)

Source: Year:	FED 1	STATE 1	OTHER 1	FED 2	STATE 2	OTHER 2	FED 3	STATE 3	OTHER 3	FED 4	STATE 4	OTHER 4	FED 5	STATE 5	OTHER 5	FED Sub-totaled	STATE across	OTHER
RESEARCH PC/LA																		
Consulting	3.0			3.0												6.0		
Development	5.0			6.0			7.0									18.0		
Travel	3.0			2.0			2.0									7.0		
Misc.	4.0			4.0			4.0									12.0		
SUB TOTAL	15.0			15.0			13.0									43.0		
OPERATING EXP.																		
Supplies		3.5			2.5			3.0			3.5			3.5			15.0	
Maint.		.5			1.0			1.5			1.5			1.5			6.0	
Startup		1.0			1.0			.5									2.5	
Misc. & Rentals		.5			1.0			1.0			1.0			1.0			4.5	
SUB TOTAL		4.5			5.5			6.0			6.0			6.0			28.0	
EQUIPMENT																		
Viewing	6.5			1.3												7.8		
Sound	2.1			1.0												3.1		
Reproduction	1.8			1.0												2.8		
Graphic	2.5			1.3												3.8		
Furniture	7.0			3.0			2.5			2.5						15.0		
Misc.							3.0									3.0		
Acct. Software																		
SUB TOTAL	19.9			7.6			5.5			2.5						35.5		
PERSONNEL																		
Full Prof.																		
Associate	18.0				18.0			18.0			18.0			18.0		18.0	72.0	
Assistant	15.0				15.0			15.0			30.0			45.0		15.0	105.0	
Lab Super.				10.0				10.0			10.0			10.0		10.0	30.0	
Secretaries	5.0			5.0	5.0			5.0			5.0			5.0		5.0	20.0	
Grad students	5.0							5.0			10.0			15.0		10.0	30.0	
SUB TOTAL	43.0			15.0	38.0			53.0			73.0			93.0		58.0	257.0	
FACILITY																		
Modification	25.0															25.0		
TOTAL:	102.9	4.5		37.6	43.5		18.5	59.0		2.5	79.0			99.0		161.5	285.0	

TABLE 8-10

MEDIA PROGRAM BUDGET
(ALL DOLLAR AMOUNTS IN THOUSANDS)

Source: / Year:	FED 1	STATE 1	OTHER 1	FED 2	STATE 2	OTHER 2	FED 3	STATE 3	OTHER 3	FED 4	STATE 4	OTHER 4	FED 5	STATE 5	OTHER 5	FED Sub-totaled across	STATE Sub-totaled across	OTHER Sub-totaled across
RESEARCH PC/LA																		
Consulting	2.0			1.0												3.0		
Development	13.0			6.0												19.0		
Travel	3.0			2.0												5.0		
Misc.	2.0			1.0												3.0		
SUB TOTAL	20.0			10.0												30.0		
OPERATING EXP.																		
Supplies		2.5			5.0			8.0			10.0			13.0			38.5	
Maint.	2.5	2.5			5.0			10.0			10.0			12.0		2.5	39.5	
Startup	15.0			15.0			10.0			10.0						50.0		
Misc. & Rentals	2.5			5.0				5.0			5.0			5.0				
SUB TOTAL	20.0	5.0		20.0	10.0		10.0	23.5		10.0	25.0			30.0			9.0	
EQUIPMENT																		
Viewing	35.0			35.0			5.0									75.0		
Sound	15.0			15.0			5.0									35.0		
Reproduction	10.0			15.0			10.0									35.0		
Graphic	15.0			20.0			5.0									40.0		
Furniture	2.0			2.0			3.0									7.0		
Misc.	3.0			3.0			1.0									7.0		
Solar, Computer				30.0			9.0									39.0		
SUB TOTAL	80.0			120.0			38.0									238.0		
PERSONNEL																		
Full Prof.																	90.0	
Associate		28.0			28.0			18.0			13.0			18.0				
Assistant	15.0	15.0			30.0			30.0			30.0			30.0		15.0	135.0	
Lab Super.	10.0			10.0			10.0			10.0			10.0			50.0	25.0	
Secretaries		5.0			5.0			5.0			5.0			5.0		37.5		
Grad Students	7.5			7.5			7.5			7.5			7.5					
SUB TOTAL	32.5	48.0		17.5	63.0		17.5	53.0		17.5	58.0		17.5	53.0		102.5	250.0	
FACILITY																		
Modification	40.0			40.0												80.0		
TOTAL:	212.5	63.0		207.5	83.0		65.5	76.0		27.5	78.0		17.5	83.0		527.5	343.0	

TABLE 8-II

SCIENCE PROGRAM BUDGET
(ALL AMOUNTS IN THOUSANDS OF DOLLARS)

Source: Year:	FED 1	STATE 1	OTHER 1	FED 2	STATE 2	OTHER 2	FED 3	STATE 3	OTHER 3	FED 4	STATE 4	OTHER 4	FED 5	STATE 5	OTHER 5	FED Sub-totaled across	STATE Sub-totaled across	OTHER Sub-totaled across
RESEARCH PC/LA																		
Consulting	3.0			3.0			2.0			1.0						9.0		
Development	4.0			6.0			4.0			5.0						21.0		
Travel	1.5			1.5			1.0			.5						4.5		
Misc.	1.0			2.0			2.0			2.5						7.5		
SUB TOTAL	9.5			12.5			11.0			9.0						42.0		
OPERATING EXP.																		
Supplies		1.0			2.5			2.5			3.0			4.0			13.0	
Maint.		.5			1.0			2.0			2.5			3.0			9.0	
Startup		1.5			2.5			2.5			1.5			1.5			9.5	
Misc. & Rentals		.5			1.0			1.0			1.0			1.5			5.0	
SUB TOTAL		3.5			7.0			8.0			8.0			10.0			36.5	
EQUIPMENT																		
Viewing	5.0			5.0			2.0			2.0						14.0		
Sound	1.0			1.0			1.0			1.0						4.0		
Reproduction	3.0			2.0			2.0			2.0						9.0		
Graphic	2.0			1.0												3.0		
Furniture				15.0			15.0									30.0		
Misc.	40.0															15.0		
Prof. Software				25.0			10.0									60.0		
SUB TOTAL	52.0			49.0			30.0			5.0						135.0		
PERSONNEL																		
Full Prof.																		
Associate																		
Assistant		30.0			30.0			45.0			45.0			15.0			15.0	
Lab Super.	10.0			10.0				10.0			10.0			45.0		20.0	195.0	
Secretaries	2.5	3.0			5.0			5.0			5.0			10.0			30.0	
Grad. Students				2.5			2.5	2.5			7.5			15.0		7.5	45.0	
SUB TOTAL	12.5	33.0		12.5	35.0		2.5	62.5			67.5			85.0		27.5	285.0	
FACILITY																		
Modification	50.0															50.0		
TOTAL:	123.0	38.5		74.0	42.0		43.5	70.5		14.0	75.5			98.0		254.5	324.5	

TABLE B-12

SOCIAL STUDIES PROGRAM BUDGET
(ALL AMOUNTS IN THOUSANDS OF DOLLARS)

Source: Year:	FED 1	STATE 1	OTHER 1	FED 2	STATE 2	OTHER 2	FED 3	STATE 3	OTHER 3	FED 4	STATE 4	OTHER 4	FED 5	STATE 5	OTHER 5	FED Sub-totaled across	STATE Sub-totaled across	OTHER Sub-totaled across
RESEARCH PC/LA																		
Consulting	2.0			2.0			1.0									5.0		
Development	4.0			5.0			5.0									14.0		
Travel	1.5			1.0			1.0									3.5		
Misc.	1.5			2.0			1.0									4.5		
Sub TOTAL	9.0			10.0			8.0									27.0		
OPERATING EXP.																		
Supplies		1.5			2.0			2.0			3.0			4.0			12.5	
Maint.		2.0			2.5			1.5			1.5			1.5			7.0	
Startup		1.5			2.0			1.0									4.5	
Misc. & Rentals		1.0			1.5			2.0			2.5			2.5			9.5	
Sub TOTAL		5.0			7.0			4.5			7.0			8.0			31.5	
EQUIPMENT																		
Viewing	7.0			13.0												20.0		
Sound	3.0			2.0												5.0		
Reproduction	2.0			1.0												3.0		
Graphic	5.0			8.0												13.0		
Furniture	2.0			7.0												9.0		
Misc.	2.0															2.0		
Acct. Software																		
Sub TOTAL	21.0			31.0												54.0		
PERSONNEL																		
Full Prof.																		
Associate								18.0			18.0			18.0			54.0	
Assistant		30.0			30.0			30.0			30.0			45.0			165.0	
Sub Supvr.																		
Secretarial	5.0			5.0				5.0			5.0			5.0		10.0	15.0	
Grad. Students	2.5			2.5				5.0			5.0			[illegible]		5.0	12.5	
Sub TOTAL	7.5	30.0		7.5	30.0			58.0			58.0			68.5		15.0	231.5	
MISCELLANEOUS																		
Publication	25.0															25.0		
TOTAL:	42.5	35.0		50.5	37.0		8.0	64.5			65.0			83.5		121.0	285.0	

TABLE B-13

INSERVICE PROGRAM BUDGET
(ALL AMOUNTS IN THOUSANDS OF DOLLARS)

Source: / Year:	FED 2	STATE 1	OTHER 1	FED 2	STATE 2	OTHER 2	FED 3	STATE 3	OTHER 3	FED 4	STATE 4	OTHER 4	FED 5	STATE 5	OTHER 5	FED Sub-totaled across	STATE Sub-totaled across	OTHER Sub-totaled across
RESEARCH PC/IA																		
Computing	4.5			2.0			1.0			.5			.5			8.5		
Development	5.0			5.0			6.0			5.0			3.0			24.0		
Travel	2.5			1.0			1.0			1.0			1.0			6.5		
Misc.	.5			.5			1.0			1.5			1.5			5.0		
[illegible]	12.5			8.5			9.0			8.0			6.0			44.0		
OPERATING EXP.																		
Supplies		1.0			1.0			1.0			1.5			1.5			6.0	
Maint.											.5						.5	
Startup																		
Maint. & Rentals		.5			1.0			1.0			1.0			3.0			6.5	
[illegible]		1.5			2.0			2.0			3.0			4.5			13.0	
EQUIPMENT																		
Viewing	.5			1.0												1.5		
Sound	.5			1.0												1.5		
Reproduction				1.0				1.0								1.0	1.0	
Graphic				1.0				.5								1.0	.5	
Furniture				1.0												1.0		
Misc.	.5			.5				2.5			3.0					1.0	5.5	
Misc. Software																		
[illegible]	1.5			5.5				4.0			3.0					7.0	7.0	
PERSONNEL																		
Full Prof.																		
Associate																		
Affiliated Tchrs.	20.0			20.0	10.0		20.0	20.0		10.0	40.0			60.0		70.0	130.0	
Lab Supvr.		15.0			15.0			15.0			15.0			15.0			75.0	
Secretaries		5.0			5.0			5.0			5.0			5.0			25.0	
Grad Students	7.5			7.5				7.5			7.5			7.5		15.0	22.5	
[illegible]	27.5	20.0		27.5	30.0		20.0	47.5		10.0	67.5			87.5		85.0	252.5	
FACILITY																		
Modification																		
TOTAL:	41.5	21.5		41.5	32.0		29.0	53.5		18.0	73.5		6.0	92.0		136.0	272.5	

TABLE B-14

ORIENTATION PROGRAM BUDGET
(ALL AMOUNTS IN THOUSANDS OF DOLLARS)

Source: / Year:	FED 1	STATE 1	OTHER 1	FED 2	STATE 2	OTHER 2	FED 3	STATE 3	OTHER 3	FED 4	STATE 4	OTHER 4	FED 5	STATE 5	OTHER 5	FED Sub-totaled across	STATE	OTHER
[illegible]																		
Consulting	2.0															2.0		
Development	2.0			4.0			4.0									10.0		
Travel	5.0															5.0		
Misc.	1.0			1.0			1.0									[illegible]		
[illegible]	[illegible]			[illegible]			[illegible]									20.0		
[illegible]																		
Supplies				2.5			3.0			5.0			6.0			16.5		
Maint.																		
Set-up																		
[illegible] & Rentals				[illegible]			[illegible]			[illegible]			[illegible]			[illegible]		
[illegible]				[illegible]			[illegible]			[illegible]			[illegible]			[illegible]		
[illegible]																		
Viewing																		
Sound																		
Reproduction																		
Graphic																		
Furniture	2.5															2.5		
Misc.																		
[illegible] Software																		
[illegible]	[illegible]															[illegible]		
[illegible]																		
Full Prof.																		
Associate																		
Assistant				15.0			30.0			30.0			30.0			105.0		
Lab Super.				5.0			5.0			5.0			5.0			20.0		
Secretaries				5.0												5.0		
[illegible] Students																		
[illegible]				[illegible]			[illegible]			[illegible]			[illegible]			[illegible]		
[illegible]																		
[illegible] Tuition																		
TOTAL:	12.5			43.0			40.0			55.0			55.0			227.5		

TABLE E-15

AESTHETICS PROGRAM BUDGET
(ALL AMOUNTS IN THOUSANDS OF DOLLARS)

Source: / Year:	FED 1	STATE 1	OTHER 1	FED 2	STATE 2	OTHER 2	FED 3	STATE 3	OTHER 3	FED 4	STATE 4	OTHER 4	FED 5	STATE 5	OTHER 5	FED Sub-totaled	STATE	OTHER
RESEARCH PC/LA																		
Consulting				10.0			5.0									15.0		
Development				8.0			13.0			4.0						25.0		
Travel				1.0			1.0									2.0		
Misc.				1.0			1.0			1.0						3.0		
S.B TOTAL				20.0			20.0			5.0						45.0		
OPERATING EXP.																		
Supplies								2.0			3.0			3.0			8.0	
Maint.											.5			.5			1.0	
Startup								.5			.5			.5			1.5	
Misc. & Rentals											1.0			1.0			2.0	
SUB TOTAL								2.5			5.0			5.0			12.5	
EQUIPMENT																		
Viewing							10.0			5.0						15.0		
Sound																		
Reproduction							5.0									5.0		
Graphic							5.0									5.0		
Furniture							5.0			5.0						10.0		
Misc.																		
Acct. Software																		
S.B TOTAL							25.0			10.0						35.0		
PERSONNEL																		
Full Prof.																		
Associate							15.0				15.0			15.0		15.0	30.0	
Assistant																		
Lab Super																		
Secretaries																		
Grad Students																		
S.B TOTAL							15.0				15.0			15.0		15.0	30.0	
FACILITY																		
Modification							25.0									25.0		
TOTAL:				20.0			75.0	2.5		15.0	20.0			20.0		210.0	42.5	

TABLE B-16

EVALUATION PROGRAM BUDGET
(ALL AMOUNTS IN THOUSANDS OF DOLLARS)

Source: / Year:	FED 1	STATE 1	OTHER 1	FED 2	STATE 2	OTHER 2	FED 3	STATE 3	OTHER 3	FED 4	STATE 4	OTHER 4	FED 5	STATE 5	OTHER 5	FED Sub-totaled	STATE Sub-totaled	OTHER across
RESEARCH PC/LA																		
Consulting				6.0			3.0									9.0		
Development				3.0			6.0			4.0						13.0		
Travel				.5			.5			.5						1.5		
Misc.				.5			.5			.5						1.5		
SUB TOTAL				10.0			10.0			5.0						25.0		
OPERATING EXP.																		
Supplies								.5			2.0			3.0			5.5	
Maint.																		
Startup								.3			.5			1.0			1.8	
Misc. & Rentals								.2			.5			1.0			1.7	
SUB TOTAL								1.0			3.0			5.0			9.0	
EQUIPMENT																		
Viewing																		
Sound																		
Reproduction																		
Graphic										5.0						5.0		
Furniture																		
Misc.																		
Acct. Software																		
SUB TOTAL										5.0						5.0		
PERSONNEL																		
Full Prof.																		
Associate																		
Assistant							15.0			15.0			15.0			45.0		
Lab Super.																		
Secretaries																		
Grad Students																		
SUB TOTAL							15.0			15.0			15.0			45.0		
FACILITY																		
Modification																		
TOTAL:				10.0			25.0	1.0		25.0	3.0		15.0	5.0		75.0	9.0	

TABLE B-17

FOREIGN LANGUAGE PROGRAM BUDGET
(ALL AMOUNTS IN THOUSANDS OF DOLLARS)

Source: Year:	FED 1	STATE 1	OTHER 1	FED 2	STATE 2	OTHER 2	FED 3	STATE 3	OTHER 3	FED 4	STATE 4	OTHER 4	FED 5	STATE 5	OTHER 5	FED Sub-totaled	STATE Sub-totaled	OTHER across
RESEARCH PC/LA																		
Consulting	15.0			5.0			2.0									22.0		
Development	10.0			11.5			14.5									36.0		
Travel	3.0			1.5			1.0									5.5		
Misc.	2.0			2.0			2.5									6.5		
SUB TOTAL	30.0			20.0			20.0									70.0		
OPERATING EXP.																		
Supplies					1.0			1.5			2.0			2.5			7.0	
Maint.					1.0			2.0			3.0			5.0			11.0	
Startup					3.0			4.0			4.0			1.5			12.5	
Misc. & Rentals											1.0			1.0			2.0	
SUB TOTAL					5.0			7.5			10.0			10.0			32.5	
EQUIPMENT																		
Viewing						20.0			20.0									40.0
Sound				40.0		20.0	30.0		20.0	20.0						90.0		40.0
Reproduction							10.0			5.0						15.0		
Graphic									5.0									5.0
Furniture				10.0		10.0	10.0									20.0		10.0
Misc.									5.0									5.0
Acct. Software																		
SUB TOTAL				50.0		50.0	50.0		50.0	25.0						125.0		100.0
PERSONNEL																		
Full Prof.																		
Associate				18.0			18.0	18.0		18.0	18.0		10.0	26.0		64.0	62.0	
Assistant																		
Lab Super.				10.0			10.0			5.0	5.0			10.0		25.0	15.0	
Secretaries																		
Grad Students				5.0			5.0			2.5	2.5			5.0		12.5	7.5	
SUB TOTAL				33.0			33.0	18.0		25.5	25.5		10.0	41.0		101.5	84.5	
FACILITY																		
Modification				25.0												25.0		
TOTAL:	30.0			128.0	5.0	50.0	103.0	25.5	50.0	50.5	35.5		10.0	51.0		321.5	117.0	100.0

TABLE B-18

SUPERVISION PROGRAM BUDGET
(ALL AMOUNTS IN THOUSANDS OF DOLLARS)

Source: / Year:	FED 1	STATE 1	OTHER 1	FED 2	STATE 2	OTHER 2	FED 3	STATE 3	OTHER 3	FED 4	STATE 4	OTHER 4	FED 5	STATE 5	OTHER 5	FED Sub-totaled across	STATE Sub-totaled across	OTHER Sub-totaled across
RESEARCH PC/IA																		
Consulting				6.0			3.0									9.0		
Development				3.0			6.0			4.0						13.0		
Travel				.5			.5			.5						1.5		
Misc.				.5			.5			.5						1.5		
SUB TOTAL				10.0			10.0			5.0						25.0		
OPERATING EXP.																		
Supplies								.5			2.0			3.0			5.5	
Maint.																		
Startup								.3			.5			1.0			1.8	
Misc. & Rentals								.2			.5			1.0			1.7	
SUB TOTAL								1.0			3.0			5.0			9.0	
EQUIPMENT																		
Viewing																		
Sound																		
Reproduction																		
Graphic																		
Furniture										5.0						5.0		
Misc.																		
Acct. Software																		
SUB TOTAL										5.0						5.0		
PERSONNEL																		
Full Prof.																		
Associate																		
Assistant							15.0			15.0			15.0			45.0		
Lab Super.																		
Secretaries																		
Grad Students																		
SUB TOTAL							15.0			15.0			15.0			45.0		
FACILITY																		
Modification																		
TOTAL:				10.0			25.0	1.0		25.0	3.0		15.0	5.0		75.0	9.0	

TABLE B-19

TECHNOLOGY PROGRAM BUDGET
(ALL AMOUNTS IN THOUSANDS OF DOLLARS)

Source: / Year:	FED 1	STATE 1	OTHER 1	FED 2	STATE 2	OTHER 2	FED 3	STATE 3	OTHER 3	FED 4	STATE 4	OTHER 4	FED 5	STATE 5	OTHER 5	FED Sub-totaled across	STATE Sub-totaled across	OTHER Sub-totaled across
RESEARCH PC/IA																		
Consulting				3.0			3.0									6.0		
Development				1.0			8.0			7.0						16.0		
Travel				.5			2.5									3.0		
Misc.				.5			1.5			3.0						5.0		
SUB TOTAL				5.0			15.0			10.0						30.0		
OPERATING EXP.																		
Supplies										3.0			3.0	2.0		6.0	2.0	
Maint.											3.0			6.0			9.0	
Startup										2.0			2.0			4.0		
Misc. & Rentals											2.0			2.0			4.0	
SUB TOTAL										5.0	5.0		5.0	10.0		10.0	15.0	
EQUIPMENT																		
Viewing																		
Sound																		
Reproduction																		
Graphic																		
Furniture										5.0						5.0		
Misc.										20.0			75.0			95.0		
Computer										125.0						125.0		
SUB TOTAL										150.0			75.0			225.0		
PERSONNEL																		
Full Prof.																		
Associate																		
Assistant										30.0			20.0	10.0		50.0	10.0	
Lab Super.																		
Secretaries																		
Grad Students																		
SUB TOTAL										30.0			20.0	10.0		50.0	10.0	
FACILITY																		
Modification							25.0			25.0						50.0		
TOTAL:				5.0			40.0			220.0	5.0		100.0	20.0		365.0	25.0	

TABLE B-20

URBAN EDUCATION PROGRAM BUDGET
(ALL AMOUNTS IN THOUSANDS OF DOLLARS)

Source: Year:	FED 1	STATE 1	OTHER 1	FED 2	STATE 2	OTHER 2	FED 3	STATE 3	OTHER 3	FED 4	STATE 4	OTHER 4	FED 5	STATE 5	OTHER 5	FED Sub-totaled	STATE Sub-totaled	OTHER across
RESEARCH PC/IA																		
Consulting				10.0		5.0	2.5		5.0							17.5		10.0
Development				10.0		15.0	20.0		15.0	6.0						36.0		30.0
Travel				5.0			5.0			1.0						11.0		
Misc.				5.0			2.5			3.0						10.5		
SUB TOTAL				30.0		20.0	30.0		20.0	10.0						75.0		40.0
OPERATING EXP.																		
Supplies								6.0			6.0			6.0			18.0	
Maint.																		
Startup								2.0			2.0			1.0			5.0	
Misc. & Rentals								2.0			2.0			3.0			7.0	
SUB TOTAL								10.0			10.0			10.0			30.0	
EQUIPMENT																		
Viewing																		
Sound																		
Reproduction							5.0									5.0		
Graphic																		
Furniture							5.0									5.0		
Misc.																		
Acct. Software																		
SUB TOTAL							10.0									10.0		
PERSONNEL																		
Full Prof.																		
Associate																		
Assistant							15.0			15.0	15.0		10.0	20.0		40.0	35.0	
Lab Super.																		
Secretaries																		
Grad Students																		
SUB TOTAL							15.0			15.0	15.0		10.0	20.0		40.0	35.0	
FACILITY																		
Modification																		
TOTAL:				30.0		20.0	55.0	10.0	20.0	25.0	25.0		10.0	30.0		120.0	65.0	40.0

SECTION V SIMULATION MODELING IN METEP

SIMULATION MODELING IN METEP

Simulation and modeling techniques allow planners to see how certain aspects of an operation might work without actually going through that operation. The success of these techniques is highly dependent on the ability to describe the proposed operation well enough to allow it to be decomposed into simple parts, the behavior of each of which can be clearly understood. It further depends on the ability to be specific about the inter-relationship of the parts, and to supply reasonable data for the operation of each part.

A simulation model is properly validated when its total behavior in some way matches the real world. This is difficult to claim when the simulation model is to be used for constructive planning of something that doesn't yet exist. The value of constructing a simulation model in the planning context may be summarized as:

a. The exercise of creating a model is very valuable in helping planners think through the consequences of their assumptions.

b. To the extent that parts and relationships have been correctly specified, the consequences of system operation with hypothesized data may be explored.

c. The cost of simulation is relatively low compared to the cost of a major error in planning.

d. The process of simulation can materially speed the process of developing a management control system for a complex, new operation.

Our concern is not with individual components as much as it is with the entire entity -- students, faculty, resources, management strategies. Simplicity of individual elements does not necessarily imply simplicity of the whole. By analogy, pulleys are simple components. However, the linking together of a number of pulleys with cord may produce a system whose behavior, when a weight is hung at one end and a force is applied at the other, is by no means intuitively obvious. The benefits of simulation modeling include gaining an understanding of the complete system through detailed descriptions of relatively simple parts and the hypothesized relationship between these parts.

For the purpose of developing and testing the Model Elementary Teacher Education Program through simulation, it appeared obviously desirable to try to think through what would happen to individuals

under various circumstances. If reasonable experiences cannot be provided for one or more types of students, or some segment of the faculty, there is something wrong with some part of the proposed program. Further, aggregation of the requirements for individuals should give a good measure of the resources needed by the institution.

Against this background, the Simulation team has produced and used four models (a fifth is under development). The technical details of these models, including flow logic and examples of data used, will be included in a Technical Report to be published separately. These models may be summarized briefly as follows:

EDSIM 1. This is an elementary model whose main purpose is to explore time to completion. The instructional program developers in each pedagogical area are asked:

a. The probability of passing pre-tests for performance criteria in that area, and, hence, needing no instruction for a student.

b. The probability of passing post-tests after instruction has been taken. One additional instructional alternative is needed for each post-test not passed.

c. For up to 10 types of instructional events, how many there are of that type and the estimated time for completion of that type by average students.

In addition, an EDSIM 1 run requires the number of students to be processed and the per cent of the available instructional events in each pedagogical area to be taken (in one "profile"). The model then generates the required number of students, one at a time, and has them take a number of randomly-selected instructional events in each area, based on the indicated number to be taken minus the number probabilistically pre-tested out, plus the number probabilistically failed on the post-test. The student's time to completion, in hours, is tallied, and the hours typically spent in each pedagogical area is computed.

The primary use of EDSIM 1 was to start the METEP modeling process. However, initial runs did show rather unexpected amounts of student time in different areas, which resulted in a shortening of time requirements in some areas for some profiles.

In EDSIM 1, there was no attempt to see if students actually could be scheduled so as to complete their requirements in the number of hours indicated, nor was there any attempt to keep track of individual instructional alternatives for individual students.

EDSIM 2. This was the major model produced during the feasibility study phase of METEP. It required the specific identification of all instructional alternatives, including resources of various types required and estimated student time to completion. Other data used in EDSIM 2 included:

a. Probability of passing pre-tests in each area.

b. Numbers of students entering METEP at various times (e.g. start of semesters).

c. Number of hours a week students were assumed to be willing to work.

d. Amount of each resource assumed to be available.

e. Per cent of the performance criteria to be met before completion of the program.

For each run of EDSIM 2, specific students were generated, with specific sets of instructional alternatives to be taken. For each two week period within a semester, instructional alternatives were offered, depending on student demand and resource availability. A record was kept of each individual student's taking and completion of instructional alternatives. When a student completed the specified per cent of the instructional alternatives, he was graduated.

Output data from EDSIM 2 includes time to graduation for students, resource utilization by two week periods, and a tally of student disappointments due to such factors as insufficient demand, no space, no staff, or more demand than the resources permitted meeting.

Data was collected from the Pedagogical teams for use in EDSIM 2. Undoubtedly, this data represented best guesses at the time it was collected, but, unfortunately, the time needed to collect and process a large amount of input data and run EDSIM 2 prevented refining the data to reflect experience gained by trying actual instructional alternatives this fall. Our separate technical report will document the data collected to indicate the working of EDSIM 2. This data, and the results presented, do not now represent our best knowledge of how METEP might work in practice.

From the use of EDSIM 2 with the data as collected, several valuable interactions with Pedagogical teams and management refinements were generated. One of the major indications from the simulation experience was that some kind of scheduling of instructional alternatives in advance, rather than in unforeseen response

to student demand, would greatly speed a student's progress through the METEP experiences. Mathematics and Language Arts did experiment with various ways of clustering their offerings, so that students still had a reasonable choice, but in addition faculty resources could be planned in advance.

Another major suggestion from the simulation experience was that instructional alternatives were taking too much student time. Either a student needed to meet fewer of the hypothesized performance criteria, or the available instructional alternatives had to be shorter, if students were to exit from METEP system in any reasonable time. For example, the Science area, in their feasibility testing, found that many more performance criteria were pre-tested satisfactorily and that many instructional alternatives took much less time than originally expected. A significant cut in both the number of performance criteria to be met and in the instructional time to meet them should generate data that contains the solution to the problem of lengthy time to graduation.

The preference of students for lectures, although perhaps a function of conditioning of present students rather than a long-range indication of what is likely to be selected, reinforces the concept that some efficiencies of large group, scheduled experiences will result in a smoother student flow through METEP.

Another interesting observation from EDSIM 2 concerns the number of hours per week students are willing to work. Theoretically, the harder a student is willing to work, the sooner he is likely to complete his program. In simulation, increasing the hours per week students were willing to work imposed severe strains on the resources, and served more to increment disappointment counters than speed student progress. Alternatively, a higher level of resources may be needed.

Demands on resources, especially faculty and staff, can be quite uneven. It would appear from EDSIM 2 results that minimum number of students needed before an instructional alternative will be offered results in cumulative pent-up demand for many students, resulting suddenly in enough students for many instructional alternatives at about the same time. It would seem from preliminary analysis that this problem could be avoided through some form of scheduling.

Many times during a semester, and especially towards the end of a semester, students had "idle" time due to inability to schedule instructional alternatives (primarily due to lack of sufficient demand, secondarily due to lack of time until end of the semester). One possible strategy for METEP planners is to provide more individual, self-study alternatives that could be used to fill in the gaps.

Alternatively, some form of advance scheduling of instructional alternatives, perhaps into a select but varied number of consistent and efficient routes to program completion, might get around the "idle time" problem, and at the same time speed student progress.

EDSIM 4 is still being created. It will use the same data as EDSIM 2 and try to provide answers for the same kinds of questions. The present intent is the EDSIM 4 will have a sounder theoretical and data base (profiting from experience in building EDSIM 2), will be more flexible, and, hopefully, be easier to run.

There is much that remains to be done with the EDSIM type of simulation modeling. Revising the input data to reflect experience gained during this feasibility study is, of course, the most obvious and necessary activity.

Model validation work is being planned in conjunction with the Individually Prescribed Instruction Project of the Learning Research and Development Center at the University of Pittsburgh. While it may not seem initially that individual prescriptions in an elementary school and student-selected instructional alternatives in a university setting have much in common, it now appears that operationally once a set of activities is selected, the behavior of the two systems may be very parallel. If the EDSIM models do provide better-than-chance predictions of system behavior in the IPI context, their usefulness for NMEP purposes is enhanced.

In time, it is to be expected that operational data will be available that will allow a better than random mechanism for anticipating what instructional alternatives students will select. The development of a "guidance" predictor of some accuracy may be important if simulation models such as these are to become useful management tools for operation as well as planning.

There is a good chance that an effective simulation model may become a central part of the management information system. Looking forward to this possibility, work needs to be done to bring the data file structures of the EDSIM models into correspondence with those of the management information system. It will also be highly desirable to provide a stable interface between simulation modeling and the research and evaluation effort, to provide both a research tool for the latter, and better parameters and decision rules for the former.

Two other small models have been created.[1] ARF 1 is a scheme for defining the anticipated staff for a school or center, in terms of hours available, and per cent of time to be spent in various types of work. The work that needs to be done is then defined as a function of parameters of the educational program - e.g. number of students, emphasis on indivudual instruction, planning time. The ARF 1 model matches work force availability against work needed in a simulated school situation. One METEP Center, Language Arts, has applied the ARF 1 model to its staffing, with results verified by experience that there simply wasn't anywhere near enough staff for the anticipated work. This type of analysis can be very helpful in designing staffing versus anticipated work in a new educational situation; its use in other METEP Centers is proposed.

The remaining model is QURUE, whose purpose is to explore probable student demand for a limited service facility. The average arrival rate of students is specified, as is the anticipated service time for a student or group of students to be served simultaneously. A starting number of service facilities is specified. The model, which operates on a time-sharing system from a desk console, creates sample days with the specified student demand, then services the demand with 1 through the specified number of service facilities available. Information presented to the user includes average facility utilization and student waiting time. If the student demand and service times are known with any certainty, this model assists planners in deciding how many service channels should be available. A typical use has been to determine the number of Language Masters to have available for a given school population with anticipated use parameters. It was found that peak demand could be met with about half the devices originally planned.

We believe that the development of these simulation tools, plus growth of sophistication in using them, has been a major and worthwhile outcome of the METEP feasibility study. The capability has been established for making better decisions as METEP plans progress.

Recommendations for the continued use of simulation in the implementation and operation of METEP are outlined in Figure 1.

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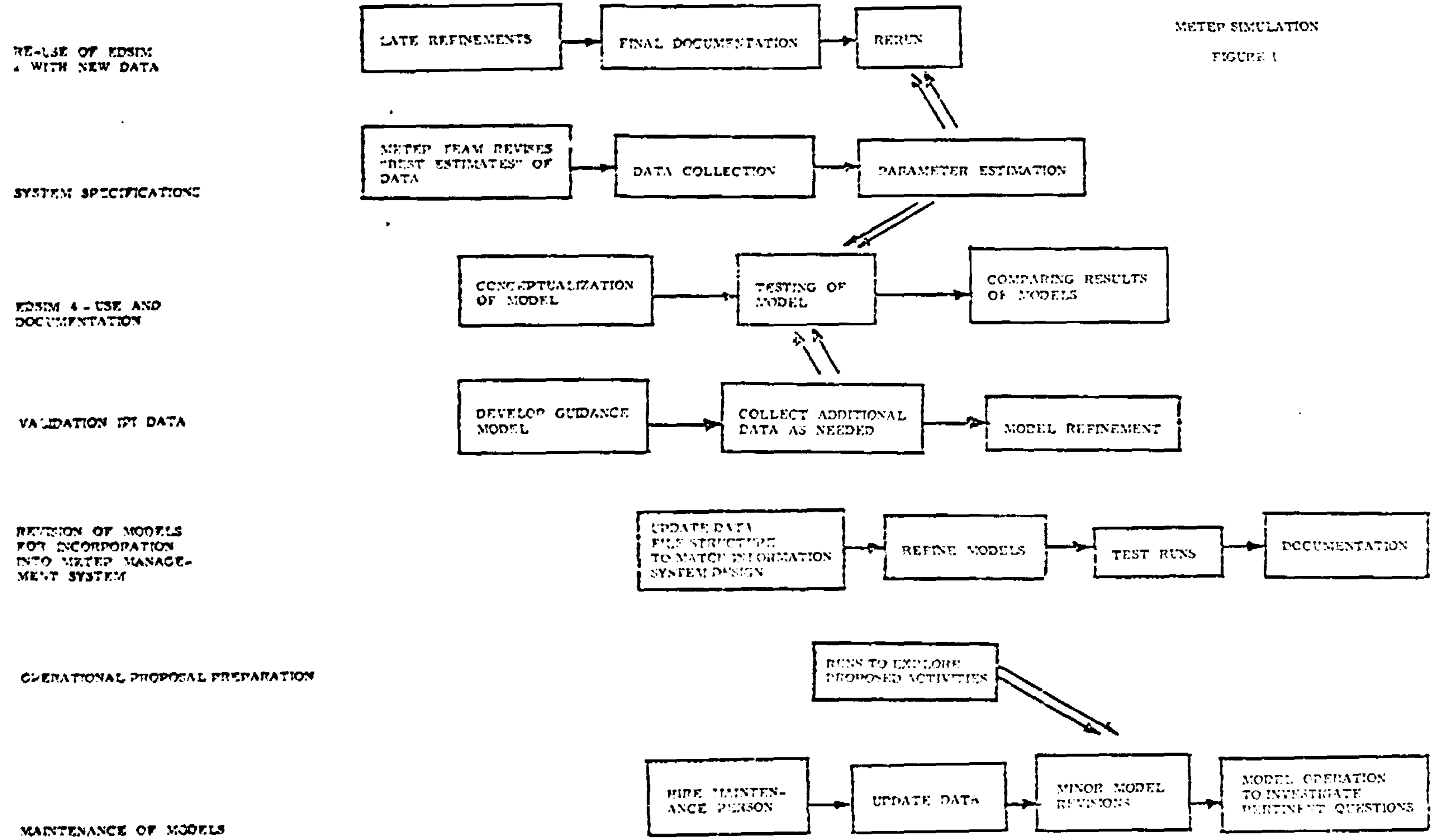
[1]Creation and initial use of these models was supported by General Learning Corporation in connection with the planning of the first educational facility for the Fort Lincoln New Town Project in Washington, D.C.

METEP SIMULATION

FIGURE 1



SECTION VI CLIENT ACCEPTABILITY

CLIENT ACCEPTABILITY

Any teacher education program has several sets of clients. These include: students, parents, teachers, school administrators, and state certification personnel. If a teacher training model is to successfully satisfy the needs and concerns of these clients, it must involve them in the creation and early evaluation of the program. The goal of the Client Acceptability component of the feasibility study is to inform a representitive sample of interested lay people and professional educators of the proposed METEP design, and then to obtain their reactions to the program as well as their suggestions for improvements.

Client acceptability of METEP has been determined by using three different methods:

a. A client conference was held in July 1969 to present the METEP design. At that time, the clients' reactions and suggestions were gathered via reaction panels, questionnaires, and the Delphi Technique.
b. State departments of teacher certification were contacted and asked to respond re METEP's compatibility to existing certification requirements.
c. Undergraduates participating in the pedagogical feasibility studies were surveyed, and asked to give their reactions to performance criteria and other instructional procedures.

The general reaction of the potential clients surveyed during the conference, and in the visits to various state certification departments, were exceptionally encouraging as well as helpful, and will be given more detailed attention within the remainder of this report. The survey of undergraduate responses will be handled within the individual pedagogical reports rather than in the client acceptability section.

The Client Conference. A client conference was conducted early in July of 1969 to get feedback on the basic components of METEP as they had progressed to that time. Twenty-three clients composed of undergraduates in elementary education, teachers in the field , all levels of administrators from public and private education, parents, and state certification personnel were invited to the University to learn about the proposed Model Elementary Teacher Education Program, and then comment on its strengths and weaknesses. The full day conference began with a general presentation by Dr. James Cooper, the project director, and was followed by several METEP staff members, each giving a brief synopsis of what was being planned in their specific subject areas. The conference participants had each been sent a copy of the METEP Phase I report prior to the conference, and the morning session

served to bring them up to date on progress since the report was written.

The second half of the conference was spent gathering reactions from the participants to be used in improvement of individual METEP components. Feedback to the staff was received in three ways: first, a presentation was made by a six member reaction panel; second, a questionnaire was filled out by each of the participants; and third, a prediction of future public acceptability was given via the RAND Corporation, Delphi Technique.

Reaction Panel. The enthusiasm shown for METEP was something more than we had expected from the traditionally reserved New England group, and it seemed to set the tone for the remainder of the conference. Reaction panel comments ranged from; "I think the concept of performance criteria is excellent, and the removal of time as a factor in completing course or degree requirements has long been needed.", to "Great care must be given when preparing performance criteria, so as to include the essential ingredients of teaching." Many questions were asked by the panel regarding quality control, undergraduate time commitment, local involvement, and the ramifications for present teacher certification requirements. These and other questions were responded to by the staff before the participants filled out the "Client Questionnaire".

Client Questionnaire. Thirteen questions were asked on the questionnaire. Each question was designed to give the METEP staff an idea of what parts of the program the clients felt were strengths or weaknesses, and in general, what their feelings were concerning the program as it had been presented. Included here are the thirteen questions asked in the questionnaire. A random response, i.e., every fifth reply, is provided.

1. Do you feel there is a need for revision in the mehtods used to train elementary teachers?

> "Definitely. There should be greater emphasis on the teaching of learning theory, the establishment and pursuit of behavioral objectives, and the development of techniques required to make the classroom a stimulating place."
>
> "Yes. More early experiences with children are needed. Micro-teaching, strength training, etc., are fine, but longer earlier periods of time with children are needed."
>
> "Yes. Revision of some traditional methods to meet present day standards are needed."

"Definitely yes. The area of human relations is one that needs much attention."

2. Disregarding minor weaknesses you may have noticed in METEP, does the general idea of a performance based curriculum for teacher education seem to have merit?

"Yes. Performance criteria seems a much more realistic perameter than time achievement. My personal reservation is that ample consideration be given to the environment in which the performance criteria is demonstrated."

"Very difinitely, it should help elevate the status of teachers and their quality, which will in turn, make the profession more attractive to competent students."

"Yes, curriculum construction has been talked about for thirty years. It is time for action."

"Yes. However, there are many ancillary experiences that take place aside from pursuit of specific objectives in the classroom, that should not be overlooked."

3. In your estimation, what are two of the most obvious weaknesses in the METEP as it now stands?

"Potentially good teachers might be washed out on the basis of failure to meet performance levels in one or two particular areas."

"Definition of a student teaching experience."

"It (METEP) may turn out teachers who are alike in method and personality."

"At this point, the field experience needs smoothing and clarification."

"The role and particulars of a "generalist" require more delineation, perhaps using a different term."

4. What do you feel are the major strong points of METEP?

"Flexibility allowing for individualization."

"It provides the trainee with a better understanding of the education process and his role in it."

"The great care given to analysis of the essential ingredients of effective teaching. This is reflected in the specific subject areas."

"Possible effects on certification, recruitment, differentiated salary structure etc."

5. Would you hire teachers trained under this method?

"Yes, background, depth and preliminary practice and understanding of youngsters would be strong points."

"I can't honestly say. The extent to which I feel the candidate can develop rapport with her children is a key consideration which requires on the scene assessment."

"Yes, I might finally have a reasonable chance to predict teacher success and pupil-teacher compatibility."

"Yes, provided they have been awarded a teaching degree by the University."

6. What are some of the qualities you would look for in a teacher before hiring him?

"Genuine love and concern for children and an ability to transfer knowledge."

"Enthusiasm for learning."

"Respect for children, flexibility, ability to listen rather than just hear."

"Knowledge of subject matter."

"Knowledge of content, knowledge of children, liking for people and the ability to get along with them and facilitate growth.

7. In your opinion, are the above qualities being developed in the METEP?

"Yes, assuming minimum requirements are realistic, which I am sure they will be."

"Yes, they are certainly a part of the design."

"Not all."

"Yes, particularly in the human relations field, this is an exciting area, but one which could be disastrous unless handled by extremely competent individuals."

"I question whether love and concern for children will be able to become a part of this program."

8. If a student had competed all of his course requirements in 2 1/2 years and was considered qualified by the University and the state certification board, do you think he would have any difficulty obtaining a job in your school system?

"I would certainly hope not. Today's asinine assumption that four years equals teacher, certainly is not valid."

"No, the fact that he has a degree would be sufficient requirement."

"No, provided the University has sufficient confidence in this program to award him a teaching degree."

"Possibly. There is more to education than attaining measurable behavioral objectives."

9. If a student took 5 1/2 years to complete all of his teacher certification requirements, would he be regarded with some suspicion or have any difficulty obtaining a job in your school system?

"This would depend on individual circumstances."

"No. The first few teachers might, but I'm sure this suspicion would only be monentary."

"As strange as it may seem, he would probably be more readily accepted than the above student."

"No, I feel he would be considered merely a more thorough and well trained person."

10. Do you foresee any difficulties arising for local school systems if teachers are trained according to performance criteria rather than the present methods?

"Just the difficulties of teachers and administrators accepting something new."

"No, I believe most superintendents would welcome this type of preparation after they study and understand it."

"Some bad feelings will occur in the teaching ranks of those who "put in" four years, but time is a great healer."

"Yes, it will likely force a rethinking and hopefully a restructuring of existing curriculum and methodology, which means confrontation between 'old and new' teachers.

11. Do you think parents and board members will be eager to hire teachers with the performance criteria background?

"Hopefully, the movement is bound to be in that direction."

"Yes, since teachers educated in the traditional method have fallen short of what is expected of them."

"Yes. They are fed up with what they are getting now and ready for performance evaluation on the job as well as in the preparation."

"Yes, there is some objectivity to performance criteria which would give confidence to the parents and the board."

12. Do you feel that the application of curriculum simulation techniques provide an effective means to study educational problems?

"Yes. It will save a lot of mistakes later."

"Yes. We should have adapted this from industry long ago."

"Don't know enough about the approach to have an opinion."

"Yes, but I would need more data and experience to comment further.

13. In what ways should the University continue to involve local school systems with regard to Teacher education?

"More cooperative efforts and more responsibility to the local teacher."

"If METEP is accepted, we should involve all schools systems in re-educating existing teachers so as to eventually get teachers to use these same concepts."

"By sending people from the School of Education to faculty meetings at the local schools."

"Offering academic credit to teachers who will do field research or cooperative work with the School of Education."

"Constant dialogue. Through gradual involvement in ways suggested in the METEP proposal, through more seminars and conferences for teachers and administrators Your enthusiasm and 'dreams' are very infectious.

Delphi Technique. The Delphi Technique is a method used for the systematic solicitation and collation of expert opinions. A technique has been found, through research done at the RAND Corporation, to improve a group's success in decision-making and the prediction of future events. The technique is explained here by N.C. Dalkey of the RAND Corporation, in a paper prepared for the National Conference on Fluid Power, in Chicago, October 17, 1968.

"The basic characteristics of the Delphi procedures are: (a) Anonymity, (b) Iteration with controlled feedback, (c) Statistical group response. Anonymity is achieved by using questionnaires or other formal channels of communication, where specific responses are not associated with individual members of the group. This is a way of cutting down on the effects of dominant individuals and reducing group pressure. Iteration consists in perfroming the interaction among members of the group in several stages; typically, at the beginning of each stage the results of the previous stage are summarized and fed back

to the members of the group, and they are then asked to reassess their answers in light of what the entire group thought on the previous round. Controlled feedback allows interaction with a large reduction in noise. Finally, rather than asking the group to arrive at a common opinion, a consensus, the group opinion is taken to be a statistical average of the final opinions of individual members of the group. In the experiments we have conducted, the median opinion--that is the middle estimate where half the group is on one side, and half on the other--has turned out to be the most accurate. By using a statistical group opinion, group pressure toward conformity is further reduced, and probably more important, the opinion of every member is reflected in the group response."

We felt the twenty-three participants at the conference, because of their varied public backgrounds, could use the Delphi technique to give us an estimation of the general public's acceptance of the METEP design. The participants received instructions on the use of the Delphi questionnaire at the conference, and completed the first round of responses at that time. During the following four weeks, participants were provided with revised information on the responses of the other conference participants, and were asked to adjust their responses if they desired. At the end of this exchange, the results were collected, giving us the following information on the estimated acceptance of the METEP design by the general public. A sample Delphi form is included in the Appendix A.

In the following questions, the participants were asked to respond to the questions by checking a number from 0 to 100 on a number line. In the first eight questions, "0" represents unacceptability and "100" represents complete acceptability.

1. "If acceptability could be placed on a scale from zero to one hundred, the general public would rate METEP as:"

   Median response = 71.9

2. "If acceptability could be placed on a scale from zero to one hundred, the general public would rate conventional teacher training techniques as:"

   Median response = 49.9

3. "The teachers now teaching in public elementary schools would rate METEP as:"

   Median response = 74.6

4. "The teachers now teaching in public elementary schools would rate conventional teacher training techniques as:"

   Median response = 46.9

5. "The administrators hiring teachers for elementary teaching positions would rate the teachers graduating from METEP as:"

   Median response = 76.2

6. "The administrators hiring teachers for elementary teaching positions would rate the teachers graduating from conventional teacher training institutions as:"

   Median response = 59.0

7. "Assuming that a teacher graduating from an average school of education would rate 50 in overall ability on a 100 point scale, where would a student graduating from METEP be rated by the public?"

   Median response = 73.6

8. "How many years will it take for the METEP approach to become accepted as a valid method for training teachers?"

   Median response = 9.5

In the next two questions, the numerals 0 to 100 represent numbers of parents.

9. "Out of 100 parents, how many see a need for elementary teachers with better training than they are now receiving?"

   Median response = 70.3

10. "Of these same 100 parents, how many would see METEP as an effective improvement over standard training methods?"

    Median response = 70.1

State Certification Departments. The METEP staff is aware that a growing state university, such as the University of Massachusetts, must consider a broad area and population when it involves prospective clients in determining METEP's feasibility. The combination of a mobile graduating student body and a geographical location that puts several of the nation's largest population centers within an hour's air travel, requires that client involvement include other states and educational systems as well as those in Massachusetts. METEP has achieved this broad involvement by visiting the teacher certification departments in New York, Minnesota, and California. The purpose of each visit was to determine the compatibility of the METEP design with existing state certification requirements, to familiarize each of the states with the design, and to receive suggestions on ways METEP could improve the design to meet existing state requirements.

Three weeks before the visit, each department was sent a copy of the METEP Phase I report and several questions to consider, regarding the generalizability of the design to their certification requirements. See appendix for a copy of the letter and questions.

New York. New York presently requires, a Bachelor of Arts degree with 24 hours in education, and a practicum experience, for teacher certification. The state is planning to convert from its present method of teacher certification to a performance based procedure within the next five years, and found the METEP design quite compatible with their projected plans. Dr. Gazzetta, Director of Teacher Certification, was very interested in METEP, and discussed possible relationships that might arise between New York and the University of Massachusetts regarding the design of performance criteria. Dr. Gazzetta stated that any changes of the degree proposed in the METEP design would require study by their certification department, but that he anticipated few problems.

Minnesota. The State of Minnesota is also in the process of revising its teacher certification requirements. Dr. Garalski, the Director of Teacher Certification, found the METEP design acceptable to Minnesota's standards provided that teachers graduating from the program had a Bachelors degree, and met the requirements for a Massachusetts teaching certificate. The proposed future plan for teacher certification in Minnesota would simply require a Bachelors degree in education from an accredited teacher preparation institution for a two year teaching certificate. During the two year trial period, teachers would be expected to meet various performance criteria, as set down by the State Certification Department, before being recertified for a five year period.

No conflict between the METEP design and existing or proposed certification requirements could be found. It seems in fact, quite possible that METEP teachers might go to Minnesota already prepared to meet the proposed performance criteria for a five year teaching certificate.

California. At the time of our visit to California, the Certification Department had just received word that the requirements it had been working under since November of 1968, were being replaced with the requirements that had been in effect prior to 1968. It seems the State Legislature found the standards they set in 1968 to be unrealistic, and in the absence of an immediate solution, they were returning to the earlier requirements.

Mr. Obradovich, one of the Departments' analysts, informed us of this change and stated that further changes were in progress within the State Legislature regarding teacher certification requirements. With the lack of definite longterm standards from which to base his judgments, Mr. Obradovich was naturally hesitant to comment on the compatability of the METEP design with California Certification Requirements.

The METEP staff will keep contact with the California Certification Department to determine if difficulties might arise for our graduates.

Connecticut. Mr. James S. LeSure, Director of the Connecticut Teacher Certification Department, participated in the client conference and indicated his enthusiasm for the program. Mr. LeSure feels that "Performance evaluation is the key to the problem of certification and professionalization of teaching." The METEP staff has remained in close contact with his department during the duration of the of the feasibility study and little, if any, difficulty is foreseen in the certification of METEP graduates.

Massachusetts. The State Department of Education in Massachusetts has been contacted and it's reactions to the model were favorable. A meeting was held in November, 1963 between James Cooper, Project Director and John P. McGrail, Director, Bureau of Teacher Certification and Placement. At the meeting, Mr. McGrail questioned certain aspects of the program, but felt there would be no certification problem as long as the program met state requirements. Since that time the METEP staff has remained in close contact with the Department and their enthusiasm for the program has continued. Provision has been made in the model to meet the minimal requirements that were of earlier concern and we now have the full support of the Massachusetts Bureau of Teacher Certification.

Summary. The client acceptibility study was designed to survey a small portion of the proposed future METEP clientele. The survey included a conference for twenty-three people of varied background, with each giving information on client acceptance via, a reaction panel, a questionnaire, and the Delphi Technique.

The size of the surveyed group and the number of questions asked, has given us a sample of the public's opinion that we feel is large enough to indicate the general likes and dislikes they have concerning METEP. All participants agreed that conventional methods of teacher education could be improved upon, and that the METEP design seemed to be a well thought out alternative with great potential. The reaction panel and client questionnaire, combined with the indication of acceptance provided by the Delphi Technique leads us to believe that the general public will accord METEP its strong support in the years to come.

The visits with certification departments in New York, Minnesota, California, Connecticut and Massachusetts indicated to us that METEP is compatible with the certification requirements of other states. It is interesting and encouraging to note that both New York and Minnesota are emphasizing the use of performance criteria in the future revision of their certification requirements. The absence of compatibility problems between out of state certification departments and the projected capabilities of METEP graduates, combined with the support of the Massachusetts Teacher Certification Department, gives us reason to believe that few future problems will be encountered in this area.

APPENDIX A

DELPHI FORM

After you have answered these questions, please return the questionnaire in the envelope provided. Your expedience in the return of this information will be most appreciated.

In the following questions you will be asked to give your answer by checking a number from 0 to 100. In these cases "0" represents complete unacceptability and "100" will represent complete acceptability.

1. If acceptability could be placed on a scale from zero to one hundred, the general public would rate METEP as:

0 10 20 30 40 50 60 70 80 90 100

2. If acceptability could be placed on a scale from zero to one hundred, the general public would rate conventional teacher training techniques as:

0 10 20 30 40 50 60 70 80 90 100

3. The teachers now teaching in public elementary schools would rate METEP as:

0 10 20 30 40 50 60 70 80 90 100

4. The teachers now teaching in public elementary schools would rate conventional teacher training techniques as:

0 10 20 30 40 50 60 70 80 90 100

5. The administrators hiring teachers for elementary teaching positions would rate the teachers graduating from METEP as:

0 10 20 30 40 50 60 70 80 90 100

6. The administrators hiring teachers for elementary teaching positions would rate the teachers graduating from conventional teacher training institutions as:

0 10 20 30 40 50 60 70 80 90 100

7. Assuming that a teacher graduating from an average school of education would rate 50 in overall ability on a 100 point scale, where would a student graduating from METEP be rated by the public?

0 10 20 30 40 50 60 70 80 90 100

8. How many years will it take for the METEP approach to become accepted as a valid method for training teachers?

0 10 20 30 40 50 60 70 80 90 100

In the next two questions, the numerals 0 to 100 represent numbers of parents.

9. Out of 100 parents, how many see a need for elementary teachers with better training than they are now receiving?

0 10 20 30 40 50 60 70 80 90 100

10. Of these same 100 parents, how many would see METEP as an effective improvement over standard training methods?

0 10 20 30 40 50 60 70 80 90 100

APPENDIX B

The Commonwealth of Massachusetts
University of Massachusetts
Amherst 01003

SCHOOL OF EDUCATION

July 16, 1969

Dear Sir:

The enclosed Model Elementary Teacher Education Program (METEP) report should give you a fairly complete idea of the direction we are heading in our future planning. This report was sent to the U.S. Office of Education in May of 1968 and was one of eight in the nation funded to develop Phase II which is a feasibility study. During the past four months of Phase II, much of what is written in this report has changed dramatically, but the performance based philosophy has remained constant.

Mr. Don Waldera, as I mentioned in my first letter, will be stopping to see you on August 1 to discuss these and other questions related to your state certification requirements. It is through this meeting that we would like to determine if there are any major certification problems to be overcome during our Phase II feasibility study.

As you read sections of the report, would you consider some of the following questions in light of your state's teacher certification requirements.

1. Are elementary teacher certification requirements in your state flexible enough to allow for graduates that have met specific performance levels, rather than credit hour requirements?

2. Since there are variable entry and exit points in the METEP, the time spent within the system will vary from student to student. Do you foresee any difficulty certifying a student that spends only two and a half years in the system or one that graduates after five and a half years?

3. Do you foresee any difficulties arising for local school systems if teachers are trained according to performance criteria?

4. What are some of the performance standards students must meet to be certified in your state?

July 16, 1969

Thank you for considering these questions, we will be looking forward to discussing them with you.

Sincerely,

James H. Cooper
Director of Teacher Education

SECTION VII INSERVICE DESIGN

INSERVICE DESIGN

The inservice design holds the key to several problems universities have had for many years. The problems we speak of are: the lack of systematic communication with local school districts, the inability of universities to fulfill their inservice training obligation to local school districts; and the powerlessness of universities to facilitate meaningful change in public school systems. These problems will find either partial or complete solutions in the proposed inservice design.

The Survey. Prior to the development of this design, a survey was conducted by the University of Massachusetts' Center for the Study of Educational Innovations (CSEI). This center is located in the School of Education, and is primarily interested in helping school systems implement educational innovations. As a result of this interest, the center has spent a great deal of time assessing the needs of public schools through contact with students and teachers. It was because of this interest in needs assessment, that the center was called upon by METEP to assist in determining the inservice needs of Massachusetts teachers. The results of that survey are included here, and have been used in the formation of the inservice component. (See Appendix A for complete survey.)

The purpose of the survey was to determine the inservice needs of public school teachers in Massachusetts. Eight thousand questionnaires were distributed to elementary and secondary teachers throughout the Commonwealth with a total of 2,850 returned. The response by elementary teachers, pre-school through grade 6, was 1,348 or 47% of the total response.

Respondants were asked to indicate their needs for inservice training in seventeen general subject areas that were divided into descriptive sub-categories. Teacher responses to the items included in the questionnaire suggests that the first priority of inservice education is the establishment of workshops, seminars, and programs designed to advance the teachers' skills in understanding and utilizing knowledge in psychology and human relations, as it relates to individualizing educational programs. In the same vein, the survey indicated that for inservice education to be meaningful, the emphasis must shift from a subject matter orientation to an emphasis on learning theory and the skills needed to cope with the varied characteristics of learners. These teacher needs, and other uncovered by the survey, form the framework for the inservice design.

The Design. The inservice design provides the opportunity for continuous personal growth through the completion of performance objectives and the chance for professional career growth through formation of a differentiated staff structure. The design has three major strengths.

1. School systems participating in this program will be committing themselves to a change in present staffing patterns that will have positive and long range effects on the structure of public school education.

2. A comprehensive student teaching experience ties in closely with the inservice design, and allows teachers an uninterrupted progression from pre-service education to inservice education via performance criteria.

3. The design provides teachers with inservice assistance and instruction, both at the University during the summer, and at the teacher's school during the academic year.

As we have mentioned, the METEP inservice program requires a commitment from both the teacher and his school system toward differentiated staff development. We are making this request because we feel that significant strides toward changing system staffing patterns must be made if personnel in education are to be used to their full potential. Our commitment toward differentiated staffing patterns has been given statewide support by the Massachusetts Advisory Council on Education (MACE), which was formed in 1965 to study the state's public education system and make recommendations on its improvement. To quote from the MACE report, "New staffing patterns for elementary and secondary schools should be developed that make full and appropriate use of various kinds of educational specialists, professional personnel, beginning or associate teachers, interns in training and para-professional workers."[1] The METEP design will act upon this suggestion by assisting school districts in the training of their teachers to meet the challenges of new staffing patterns.

Realizing that this type of commitment necessitates advance planning by school administrators, the METEP staff contacted five school districts to explain the design and ask for suggestions. The five western Massachusetts school districts confirmed their

[1] Massachusetts Advisory Council on Education. Teacher Certification and Preparation in Massachusetts, Boston: July 1968, p. 46.

interest in this design and provided METEP with letters of intent to participate. (See Appendix B.)

The inservice program will operate in the following manner. Teachers will attend the University for six weeks during the summer where they will perform two roles: one as a student, and the other as an assistant instructor. As a student, the teacher will develop skills in observational techniques, supervision, and clinical procedures such as microteaching and strength straining. Emphasis will also be placed on the utilization of additional staff in the classroom, i.e., large and small group instruction, seminars, tutoring, etc. As students, the teachers will also meet performance criteria in subject areas such as math, human relations, and language arts. The areas and depth of each experience will vary according to the needs profile of individual teachers.

As assistant instructors, the teachers will work with METEP undergraduates preparing them for internships during the following school year. All teachers will be assigned four interns to work with during the summer, and these same students will be assigned to them during the undergraduate's internship--two interns each semester. Teachers and interns willspend approximately two hours a day together in seminars and micro-teaching clinics. During this time teachers will be able to familiarize the interns with the cooperating school and its philosophy in a way that has not been possible before.

Both the teachers and undergraduates will find that this design allows a smooth and logical progression from performance criteria completed at the university to those they will work on in the classroom. Dr. Kevin Ryan, Director of the MAT program at the University of Chicago refers to the problem of transition in his paper "A New Start For Teachers" when he says, "Right now the major problem in teacher education is how to bridge the gap between formal university work in education and skilled performance in the classroom".[2] The procedure of bringing classroom teachers and interns together during the summer will do much to eliminate the coordination problem Dr. Ryan writes about. This partnership in the training of interns will also help to increase the communication between the University and local school districts.

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[2]Dr. Kevin Ryan, "A New Start For Teachers" (unpublished paper, University of Chicago

After the inservice teacher completes his summer at the University, he will return to his school with new skills in subject matter areas, and evaluation procedures as well as background on the development of a differentiated staff. The two interns the cooperating teacher will have in his room will act as the core from which a differentiated staff will grow. As soon as the classroom teacher is equipped to handle additional personnel in the room, aides will be supplied by the school district to continue the staff differentiation. A University resource that will be available to assist schools in the implementation of differentiated staffing is the More Effective School Personnel Utilization task force (MESPU). MESPU is centered at the School of Education as a branch of the Bureau of Education Processions Development of USOE and will provide valuable resources, both human and material, for efforts in differentiated staffing.

For school systems that commit twenty-five or more teachers to this program, on site inservice visits will be made. This on site inservice program will include workshops in human relations, ways of individualizing instruction, and specific subject matter areas; assistance with staff development; and individual guidance in planning and meeting performance criteria. Also at the disposal of the schools will be all the materials produced by METEP for its undergraduate teacher education program. Of specific interest to inservice teachers will be the materials developed in learning theory, ways of diagnosing student problems, and individualizing instruction. Other resources such as videotape equipment, evaluation materials, etc., will be made available during the year for use by interns and cooperating teachers.

Let us sum up the advantages of the METEP design to interns, inservice teachers, and cooperating school systems.

Interns. Continuity is provided for the interns between the performance criteria he has been working on at the University and those he will be expected to master in the classroom.

All interns will work with cooperating teachers who have knowledge of their performance capabilities.

Interns will have an opportunity to meet and learn from their cooperating teachers during the summer.

Because two interns will be assigned to each teacher, they will have the advantage of peer learning.

Inservice Teachers. The inservice teacher will receive an attractive stipend as an assistant instructor during his summer session at the University, and will receive free tuition for graduate work during the year.

The teacher will obtain continuous inservice training in areas of his need, as well as assistance in perfecting his role within a differentiated staff.

Teachers will gain the opportunity to move ahead professionally within the classroom due to the move toward differentiated staffing.

Cooperating Schools. The skills and materials to help the schools move toward innovative staffing patterns will be available at a minimum expense.

The system's quality teachers will have the opportunity to remain in the classroom rather than be promoted out in order to continue their professional growth.

The student-adult ratio will be improved because of the move toward differentiated staffing, resulting in improved learning opportunities for children.

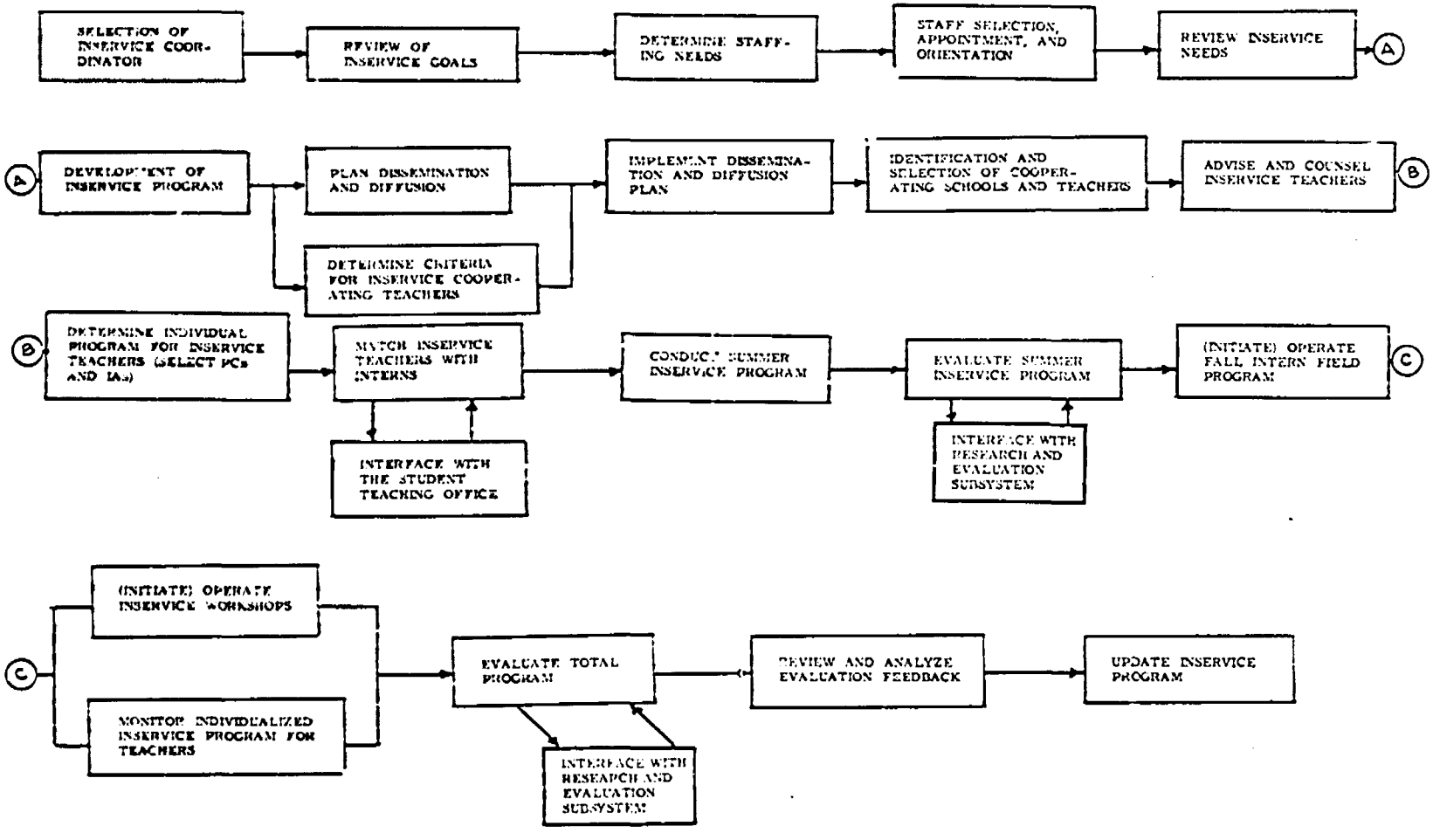
Schools will have a quality inservice program due to their affiliation with METEP.

Implementation. The implementation of the inservice program will follow the steps outlined in Figure 1. Although these activities are linearly presented, the last step, "update inservice program," implies the necessary repetition of many of the listed activities.

Summary. The METEP design will provide the inservice teacher with on site as well as University instruction in areas of the teachers' need. To complement this instruction, the METEP staff will be working with the teacher's school district to implement changes in the traditional staffing patterns that have become stifling to professional growth within the classroom. This design also improves the present student teaching procedures so that a smooth and logical step may be made from the University to the classroom. It is our conviction that this concentrated three-pronged attack will form a broad groundwork for future changes within the public school systems.

INSERVICE COMPONENT

FIGURE 1



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APPENDIX A

TEACHERS: DATA SOURCE FOR DETERMINING IN-SERVICE EDUCATION PROGRAMS

by

David P. Crandall

Richard Holzman

Robert Sinclair

A Survey Conducted

by

The Center for the Study of Educational Innovations

November, 1969

Introduction. Education is experiencing an unprecedented period of reform. Never before have there existed so many new programs from which educators may choose. However, only a few teachers have received adequate in-service education to prepare them for the many options for change. Because of their responsibilities for instruction, teachers have little opportunity, time or energy to develop skills appropriate for implementing the new solutions to the persistent problems of education. In fact, teachers often find themselves running just to keep up with the many changes. The present study centers on determining what in-service education is perceived by teachers to be most important for improving schooling.

Purpose of the Survey. The purpose of this survey was to determine the needs for in-service education for public school teachers in Massachusetts. The investigator sought to identify perceived curricular and instructional needs of selected teachers. Frequency tabulations of responses to each item were computed to determine teacher consensus toward needs in in-service education. Teachers responded to the items by designating if method, content, or method and content best represented their needs.

One description of in-service needs is found in the perceptions of teachers who are close to the problems associated with the educational programs of the schools. In this study, not all dimensions of in-service needs are considered. Rather, the variables selected for gaining teacher perceptions were those thought to reflect current curriculum movement and present instructional trends.

Selection of the Sample. Eight thousand questionnaires were distributed to elementary and secondary public school teachers throughout the Commonwealth. The teachers participating in the survey were designated by superintendents from demographically different school systems. Each superintendent was instructed to distribute the questionnaire randomly to teachers representative of the total system. The number of questionnaires returned totaled 2,850. Following is a specific account of the educators responding to the questionnaire:

Figure 1

WHO WERE THE EDUCATORS WHO RESPONDED TO THE QUESTIONNAIRE?

Teachers (2850)	# of responses	% of total
Pre-school and kindergarten	58	2
Primary grades (1-3)	628	22
Intermediate grades (4-6)	662	23
Junior High School	518	18
Senior High School	915	32
No response	60	2

School systems were selected on the basis of diverse demographic conditions so that a larger cross-section of schools would be characterized. In this way it was possible to insure that teachers from varied school systems would report their perceived needs for in-service education. The teachers were selected randomly and results were generalized to the total sample.

Interpretation of Data. Respondants were asked to indicate their needs for in-service training in seventeen general subject areas that were divided into descriptive sub-categories. Several interesting trends emerged from the data. The priority ranking of the general categories was as follows:

Figure 2

PRIORITY RANKING ACCORDING TO TOTAL RESPONSES

1. Psychology
2. Science
3. Instruction
4. Language Arts
5. Mathematics
6. Media--Educational Communication
7. Social Studies
8. Student-Centered Teaching
9. Administration
10. Curriculum
11. Aesthetics
12. Health and Physical Education
13. International Ed.
14. Guidance
15. Foreign Language
16. Vocational-Distributive Education
17. Early Childhood Ed.

The frequency distribution of responses to the items in the survey revealed the teacher needs. Following is a report of the teacher responses to all items included in the in-service questionnaire:

Figure 3

TEACHER RESPONSES

	Method	Content	Both Method & Content
Mathematics			
Modern Mathematics	235	126	554
Algebra	42	46	94
Calculus	28	48	65
Programs for the Underachiever	271	91	640
Programs for the Gifted	125	108	411
Probability and Statistics	15	63	81
Others	11	11	45

	Method	Content	Both Method & Content
Science			
Modern Biology	27	69	143
Modern Chemistry	18	46	84
Modern Physics	14	43	80
Earth Science	45	92	179
Physical Science	29	66	118
General Science	67	96	265
Marine Biology	24	90	121
Laboratory Procedures	68	35	158
Programs for the Underachiever	117	62	379
Programs for the Gifted	102	74	327
Creative Science Techniques	150	75	358
Conservation and Environmental Education	38	69	183
Others	3	9	31
Health and Physical Education			
Health Counseling for Nurses	5	8	29
Narcotics and Smoking Education	49	101	290
Sex Education	125	91	482
General Health Education	54	82	224
Physical Education	51	64	185
Outdoor Education	41	68	150
Others	6	5	24
Psychology			
Educating the Underachiever	246	127	599
Educating the Gifted Student	147	87	375
Child Psychology	49	114	158
Teaching the Retarded Student	62	48	182
Sensory-Motor Perception	50	73	270
The Emotionally Disturbed Child	155	108	454
Human Relations in the Classroom	145	175	506
Others	12	7	47
Guidance			
Methods and Techniques of Testing	49	43	127
Vocational & Academic Counseling	61	64	157
Human Relations	57	62	184
Others	50	76	147
Social Studies			
The New Curricula	59	166	370
Civilizations of Asia	14	121	111
Civilizations of Africa	15	133	149
Black History in the Social Studies Curriculum	16	152	254

	Method	Content	Both Method & Content
Social Studies (continued)			
Anthropology	14	118	141
Sociology	25	93	125
Programs for the Underachiever	93	75	369
Programs for the Gifted	68	68	262
Others	4	10	34
International Education			
Civilizations of Asia	12	108	80
Civilizations of Africa	15	109	77
Civilizations of Latin America	18	109	84
Teaching International Relations	47	86	165
Problems in the Developing Societies	18	71	112
Teacher-student Exchange Programs	40	70	93
Programs in Cross-cultural Immersion	25	49	101
Others	1	4	3
Aesthetics			
Arts as the Focal Point of a Curriculum	19	49	113
An Integrated Arts Curriculum	41	65	206
Aesthetics and the Rational Curriculum	8	37	58
Self-expression and Understanding Through the Non-Verbal Arts	45	77	218
New Techniques for Teaching the Arts: Music, Art, Dance Dramatics	84	62	270
Daily Use of the Arts by the Elementary Classroom Teacher	113	111	484
Others	4	4	24
Language Arts			
Written Composition	165	92	436
Linguistics	71	118	382
Speech Correction	87	44	187
Grammar	96	72	236
Fundamentals of Teaching Reading			
Severe Reading Problems			
Programs for the Underachiever	153	89	616
Programs for the Gifted	90	96	419
Others	8	7	41

	Method	Content	Both Method & Content
Foreign Languages			
The Physiology and Psychology of Language Learning	21	46	76
Analyzing and Teaching in Cross-cultural Concepts	11	23	63
Teaching of Foreign Literature	34	27	80
New Curricular Developments	30	54	104
Materials and Equipment Testing	35	24	87
Romance Languages	19	38	73
Others High on Creative Methods and Technique of Teaching	5	9	22
Instruction			
Classroom Management Problems	230	83	313
Classroom Creativity	248	188	599
Orientation for Beginning Teachers	103	78	247
Individualized Instruction	226	85	466
Others	119	271	396
Curriculum			
The Teacher's Role in Curriculum Development	58	319	257
Current Theories of Learning	31	204	144
Examination of Recent Changes in State Curricula			
Federal Programs, Current Trends and Effect on Curriculum Development	42	238	217
Pre-School and Kindergarten Programs	15	58	168
Developing an Emotionally Based Curriculum	37	108	196
Others	8	4	22
Student Centered Teaching			
Using Students as Teacher Assistants	273	108	294
Improving Student Government	61	45	84
The Use of Learning Contracts and Learning Interviews	52	44	84
Developing Learner Initiatives	166	78	260
Group Problem-Solving Skills	123	72	229
Student Planned and Administered Curricular Programs	49	40	131
In-School and Inter-school Student Tutoring	83	53	139

Student Centered Teaching (continued)	Method	Content	Both Method & Content
Student Evaluation of the Teaching-Learning Process	88	79	165
Others	3	3	11
Early Childhood Education			
Child Development including History, Research and Current Trends in Curriculum Development	31	100	131
Restructuring Kindergarten Programs	18	55	147
Others	1	4	12
Media-Educational Communications			
Systems Applications in Education	32	64	114
Computer Assisted Instruction	62	91	230
Information Systems for Individualized Instruction	45	103	214
Creative Approaches for Librarians and Audio-Visual Coordinators	27	48	109
Fundamentals of Media	30	79	127
Use of Multi-media Approaches in the Classroom	193	142	456
The Art of Film	47	74	155
Using the Computer for School Management	50	51	85
Vocational Training on the Computer	26	31	100
Computer Use in Accounting, Mathematics, and Science	34	49	179
Others	1	5	13
Vocational-Distributive Education			
Current Trends and New Concepts	31	77	137
Systems Application of Work-Study Programs	42	48	122
Industrial Arts	11	24	71
New Careers--a New Concept in Adult Education	16	64	113
Others	2	10	32
Administration			
Developing a Flexible Schedule	120	107	302
Preparing Departmental Budgets	65	70	147
Problems of Administration	42	109	175
Acquisition and Use of Federal Funds	69	108	184
School Plant Planning	23	55	95

	Method	Content	Both Method & Content
Administration (continued)			
Organization and Administration of Work-Study Programs	31	52	128
Public School Law	26	160	145
The Use of Microteaching to Improve Teaching Performance	53	63	193
Systems Applications to Education	2	10	32
Management Decision-Making	3	3	11
Implementing a Differentiated Teaching Staff	7	17	52

Major results of the frequency tabulations show that teachers desire in-service training in modern mathematics and perceive the need for continued attention to be given to helping teachers with creative ways to teach science. In the Health and Physical Education category, a consensus was expressed toward providing in-service programs in sex education. Also, attention should be given to the topics of narcotics and smoking. The school is accepting larger responsibility in these important and controversial areas and teachers need supporting services to prepare them for coping with the complexities of such compelling topics. The major category of Psychology received more attention than any other dimension. It is here that the item of educating the underachiever received a significant response. The need for in-service to center on the emotionally disturbed child was expressed. Further, a large number of teachers thought it was important to consider human relations in the classroom.

The tabulations suggest that teachers need in-service help in the new social studies curriculum and they desire training in black history as part of the social studies curriculum. The arts were a concern of the teachers. Specifically the respondents expressed interest in an integrated arts curriculum and the understanding and expression of self through the use of non-verbal art media. Teachers perceived a need for in-service help in new teaching techniques for music, art, dance, and dramatics. Elementary teachers desire supporting services related to the daily use of the arts in the classroom. Written composition and linguistics were high priorities in the Language Arts category. Again, there was an expressed need for assistance in programs for the gifted and underachiever. Programs for the latter were perceived to be most important by the respondents.

The categories of Instruction and Curriculum received considerable attention. All items under instruction represented priority needs for teachers. Programs in individualized instruction and creative classroom teaching were most in demand. A significant number of additional instructional needs were also expressed. Teachers desire in-service

training in the diagnosis of learning problems, the prescription of learning opportunities appropriate for each individual learner, and the evaluation of student progress.

The teachers reported a need to consider the teacher's role in curriculum development. They were particularly interested in determining what content is included in the curriculum. Interest in recent changes in state-developed curricula was non-existent.

Group problem-solving skills, student initiated learning, and students serving in a teaching role are the priority in-service needs in the category of Student Centered Teaching. When considering the use of media for learning, the teachers were interested most in computer assisted instruction and the use of multi-media approaches in the classroom. Responses in the final category of Administration reveal that there is a perceived need for in-service programs in flexible scheduling and micro-teaching to improve the effectiveness of teaching performance.

Summary. The scores attached to these topics suggests that teachers consider in-service education aimed at the learning process to be a priority. Further, the responses stress the importance of instruction reaching all children. There was a significant emphasis placed on educating the underachiever and the gifted student. This priority was represented throughout the subject matter categories of Mathematics, Science, Social Studies, and Language Arts. The consistent emphasis placed on the underachiever and the gifted student suggests that it is one of the most critical problems to be included in in-service programs. The indentification of this problem points to the need for in-service education that centers on the diagnosis of individual learning problems and the prescription of alternative learning opportunities. In other words, the universities should provide experiences for teachers to become skillful in individualizing instruction and capable of reaching all students no matter what the nature of the pupil population in the classroom.

It seems that the sampled teachers perceived themselves as being more knowledgeable and capable in the subject matter areas than they are in coping with the varied characteristics of learners. The suggestion that for in-service education to be meaningful the emphasis must shift from being solely on teaching to an emphasis on learning seems to be confirmed by our survey. Despite the continuing importance of solid grounding in subject matter, the institutions charged with the training of teachers must attend to the compelling need for in-service programs that concentrate on understanding the learner and the teacher's relationship to individual students.

In a general way, the teacher responses to the items included in the seventeen categories of the questionnaire suggest that the first

priority of in-service education is the establishment of workshops, seminars, and programs designed to advance the teachers' skills in understanding and utilizing knowledge in psychology and human relations as it relates to individualizing educational programs. Teachers currently do not have a repertoire of these complex instructional skills. The institutions of higher education must now provide programs for coping with this expressed need for sensitive and conscious teaching. If the institutions do not respond, they will continue to produce teachers who are outdated before they enter the classroom. Further, the many teachers who face the day to day jobs of schooling will be forced to rely on ineffective means for providing learning for all students.

The Commonwealth of Massachusetts
University of Massachusetts
Amherst 01003

SCHOOL OF EDUCATION

October 25, 1968

Dear Colleague:

The newly established Center for the Study of Innovations in Education at the School of Education is conducting a state survey of teacher in-service needs. This questionnaire is the major part of the survey and the data collected will insure that workshops and in-service activities are directly related to your perceived needs.

Your responses will be tabulated by computer and compiled with the information received from others within the state. The resulting data will be of value in the present planning and future operation of a local and regional network of in-service programs offered by the School of Education. The findings of this survey will be made available to you in a report that will be sent to your district at a future date.

We would appreciate it if you would complete this questionnaire and return it in the postage-paid reply envelope provided for your convenience by December 1, 1968.

If we can be of assistance to you in your professional work, please do not hesitate to contact Dr. Robert Sinclair, Director of the Center for the Study of Innovations in Education, at the School of Education. Thank you for your cooperation.

Sincerely,

Dwight W. Allen
Dean

DWA:nak

INSTRUCTIONS: Please answer all questions by checking the appropriate box and by filling in information where indicated.

1. At what school level are you presently teaching?

Pre-school & Kindergarten	1.1	[ ]
Primary grades (1-3)	1.2	[ ]
Intermediate grades (4-6)	1.3	[ ]
Junior high school	1.4	[ ]
Senior high school	1.5	[ ]

2. Number of years of teaching experience?

1 - 3	2.1	[ ]
4 - 10	2.2	[ ]
11 - 20	2.3	[ ]
21 - 35	2.4	[ ]
Over 35	2.5	[ ]

3. Degrees held:

Normal school diploma	3.1	[ ]
Bachelor's	3.2	[ ]
Master's	3.3	[ ]
Doctorate	3.4	[ ]
Others_____	3.5	[ ]

4. Under the general headings below are listed areas which might be of interest to you (mathematics, science, health and physical education, psychology, guidance, social studies, international education, aesthetics, language arts, foreign languages, instruction, curriculum, student centered teaching, early childhood education, media-educational communications, vocational education, administration). Please indicate any specific areas that interest you, including the relevant grade levels, by placing an "M" within the brackets if you are interested in the instruction emphasizing methodology and "C" if you wish that the instruction focus upon new content. Place "MC" if you would like the instruction to emphasize both. If you would like to suggest a workshop in an area not listed, please write in your suggestion and indicate the appropriate grade level.

		Elementary School	Junior High School	Senior High School
Mathematics				
Modern Mathematics	4.1	[ ]	[ ]	[ ]
Affine Geometry	4.2	[ ]	[ ]	[ ]
Algebra	4.3	[ ]	[ ]	[ ]
Calculus	4.4	[ ]	[ ]	[ ]
Programs for the Underachiever	4.5	[ ]	[ ]	[ ]
Programs for the Gifted	4.6	[ ]	[ ]	[ ]
Probability and Statistics	4.7	[ ]	[ ]	[ ]
Others_____	4.8	[ ]	[ ]	[ ]
Science				
Modern Biology	4.9	[ ]	[ ]	[ ]
Modern Chemistry	4.10	[ ]	[ ]	[ ]
Modern Physics	4.11	[ ]	[ ]	[ ]
Earth Science	4.12	[ ]	[ ]	[ ]
Physical Science	4.13	[ ]	[ ]	[ ]
General Science	4.14	[ ]	[ ]	[ ]
Marine Biology	4.15	[ ]	[ ]	[ ]
Laboratory Procedures	4.16	[ ]	[ ]	[ ]
Programs for the Underachiever	4.17	[ ]	[ ]	[ ]
Programs for the Gifted	4.18	[ ]	[ ]	[ ]
Creative Science Techniques	4.19	[ ]	[ ]	[ ]
Conservation and Environmental Education	4.20	[ ]	[ ]	[ ]
Others_____	4.21	[ ]	[ ]	[ ]
Health and Physical Education				
Health Counseling for Nurses	4.22	[ ]	[ ]	[ ]
Narcotics and Smoking Education	4.23	[ ]	[ ]	[ ]
Sex Education	4.24	[ ]	[ ]	[ ]
General Health Education	4.25	[ ]	[ ]	[ ]
Physical Education	4.26	[ ]	[ ]	[ ]
Outdoor Education	4.27	[ ]	[ ]	[ ]
Others_____	4.28	[ ]	[ ]	[ ]

		Elementary School	Junior High School	Senior High School
Psychology				
Educating the Underachiever	4.29	[ ]	[ ]	[ ]
Educating the Gifted Student	4.30	[ ]	[ ]	[ ]
Child Psychology	4.31	[ ]	[ ]	[ ]
Teaching the Retarded Student	4.32	[ ]	[ ]	[ ]
Sensory-Motor Perception	4.33	[ ]	[ ]	[ ]
The Emotionally Disturbed Child	4.34	[ ]	[ ]	[ ]
Human Relations in the Classroom	4.35	[ ]	[ ]	[ ]
Others	4.36	[ ]	[ ]	[ ]
Guidance				
	4.37	[ ]	[ ]	[ ]
Methods and Techniques of Testing	4.38	[ ]	[ ]	[ ]
Vocational and Academic Counseling	4.39	[ ]	[ ]	[ ]
Human Relations	4.40	[ ]	[ ]	[ ]
Others				
Social Studies				
The New Curricula	4.41	[ ]	[ ]	[ ]
Civilizations of Asia	4.42	[ ]	[ ]	[ ]
Civilizations of Africa	4.43	[ ]	[ ]	[ ]
Black History in the Social Studies Curriculum	4.44	[ ]	[ ]	[ ]
Anthropology	4.45	[ ]	[ ]	[ ]
Sociology	4.46	[ ]	[ ]	[ ]
Programs for the Underachiever	4.47	[ ]	[ ]	[ ]
Programs for the Gifted	4.48	[ ]	[ ]	[ ]
Others	4.49	[ ]	[ ]	[ ]
International Education				
Civilizations of Asia	4.50	[ ]	[ ]	[ ]
Civilizations of Africa	4.51	[ ]	[ ]	[ ]
Civilizations of Latin America	4.52	[ ]	[ ]	[ ]
Teaching International Relations	4.53	[ ]	[ ]	[ ]
Problems in the Developing Societies	4.54	[ ]	[ ]	[ ]
Teacher-student Exchange Programs	4.55	[ ]	[ ]	[ ]
Programs in Cross-cultural Immersion	4.56	[ ]	[ ]	[ ]
Others	4.57	[ ]	[ ]	[ ]
Aesthetics				
Arts as the Focal Point of a Curriculum	4.58	[ ]	[ ]	[ ]
An Integrated Arts Curriculum	4.59	[ ]	[ ]	[ ]
Aesthetics and the Rational Curriculum	4.60	[ ]	[ ]	[ ]
Self-expression and Understanding Through the Non-Verbal Arts	4.61	[ ]	[ ]	[ ]
New Techniques for Teaching the Arts: Music, Art, Dance, Dramatics	4.62	[ ]	[ ]	[ ]
Daily Use of the Arts by the Elementary Classroom Teacher	4.63	[ ]	[ ]	[ ]
Others	4.64	[ ]	[ ]	[ ]
Language Arts				
Written Composition	4.65	[ ]	[ ]	[ ]
Linguistics	4.66	[ ]	[ ]	[ ]
Speech Correction	4.67	[ ]	[ ]	[ ]
Grammar	4.68	[ ]	[ ]	[ ]
Fundamentals of Teaching Reading	4.69	[ ]	[ ]	[ ]
Severe Reading Problems	4.70	[ ]	[ ]	[ ]
Programs for the Underachiever	4.71	[ ]	[ ]	[ ]
Programs for the Gifted	4.72	[ ]	[ ]	[ ]
Others	4.73	[ ]	[ ]	[ ]
Foreign Languages				
The Physiology and Psychology of Language Learning	4.74	[ ]	[ ]	[ ]
Analyzing and Teaching in Cross-cultural Concepts	4.75	[ ]	[ ]	[ ]
Teaching of Foreign Literature	4.76	[ ]	[ ]	[ ]
New Curricular Developments	4.77	[ ]	[ ]	[ ]
Creative Methods and Techniques of Teaching				
Materials and Equipment Testing	4.78	[ ]	[ ]	[ ]
Romance Languages	4.79	[ ]	[ ]	[ ]
Others	4.80	[ ]	[ ]	[ ]

		Elementary School	Junior High School	Senior High School
Instruction				
Methods of Confronting Classroom Management Problems	4.81	[ ]	[ ]	[ ]
Classroom Creativity	4.82	[ ]	[ ]	[ ]
Orientation for Beginning Teachers	4.83	[ ]	[ ]	[ ]
Individualized Instruction	4.84	[ ]	[ ]	[ ]
Others_____	4.85	[ ]	[ ]	[ ]
Curriculum				
The Teacher's Role in Curriculum Development	4.86	[ ]	[ ]	[ ]
Current Theories of Learning	4.87	[ ]	[ ]	[ ]
Examination of Recent Changes in State Curricula	4.88	[ ]	[ ]	[ ]
Federal Programs, Current Trends and Effect on Curriculum Development	4.89	[ ]	[ ]	[ ]
Pre-School and Kindergarten Programs	4.90	[ ]	[ ]	[ ]
Developing an Emotionally Based Curriculum	4.91	[ ]	[ ]	[ ]
Others_____	4.92	[ ]	[ ]	[ ]
Student Centered Teaching				
Using Students as Teacher Assistants	4.93	[ ]	[ ]	[ ]
Improving Student Government	4.94	[ ]	[ ]	[ ]
The Use of Learning Contracts and Learning Interviews	4.95	[ ]	[ ]	[ ]
Developing Learner Initiatives	4.96	[ ]	[ ]	[ ]
Group Problem-Solving Skills	4.97	[ ]	[ ]	[ ]
Student Planned and Administered Curricular Programs	4.98	[ ]	[ ]	[ ]
In-school and Inter-school Student Tutoring	4.99	[ ]	[ ]	[ ]
Student Evaluation of the Teaching-Learning Process	4.100	[ ]	[ ]	[ ]
Others_____	4.101	[ ]	[ ]	[ ]
Early Childhood Education				
Child Development including History, Research, and Current Trends in Curriculum Development	4.102	[ ]	[ ]	[ ]
Restructuring Kindergarten Programs	4.103	[ ]	[ ]	[ ]
Others_____	4.104	[ ]	[ ]	[ ]
Media-Educational Communications				
Systems Applications in Education	4.105	[ ]	[ ]	[ ]
Computer Assisted Instruction	4.106	[ ]	[ ]	[ ]
Information Systems for Individualized Instruction	4.107	[ ]	[ ]	[ ]
Creative Approaches for Librarians and Audio-Visual Coordinators	4.108	[ ]	[ ]	[ ]
Fundamentals of Media	4.109	[ ]	[ ]	[ ]
Use of Multi-media Approaches in the Classroom	4.110	[ ]	[ ]	[ ]
The Art of Film	4.111	[ ]	[ ]	[ ]
Using the Computer for School Management	4.112	[ ]	[ ]	[ ]
Vocational Training on the Computer	4.113	[ ]	[ ]	[ ]
Computer Use in Accounting, Mathematics, and Science	4.114	[ ]	[ ]	[ ]
Others_____	4.115	[ ]	[ ]	[ ]

		Elementary School	Junior High School	Senior High School
Vocational-Distributive Education				
Current Trends and New Concepts	4.116	[ ]	[ ]	[ ]
Systems Application of Work-Study Programs	4.117	[ ]	[ ]	[ ]
Industrial Arts	4.118	[ ]	[ ]	[ ]
New Careers - a New Concept in Adult Education	4.119	[ ]	[ ]	[ ]
Others_____	4.120	[ ]	[ ]	[ ]
Administration				
Developing a Flexible Schedule	4.121	[ ]	[ ]	[ ]
Preparing Departmental Budgets	4.122	[ ]	[ ]	[ ]
Problems of Administration	4.123	[ ]	[ ]	[ ]
Acquisition and Use of Federal Funds	4.124	[ ]	[ ]	[ ]
School-Plant Planning	4.125	[ ]	[ ]	[ ]
Organization and Administration of Work-Study Programs	4.126	[ ]	[ ]	[ ]
Public School Law	4.127	[ ]	[ ]	[ ]
The Use of Microteaching to Improve Teaching Performance	4.128	[ ]	[ ]	[ ]
System Applications in Education	4.129	[ ]	[ ]	[ ]
Management Decision-Making	4.130	[ ]	[ ]	[ ]
Implementing a Differentiated Teaching Staff	4.131	[ ]	[ ]	[ ]
Others_____	4.132	[ ]	[ ]	[ ]

5. If the Center for Innovations were to provide inservice education opportunities for you on a regional basis, which suggested location would be most convenient and what instructional unit would you give highest priority? (Note: mark location by writing in the program priority: i.e. Modern Math next to Pittsfield, if that is what you desire.)

Amherst_____	Greenfield_____	Newton_____
Athol_____	Holyoke_____	North Adams_____
Bedford_____	Lawrence_____	Pittsfield_____
Boston_____	Lowell_____	Quincy_____
Brookline_____	Lynn_____	Salem_____
Cambridge_____	Malden_____	Springfield_____
Fall River_____	Manchester_____	Waltham_____
Falmouth_____	Needham_____	Worcester_____
Framingham_____	New Bedford_____	Other location not listed:
Gardner_____	Newburyport_____	_____

6. Are you now participating in college or university level studies?

Yes	6.1	[ ]
No	6.2	[ ]
Undergraduate	6.3	[ ]
Graduate	6.4	[ ]
Others_____	6.5	[ ]

7. Which day is most convenient for you to participate in weekly workshops?

Monday	7.1	[ ]
Tuesday	7.2	[ ]
Wednesday	7.3	[ ]
Thursday	7.4	[ ]
Friday	7.5	[ ]

8. What time is convenient? (Check more than one if you wish.)

4:00 - 6:00 PM	8.1	[ ]
7:00 - 9:00 PM	8.2	[ ]
Others_____	8.3	[ ]

9. If a workshop were scheduled for a Saturday morning, from 9:00 to 11:00 AM, would you attend?

Yes	9.1	[ ]
No	9.2	[ ]

10. Would you participate in a 1 or 2-week intensive Inservice program during the summer in the following areas

Microteaching	10.1	[ ]
Flexible Scheduling	10.2	[ ]
Individualized Instruction	10.3	[ ]
Technology	10.4	[ ]
Elementary Reading	10.5	[ ]
Secondary Reading	10.6	[ ]
Others_____	10.7	[ ]

11. If your answer to the previous question is Yes, which month would be preferable?

July	11.1	[ ]
August	11.2	[ ]

12. Would you be interested in attending 1, 2, or 3 day conferences in the following general areas during the school year?

		1 Day	2 Day	3 Day
Creativity in the Elementary Classroom	12.1	[ ]	[ ]	[ ]
Individualized Instruction	12.2	[ ]	[ ]	[ ]
International Education	12.3	[ ]	[ ]	[ ]
Children with Learning Disabilities	12.4	[ ]	[ ]	[ ]
Urban Education	12.5	[ ]	[ ]	[ ]
Aesthetics	12.6	[ ]	[ ]	[ ]
Technology	12.7	[ ]	[ ]	[ ]
Human Relations	12.8	[ ]	[ ]	[ ]
Institutes for School Committee Members	12.9	[ ]	[ ]	[ ]
Content Areas (Please Specify)	12.10	[ ]	[ ]	[ ]
Others_____	12.11	[ ]	[ ]	[ ]

13. Given six incentives for participating in an inservice program, rank according to importance your reasons for enrollment, i.e. if pay increment is the most important reason, rank it 1. Rank decreasing levels of importance with 2, 3, 4, 5, and 6 and 7.

Desire to grow professionally	13.1	[ ]
College Credit	13.2	[ ]
Certification Requirements	13.3	[ ]
Revitalization	13.4	[ ]
Pay Increment	13.5	[ ]
Promotion	13.6	[ ]
Others_____	13.7	[ ]

14. Would you be interested in serving as an instructor for an inservice workshop?

Yes	14.1	[ ]
No	14.2	[ ]
Not sure	14.3	[ ]

15. The School of Education welcomes any comments which you feel would be relevant in its planning for the future. Kindly include such thoughts as special problems that the School of Education could help resolve, ideas on how to improve education, and ways in which you feel that the School of Education could join with you in pursuing educational improvement.

16. Name and School District - If you desire.

APPENDIX B

GREENFIELD PUBLIC SCHOOLS

GREENFIELD, MASSACHUSETTS 01301

William R. Wright, Superintendent

August 6, 1969

Dr. W. V. Fanslow
School of Education
University of Massachusetts
Amherst, Massachusetts

Dear Dr. Fanslow:

This is to certify that the Greenfield Public Schools are vitally interested in your proposed program of "Cooperative Teacher Training" and wholeheartedly endorses the project.

We will be most happy to participate in the program and will give complete cooperation and assistance in insuring its success.

If there is any further effort we can make to insure that this project is funded, please let us know. We look upon the concept of the program as a truly forward step in the preparation of teachers for classroom duty.

Sincerely,

William R. Wright
Superintendent

The Public Schools of Pittsfield

Curriculum Development

[illegible]

ASSISTANT SUPERINTENDENT
Louis J. Hebert
DIRECTORS
Gilbert K. French - *Mathematics*
John D. Hadden - *Social Studies*
Norman C. Najimy - *English*
Anne E. Nesbit - *Science*

August 7, 1969

Dr. William Fanslow, Director
Teacher Training
University of Massachusetts
Amherst, Massachusetts

Dear Dr. Fanslow:

The Pittsfield Public Schools have long considered the desirability of improving the teacher-training experience in our schools. An opportunity to cooperate more fully with the University of Massachusetts in training personnel would certainly be welcome. We desperately need people who are equipped to handle a variety of assignments in the classroom in addition to staff people who have been trained to work with other professionals and paraprofessionals in the same classroom. We therefore request that the University of Massachusetts give serious consideration to the establishment of a Teacher Education Program which would better meet our needs while at the same time providing an opportunity for a more meaningful learning experience for student teachers and staff alike.

Specifically, we would heartily recommend a program containing these elements:

1. Preparation for teacher training during the summer months which would concentrate on both the usual practicum components and whatever added subject matter instruction was deemed necessary.

2. An opportunity for cooperating teachers from the Pittsfield Public Schools to attend the same summer training session as supervisors and trainees of those with whom they would work during the following year. Cooperating teachers should be paid as well as given course benefits at the University.

3. The cooperating teacher, in undertaking this assignment, would be obligated to accept the same four student teachers during the school year in some sort of differentiated staff organization. Cooperating teachers could work with two of these interns each semester.

4. The Pittsfield Public Schools would be interested in sending fifteen to twenty teachers to the University for participation in such a program.

The advantages to the Pittsfield Public Schools, were such a program funded, are many:

1. Joint working and planning between cooperating teachers and practice teachers provides greater opportunity for significant educational achievement during the school year. The cooperating teacher is afforded an opportunity to assess the strengths and weaknesses of the student teachers and to develop effective rapport.

2. I think that such a cooperative venture will certainly help to improve the prospective teacher's image of the school system in which he will gain his first practical experience and will hopefully increase the school's likelihood of attracting outstanding candidates.

3. Pittsfield would be given the opportunity to explore the exciting possibilities offered by differentiate staffing. This model might then be adopted in other classes and result in better staff utilization and improvement of the instructional mode.

Sincerely,

Louis J. Hebert
Assistant Superintendent
Curriculum Development

LJH/edk

THE PUBLIC SCHOOLS of SPRINGFIELD, MASSACHUSETTS

John E. Deady, Superintendent

Central Office
195 State Street
01103

August 12, 1969

Dr. William B. Fanslow
Director of Field Experience
School of Education
University of Massachusetts
Amherst, Massachusetts 01002

Dear Dr. Fanslow:

Thank you for sending me a copy of your proposal to improve the teacher training program at the University of Massachusetts. Reviewing it has confirmed my positive attitude towards the project which I discussed with you last week. The problem of improving teacher training programs is a provocative one which has failed to receive sufficient amounts of critical analysis and creative thinking in the past. I believe your plan to train "Clinical Professors" to work in the training of prospective teachers prior to serving as their supervisors during the practicum will bring a continuity to the whole process which has been lacking in the past. It will lend status to teachers from our school system participating in the program, it will compensate them for their efforts, and the presence of two student teachers in the classroom each semester with the supervisor will enable us to experiment with various differentiated staffing techniques which can result in better educational opportunities for students here in Springfield.

We commend your efforts and look forward to cooperating with you in the implementation of this proposal when it has been funded.

Sincerely,

JOHN E. DEADY
Superintendent of Schools

JED:jf

CITY OF HOLYOKE

MASSACHUSETTS

Zip Code 01040

Dr. Marcella R. Kelly, Superintendent
HOLYOKE PUBLIC SCHOOLS
98 SUFFOLK STREET
TEL 534-3678

September 19, 1969

Assistant Professor William V. Fanslow
School of Education
University of Massachusetts
Amherst, Massachusetts

Dear Professor Fanslow:

You will be pleased to learn that at the September 15 meeting of the School Committee the nine members present voted unanimously to support and indorse your proposed Teacher Training Project in which the Public Schools of Holyoke would be a cooperating sponsor.

Very truly yours,

Marcella R. Kelly
Superintendent

MRK:lb

AMHERST-PELHAM Regional SCHOOL DISTRICT

AMHERST • PELHAM LEVERETT • SHUTESBURY

SCHOOL ADMINISTRATION OFFICES
CHESTNUT STREET
AMHERST, MASSACHUSETTS 01002

August 12, 1969

Dr. William Fanslow
School of Education
University of Mass.
Amherst, Mass. 01002

Dear Dr. Fanslow:

At our meeting of August 11th, the Amherst-Pelham Regional School Committee members expressed interest in participating in undergraduate teacher training program along with the University and four other school systems. We will be glad to help in preparing an EPDA proposal to seek the funds that would be needed to initiate such a program.

Sincerely,

Ronald J. Fitzgerald

Ronald J. Fitzgerald
Superintendent of Schools

RJF:pl

SECTION VIII EVALUATION AND RESEARCH

EVALUATION AND RESEARCH

Introduction

In this section, a framework for the evaluation and research components of METEP will be outlined. However, it is not the purpose of this report to exhaustively cover all aspects of the evaluation and research components. The purpose is to present an overview of the main steps and techniques to be used. And just as one should conceive of METEP as a flexible, ever-developing program, the evaluation and research components should be thought of in the same way. At the present moment, evaluation methodology is emerging - as newer and better evaluation techniques are discovered our components will be modified accordingly. It is expected that this section of the report will serve as a'starting point' for the group charged with the responsibility of developing the research and evaluation methodology in Phase III of the project.

The role of the elementary school teacher is changing and will continue to change in the future. In order to answer the criticisms leveled at existing teacher training programs, educators are finding it necessary to devise radically new approaches and experiment with various innovations for training teachers. METEP is one of a few new models which purports to bring about the necessary changes in teacher-training programs. Evidence must be made available to determine if this is so. For this reason it is necessary to engage in evaluation studies. Certainly, any progress in education is dependent on effective evaluation. It would be foolish, to say the least, to implement innovations into teacher-training programs on a large scale basis without first empirically demonstrating their usefulness. At the same time, because so little is known about the variables instrumental in turning out good teachers, there is a heavy demand for basic research in the area of teacher-training. This point is made by Gage (1964) and others. It is expected that the research studies conducted within METEP will solve some of the current problems in teacher-training as well as problems related to other aspects of education which exist today.

One can argue, and rightly so, that every innovative project like METEP needs an evaluative component; if only because the government has invested a large sum of money in the project and deserves to see the results of their investment. In the case of METEP however, an effective evaluation takes on increased importance when one considers the implications. Pending the outcome of the evaluation are decisions which will affect the future development in the design and functioning of teacher-training programs. Thus it is imperative that every effort be made to evaluate METEP with the best techniques available, at all levels of operation and in every way possible.

Unfortunately, from the point of view of the project director, evaluation methodology is only now being developed. This, of course, complicated the problem of doing an effective evaluation. A variety of evaluation models exist, designed for different purposes, each with certain advantages and disadvantages when applied to METEP. These include models for Title I and IV projects and curriculum projects among others. Included among those who have directed attention to evaluation models have been Hastings (1966), Wilhelms (1967), Bloom (1967), Glaser (1967), Scriven (1967) and Stufflebeam (1966). Many of these models are at least partially useful for the evaluation of METEP. Rather than adopt one model as a guide, we have taken suggestions from a wide selection of writers. In some cases, because of conflicting viewpoints, we have had to make certain decisions concerning our own evaluation model.

Before describing the evaluation and research components for METEP, it would be useful to backtrack and describe the purposes of evaluation and research in this project and also note the differences between the terms. According to Hemphill (1969), "In many instances, no distinctions are made between evaluation and research." Baker (1969) goes on,

> Although logically and perhaps semantically, one can distinguish between research and evaluation, it is not very useful to base that distinction on a review of literature dealing with curriculum research and evaluation on the basis of the terms used by the authors in the titles and the operational definitions assigned to the terms in the articles is nearly impossible.

In spite of the associated difficulties, we will attempt to make the distinction in METEP.

The purposes of evaluation in this project are two-fold: first, it provides a way of making decisions concerning revision, refining, and discarding facilities, materials and methods. Scriven (1967) refers to this as "formative evaluation". Formative evaluation techniques are employed when one is interested in revising an ongoing project. On the basis of reliable and valid empirical evidence obtained by objective means (if possible) decisions are made to modify deficiencies in the program. Recently Scriven (1967) and Stake (1967) have argued that even some evaluators are capable of making objective value judgments. Formative evaluation leads to trial-revision cycle.

The second purpose of evaluation is to determine the overall effectiveness of the project. This kind of decision making is referred to by Scriven (1967) as "summative evaluation".

Almost all summative evaluation is comparative; however in some cases, it is simply a description of the outcomes of the project. It is note-worthy that not all evaluators are convinced of the usefulness of comparative studies. This point will be discussed in more detail later.

In differentiating between summative and formative evaluations, Ahmann (1967) made a point which is relevant here. He said that the distinction between summative and formative evaluation is less clear than it appears to be. The distinction cannot usually be made until the use which is going to be made of the evaluation data, and by whom, is determined.

The purpose of basic research in this project is to add to our knowledge of the practices and methods of education (Hemphill, 1969). In order that useful, generalizable research results be obtained, it is imperative that attention be given to the specification of treatments and experimental designs.

In noting the differences between research and evaluation, Hemphill (1969) says,

> Evaluation differs from basic research in its orientation to a specific program rather than to variables common to many programs. The objective of educational research is to gain generalizable knowledge about the practice of education; evaluation seeks to provide a basis for making decisions among alternatives. Thus, evaluation is concerned with questions of utility that involve value and judgment.

Finally, it should be mentioned that it is expected that a wide variety of evaluative techniques and experimental designs will be used in the project. Obviously, no one technique and experimental design will be sufficiently useful to measure every objective of the program. For example, in the case of evaluative techniques, when we are interested in evaluating (summative evaluation) a multiple-choice test constructed by an instructor in the program, we will use the technique of item analysis. Whereas when we are concerned with the attitudes of students in the program, we will make use of questionnaire data.

The remainder of this report is divided into six major sections. In the following section is a description of some of the data which will be collected on the students entering and leaving the program upon graduation. The following sections describe the formative evaluation, summative evaluation, and basic research components of METEP.

'n the final two sections of this report are short discussions of the purposes and composition of an evaluation and research committee, and some suggested procedures for disseminating information on the project.

Collection of Background Information

In order to facilitate the evaluation (formative and summative) and the basic research, it will be necessary to administer a diverse battery of tests to students entering the program. The same battery of tests will also be administered to graduating students. To supplement this, biographical and high school records on the students will be collected. For the purposes of comparison the same data will be collected on several other large groups of students in different universities. It will be useful to know something about the comparibility of the input and the output in different institutions. It would not be surprising for example to find differences in the groups on certain psychological variables such as risk-taking. A reasonable hypothesis would be that students enrolling in an experimental program would be more likely to be high risk-takers than students enrolling in more conventional programs.

The battery will include tests to measure intelligence and a variety of aptitude, achievement and personality variables. Tests to measure specific factors of intelligence will be chosen from Guilford's "Structure of Intellect Model" (1956) and French's, et.al., (1963), "Kit of Reference Tests for Cognitive Factors". Of particular interest will be the tests measuring factors which have been hypothesized to predict success in teacher training programs (Gallagher, 1968). These would include tests measuring convergent thinking, divergent thinking, and evaluation factors in the contents dimension of the Guilford Model.

The aptitude and achievement tests will come from at least two sources: the Differential Aptitude Test and the French Kit of Reference Tests for Cognitive Factors. The battery of personality tests will include general anxiety (Taylor, 1953), test anxiety (Alpert and Haber, 1960), need achievement (Atkinson and Feather, 1966) and risk-taking measures (Swineford, 1938, 1941; Slakter, 1969). Also measures of need-for affiliation and interpersonal attitudes will be obtained. Student responses to preference inventories, value inventories and interest profiles will be obtained. Two other tests which will be included in the battery as they have been found useful are the Watson-Glaser Critical Thinking Appraisal Test (Yager, 1968) and the Minnesota Teacher Attitude Inventory (Yee, 1969). Finally, this list of variables will be modified by removing some tests and/or adding new tests as new theories are hypothesized and developed concerning teacher-training programs.

Formative Evaluation

The purpose of formative evaluation will be to suggest improvements for the project while it is developing. Cronbach (1963), strongly advocated the use of evaluation in identifying aspects of the program which needed revision, while both Flanagan (1969) and Stufflebeam (1966) indicated how much more effective formative is than summative evaluation for improving education. In spite of this, Welch (1969) pointed out a potential problem. He said that the feedback process in stimulating changes in developmental projects had not been extensively studied. Some of the problems with formative evaluations include time-delays, inability of course instructors to incorporate suggested changes, and test items failing to measure what the instructors specifically wanted. The decision-making processes will be watched very carefully in this project. Controlling this situation will be a group of specially trained formative evaluators. However, the role of the group should be clearly understood - unlike the basic researchers - these people will not exercise any experimental control over the project nor will they directly manipulate any part of METEP. The formative evaluators will observe the workings of the project without intervening, or at least intervening as little as possible. Through their evaluations however, they will be able to instigate changes at periodic times in the program. As Stufflebeam (1966) said in describing the formative evaluator,

> He then "bugs" the situation as best he can by focusing his best observation and other non-interventionist data collection techniques on those aspects of the project which are most crucial to its success. The nature of such an evaluation is multivariate, and not all of the important variates can be specified prior to the initiation of a project. Consequently, (he) focuses on those variates which are theoretically important, but also remains alert to any unanticipated but significant events that may occur along the way. In summary, data are collected day by day, organized systematically, analyzed periodically, for example weekly and reported as often as the project director may require such information.

The formative evaluators will use a variety of techniques. These techniques include (as summarized by Welch, 1969): Teacher reports (written and verbal), student interviews and discussion, questionnaires, observations, test results, and outside professional views of produced materials. On the basis of frequent evaluation reports, the project director will make decisions concerning the project and appropriate modifications. This cycle will be continuous throughout the duration of the program.

The formative evaluation will have its effect in many areas of the program. In this report, we will limit the discussion to some specific examples in the content and the human relations areas.

Content Areas. To begin with, there exist many questions concerning the performance criteria and the instructional alternatives. Can students learn to achieve the selected criteria by experiencing the available instructional alternatives? What percentage of students pass the test associated with each performance criterion (i.e., what is the difficulty level of each test)? Is this percentage the same for students who chose different instructional alternatives? Are there personality characteristics which typify students who chose different instructional alternatives? Can some of the students pass some of the criteria without experiencing any instructional alternatives? Does success or failure under an instructional alternative have any effect on a student's subsequent choice of instructional alternatives for other performance criteria? What is the cost of providing each instructional alternative and is it reasonable to provide such an alternative when only small numbers of students take advantage of it? The answers to some of these questions will obviously lead to improvements in METEP. Answers to other questions will suggest controlled research studies.

In order to answer some of the questions raised above, it would be extremely useful to summarize the data on each performance criterion in a two-way table with the rows of the table corresponding to the instructional alternatives and the columns to the possible outcomes (pass and fail) on the test associated with each performance criterion. A sample is presented in Table 1. Entries in the table include the distribution of students across instructional alternatives, and the frequency and percentages with which students pass and fail the criterion test by choosing different instructional alternatives. Since the raw data (student outcomes on each performance criterion and choice of instructional alternatives) are available in the data bank, these tables can be readily produced by the computer (at say, once every few months) to provide useful information for instructors and evaluators to make modifications.

One responsibility of the evaluators will be to train the instructors to interpret the computer output. The importance of this responsibility is magnified when one considers the results of a study by Dick (1968). Dick studied the behavior of a group of instructors making modification to a programmed text by using different sets of information. Results showed that the group without proper guidance as to which parts of the information were most useful consistently made use of the wrong information in making modifications. This study emphasized the importance of proper training for those modifying curricular materials.

TABLE 1

SAMPLE DATA ON A TYPICAL PERFORMANCE CRITERION

PERFORMANCE CRITERION: _____

Outcome

Instructional Alternatives	Sample	Pass	Fail
Pre-Test	200	20 / 10%	180 / 90%
1	60	55 / 92%	5 / 8%
2	80	60 / 75%	20 / 25%
3	10	5 / 50%	5 / 50%
4	30	10 / 33%	20 / 67%

As a result of our feasibility testing it was found that in some content areas as many as 80% of the students preferred conventional lectures as opposed to other instructional alternatives. Given that other instructional alternatives are more effective for promoting learning, at least for some students (Cronbach, 1967; Snow, 1969), then it is necessary to encourage students to show more variability in their choice of instructional alternatives. It has been suggested that in the early stages of the program, students be forced to make use of different instructional alternatives. It is expected that early exposure to a variety of instructional alternatives will increase the liklihood of students choosing those strategies again.

This same two-way table described earlier will be extremely useful for research in the areas of time studies and cost analysis.

It will be important to take a close look at the performance criterion tests. In some cases, it will be possible only to estimate content validity. This will be done by obtaining opinions of content experts. In areas where multiple-choice tests are used, item analysis will be a useful evaluative tool. To increase the feasibility of this, tests will be answered on digitek sheets, processed through the digitek machine which in turn will return student response information punched on IBM computer cards. When sufficient numbers of cards are collected for each performance criterion a computer program will be used to carry out an item analysis.

By continually modifying and testing out experimental items it will be possible to build item pools for the performance criteria which utilize multiple-choice tests. Since it would be unrealistic to use the same test repeatedly, the item pool will facilitate the construction of alternative forms for each of the performance criterion tests. The work of Gorth et. al.(1969a, 1969b) in the area of item sampling designs and tape-based data banks will be extremely useful here.

Many evaluators have stressed the importance of evaluation beyond the simple analysis of pre-test and post-test scores. The additional data was stressed because in many comparative studies (comparative in the sense that post-test achievement scores were compared between students in an experimental program and a conventional program), although teachers and students praised the new experimental technique, differences in post-test achievement scores between the experimental and control group were not usually obtained. Webb (1966) recommended that additional useful information of perceptions of teachers and students regarding the learning process would be relevant. The technique of analyzing achievement scores, and teacher and student attitudes is referred to by some researchers as the triangulation procedure. This is rapidly becoming a pwerful tool in evaluation. This technique of evaluating each component of the program on three dimensions will be used where it is relevant.

Human Relations. Evaluation in the human relations component raises many new questions. First, however, it is necessary to review METEP's goals in this area. METEP is interested in producing the fully human teacher, a person who meets the human criteria of warmth and human understanding, is capable of rigorous thinking, is in control of his own behavior, and is in a constant pattern of growth. Some of the questions which will arise in the developmental stage include: can a human relations program result in personal growth for the elementary teacher which is measurable? The question here is can we influence the day-to-day behavior of the student teacher in and out of the classroom through human relations training? How can we move from subjective evaluations to behavior counts of specific human relations acts? What behaviors are most relevant to teach the student teacher? Knowing that there exist individual differences in human relations skills, can a "behavioral diagnostic test" be developed which will identify the "best" way to proceed with each individual? What relationship does teaching human relations skills have with teaching material in other content domains? Answers to some of these questions will not only aid in the development of METEP but will provide information in an area which has not been extensively explored mainly because of the complex problems associated with this kind of research.

Summative Evaluation

In applying summative evaluation techniques we will be interested in making an overall evaluation of the project. Whereas formative evaluation will be most important in the first two to three years of the project, the emphasis will shift in the third year towards summative evaluations.

Before going into the details of the summative evaluation techniques, two strategies of evaluation which have been frequently used deserve special attention. These are: the use of comparative experiments and global evaluations. Concerning the first, Welch(1969) reviewed 46 curriculum development projects and reported that only 19 of the projects used a control group in their evaluations. Actually Cronbach (1963) raised questions concerning comparative experimental studies in curriculum evaluation. However Guba (1969) pointed out that workable alternatives have not been proposed and Scriven (1967) argued strongly for comparative studies. He said that it is often the case that comparative evaluations are very much easier than non-comparative evaluations, because we can frequently use tests which would yield differences instead of having to find an absolute scale and then eventually compare absolute scores. Data will be collected on large samples of graduating students from other teacher-training programs for the purposes of comparison. Such an evaluation design has one major limitation: students have not been randomly assigned to either the experimental or the conventional program. Obviously,

we cannot order a student to go to a certain university. Fortunately, covariate data collected on students before they enter university will allow for partial statistical corrections for any pre-existing differences.

The second, global evaluation has come in for a great deal of discussion. Cage (1964) stressed the fact that evaluation directed at a general criterion of teacher effectiveness has yielded few reliable and usable results. Armstrong (1968) demonstrated that the evaluator who uses a global measure to assess effects of a program may discover no significant differences (comparison with a control group) became of cancelling interactive effects. A variety of other evaluators have observed the same thing. The logical step is to make separate evaluations of each of the components or dimensions of the program. One of the first steps in Phase III of the Project will be to specify the relevant components. The separate evaluation of the components of a project is frequently identified with the modern trend in evaluation.

It has been suggested that summative evaluation involves the measurement of competing programs on performance or goal scales and the integration of the data into a conclusion of superiority for one program. Unfortunately, evaluation methodologists have given practically no attention to the methods of integrating information into a summative judgment. Thus at the present time, this is one of the most important unresolved questions in evaluation methodology (Glass, 1969). Until a solution to the problem is obtained, the weighted -sum model is proposed for use in METEP. In this model, competing programs are compared on a large set of scales. The program receiving the highest total score on the scales would be preferred. In addition to comparing METEP with conventional programs it is highly recommended that it be compared with the other experimental programs.

Another evaluation strategy which emphasizes measuring the extent to which the objectives of the project are met will be used. The steps will include specifications of the objectives in behavioral terms, and later measuring the outcomes. We will be interested in determining the extent to which our goals relating to attitude, achievement, interest, etc. are obtained by the graduating students. There are however, at least three problems related to this approach.

The first problem raised by Scriven (1967) concerns the goals themselves. He argued that it is not good enough to know how close students come to achieving objectives of the program. It is important to know how valid those objectives are. The second problem (which is research based) concerns the methods for measuring achievement of the objectives. Finally, Atkin (1963, 1968) pointed out that there is more to evaluation than measuring the extent to which objectives are

achieved. He pointed out the importance of unplanned, unanticipated learning. Atkin also criticized the objectives approach because it focused on short-term behavioral changes rather than the possibly more important long-term goals. A great deal of work will be done on the comments and criticisms of Scriven (1967) and Atkin (1968) before the final formulation of the summative evaluation plans are completed.

The techniques used in summative evaluation will include project-developed achievement tests, standardized achievement tests, questionnaires, attitude and interest measures. The battery of tests described earlier which is to be administered at the end of the program will also provide useful information.

An integral part of the evaluation will include determining the extent to which the program is acceptable to a variety of clients: students, teachers, and principals. Students will be queried on their likes and dislikes in the program, and their perceptions of the advantages and disadvantages. Teachers and principals will be asked to rate the students on a variety of skills at various stages of their development (one years' teaching experience, three years' experience, etc.). Ratings will also be obtained on graduates of conventional programs and comparisons will be made.

Finally, an attempt will be made to incorporate a curriculum evaluation model developed by Gorth et al. (1969c) called Comprehensive Achievement Monitoring (CAM) into METEP on an experimental basis. Gorth (personal communication) described CAM as a system of curriculum evaluation which is organized to include each of the necessary components of an evaluation and which has the flexibility to provide needed addition information.

The CAM system utilizes a computer-centered test generation, test scoring, test analysis, and information reporting design. The computer provides the quick processing and sophistication of analysis needed in the effective curriculum evaluation. It presently allows CAM to administer, analyze and report results in terms of each performance criterion to more than 2000 students on a bi-weekly test schedule.

Flexibility is built into the CAM system because (1) the evaluation is specific to the performance criterion and (2) there are repeated measures of the student's achievement on each performance criterion. The evaluation of the curriculum is based upon the student's own report of the performance criterion he has chosen to work on. If he has not worked on a particular performance criterion, then his test results would not include an evaluation of his performance on that one. When he indicates that he has completed a performance criterion, he is evaluated soon after, and also repeatedly tested for retention of knowledge and ability in that performance criterion.

Basic Research

In this section we will outline briefly some of the proposed research for METEP. By definition the results of the research studies will be generalizable. This will be so, provided enough attention is given to the specification of treatments and designs of the studies (Wittrock, 1966). In this regard, Campbell and Stanley's (1963) summary of experimental designs will be most helpful. (Current developments on design and data analysis in evaluation and research have been recently reviewed by Baker [1969] and Welch [1969]). But in order to facilitate the research, it will be necessary to impose constraints on the students such as randomly assigning them to specified instructional alternatives. Designs in which students are randomly assigned to treatments are considered true experiments. In describing true experiments Campbell and Stanley (1963) wrote: "[They are] the only means for settling disputes regarding educational practice, the only way of verifying educational improvement..."

One of the attractive features of METEP is that it provides an opportunity to individualize educational experiences. It is essential to match teachers, materials, and students in order to create optimal individual learning situations. In order to maximize the gain for the student from this unique learning experience, we must gather a wide variety of aptitude-treatment interaction data. This will help us learn what kinds of students learn most under what kinds of conditions. This information will be invaluable when student guidance is needed in selecting programs. We will attempt to find instructional alternatives that produce superior results for learners of different characteristics. In this research, aptitude will be defined rather broadly to include personality factors, intellectual factors, aptitudes (as they are conventionally defined), socio-economic background, etc.

Another area about which very little is known concerns the relevant variables for predicting success in teacher-training programs. With the wide assortment of data available this kind of research is possible. Research results bearing on this important question will have obvious implications. Similar studies will be conducted in the schools serving as control groups and comparisons will be made between the prediction equations, etc.

In addition to aptitude-treatment interaction and prediction studies there exist a wide variety of other studies which will be conducted. To name a few, at the moment a great deal of research is centered around testing methodology. For example, researchers are developing procedures for extracting more information from a student's responses to multiple choice tests. Further research on scoring fomulas (Traub, Hambleton & Singh, 1969), confidence testing and item weighing systems (Shuford, Albert and Massengill, 1966; Rippey,

1968; Hambleton, Roberts and Traub, 1969) provide potential means for increasing reliability and validity of the criterion tests. Computerized testing offers many exciting prospects - individualized tests, more efficient testing (Cleary, Linn and Rock, 1968). New techniques such as generalized factor analysis (McDonald, 1969) offer interesting new methods for analyzing semantic differential data. More conventional factor analyses can be used to investigate a wide selection of hypotheses about interrelationships among many of the variables under investigation.

Perhaps more important research will relate to recent developments in micro-teaching (Goldthwaite, 1968) and some of his surprising findings. The work of Yee (1969) on guidelines for matching students with co-operating teachers has obvious implications for METEP. However, there exist many unresolved problems here. At the present, there is a great deal of work to be done on the construction of scales to measure teacher effectiveness (Biddle and Ellena, 1963) in which the tenets of psychological scaling are used (Torgerson, 1958; Beck and Jones, 1968). Of course, these scales could later be used in other teacher-training colleges.

The problem of determining the cut-off point between passing and failing on the performance criterion tests will be a difficult one to solve. Do we want to use the same level of proficiency on each performance criterion? What level of proficiency must we use on the performance criterion test to insure a high level of proficiency on the same performance criterion at a later date?

Other potential research areas include work on item sampling models (Lord, 1967) and the Hawthorne Effect (Cook, 1968).

Evaluation and Research Committee

In order to oversee the evaluation and research of METEP it is recommended that a committee of five headed by a co-ordinator be appointed. In addition it would be expected that a variety of research associates with statistics, research design, and computer programming skills, along with a number of graduate students, would be available to help with the work of the committee. In addition to designing and coordinating the evaluation and research component, the committee would serve as a review board for research proposals.

Dissemination

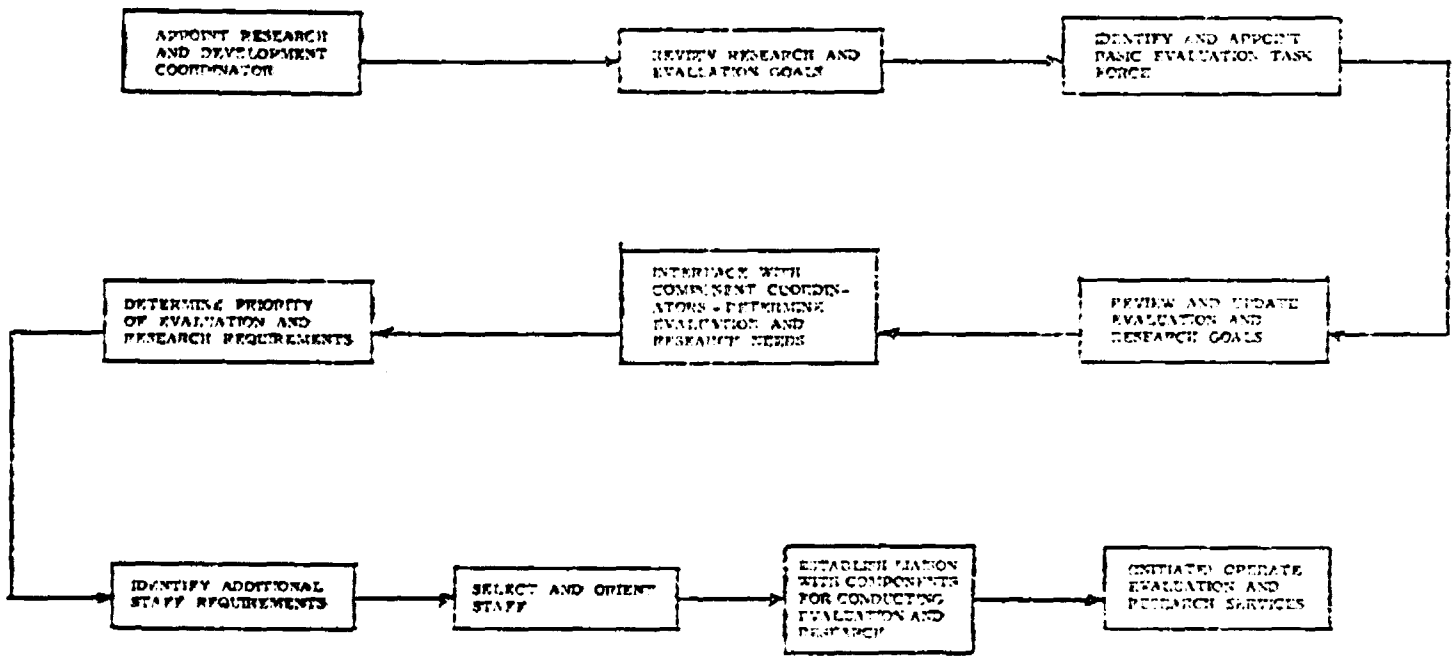
Results of formative and summative evaluations and research findings will be distributed through the usual channels. These will include technical reports, publication of findings in relevant jour-

nals, presentation of papers at conferences, dissertations and news releases to newspapers, television and radio. It is also expected that school supervisors, principals, and other interested parties will be kept up to date by periodic symposia held at the University.

Implementation. The activities required for the implementation of the research and evaluation subsystem are graphically presented in Figure 1. The operation of this subsystem is to provide research and evaluation services for the program. Therefore, as new or revised needs are identified, many of the steps outlined in the activity network chart will be continuously repeated.

RESEARCH AND EVALUATION SUBSYSTEM

FIGURE 1



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SECTION IX MAINTAINING RELEVANCE OF THE MODEL FOR TEACHER EDUCATION IN THE 1970's

HOW WILL THE MODEL INSURE AND MAINTAIN ITS RELEVANCE FOR TEACHER EDUCATION IN THE 1970's?

Recognizing that an elementary teacher education program developed in 1968 may not be completely relevant for the 1970's we have taken several steps to insure that our program does not become static and inflexible in response to changing needs. The first precaution is the assumption that the program we have designed for 1968 will not be the same program in 1975. The structure of our program is designed to allow for constant revision and up-grading. Highlights of our program consist of behaviorally stated outcomes expected of the trainee, multiple instructional alternatives for achieving these expected outcomes, and the ability to add or subtract areas of specialization. The specific performance criteria required of the trainees and the accompanying instructional alternatives are tentative hypotheses about the required training for elementary teachers. They are not interpreted as fixed, but rather subject to change based upon evaluation analysis.

> As change and development become increasingly important, effective models must be responsive to the information from their operation and from their environment.....Information about the inputs and the environment are collected, and statements of goals and purposes are formulated.....Appropriate adjustments can be made in the system's operation based on this information or in conformance with changing goals or standards.[1]

The METEP system is designed to systematically assess both its internal and external environments. As LeBaron has noted above, feedback from the external environment is necessary in order to continually assess METEP goals with those clients who are affected by the program and the teachers who graduate from the program. By continually collecting information relating to societal changes and the changing role of the elementary teacher, the major aspects of the environment can be systematically assessed.

METEP, as a teacher education program, has at least seven different client groups. These clients are affected either directly or indirectly by the program and the teachers who graduate from the program. These include:

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[1]Walt LeBaron, "Techniques for Developing an Elementary Teacher Education Model," U.S.O.E., Bureau of Research, Contract #OEC-0-9-569006-3704 (010), July, 1969, pp. 8-9.

1. students in the METEP program
2. public school teachers
3. public school administrators
4. children in elementary schools
5. parents of children in elementary schools
6. professional educators in teacher education
7. state departments of education

One function to be performed in METEP is the analysis of client demands. This function represents a central monitoring effort on the part of METEP to ascertain client needs and demands. In one way or another, all of the above client groups are affected by the METEP program and their needs and demands should be systematically collected and considered in the decision-making process vis-a-vis curriculum components, instructional alternatives, etc. Since clients and society will change over time, their needs will also change. The monitoring process of METEP must be sensitized to such changes.

In addition to monitoring client needs, there are other environmental states which need to be systematically assessed to insure relevancy for the future. These include:

1. economic environment
2. political environment
3. sociological environment
4. ideological environment
5. technological environment
6. psychological environment

Another function of the METEP system is to develop various screening and scanning devices to assess changes in these environments.

1. Economic environment - A changing economic environment means that METEP's clients' needs must be balanced against the realities of economics. For instance, a recession in American society could significantly alter client needs; e.g. the students in METEP may change because certain students may not be able to attend college.

2. Political environment - Enacted or proposed legislation may either impose restraints or provide new opportunities.....decisions obtained through election results... approval or defeat of bond issues....all may have serious implications on the design or implementation of METEP.

3. Sociological environment - Changes in roles, expectations, and status can directly or indirectly affect METEP. Changes in the role of the elementary teacher

is the most obvious example of how a sociological change could affect METEP.

4. Ideological environment - The ideological environment is concerned with society's value system. The value changes of college students in recent years is an excellent example of how a teacher education program could be affected. The demand of students to participate in planning their own futures is the kind of .. change which has tremendous implications.

5. Technological environment - Innovation can lead to changed and improved performance in the operation of METEP. New computer usages could, for example, drastically reduce the information system's cost.

6. Psychological environment - It is important to understand how individuals respond to environmental change because METEP will be in constant communication with various parts of the public sector. METEP should be able to know and predict the reactions of various client groups, especially when dealing with changes or modifications in the program.

Pedagogical Plans for the 70's. The most important feature of the performance curriculum as developed and envisioned by the pedagogical teams is continual short-term and long-term planning and action for constant change and revision in performance criteria and instructional alternatives. The very process of curriculum development is a dangerous procedure for when one commits oneself to action (no matter how wise), alternative organizational and action plans are simultaneously committed to inaction. In another unique situation these same discarded plans (or new ones which may be synthesized) may prove more relevant than old plans. As such, constant change, development of new approaches, and program evaluation are vital.

Already the pedagogical teams have been engaged in large-scale reorientation of curricula. At the immediate level, for example, the mathematics and language arts teams are developing new instructional alternatives and new performance curriculum hierarchies. The science team is developing a new, flexible way of utilizing space for laboratory work in science education which combines elementary children and beginning teachers in new ways of learning. The social studies and human relations team are beginning preliminary explorations of articulation and coordination between the curricula.

Important in this change process is student feedback and participation. For example, the human relations team at the completion

of each performance curriculum hierarchy solicited suggestions from the students for changing and sharpening the material they had just completed. These same students during the coming term will serve as a team which will help in the development of new hierarchies of training in human relations.

Thus, several important dimensions of maintaining short-term relevance and changes can be summarized;

1. Staff evaluation of program and change through evaluation and research.

2. Student participation in decision making and curriculum development.

3. Development of articulation between programs to ensure smooth coordination.

4. Not mentioned above, but equally important will be feedback from the support and maintenance teams in terms of computer scheduling, guidance of students, and data on the use of instructional alternatives.

Long-term planning requires a more complex program of evaluation and coordination. Perhaps the most important and interesting of these involves potential restructing of the entire concept of elementary teacher training.

While articulation between subject matter fields has always been stressed in teacher training programs, the methods through which this articulation can be brought about are less clear. The breaking down of specific elements of teacher training skills in each of the five training areas, science, language arts, social studies, mathematics, and human relations has revealed many skills which are parallel, and in some cases even exactly the same. For example, the skills of model building within the knowledge component of social studies are close to the decision making hierarchy developed by human relations. While the content of the two programs differ, the structure or underlying process is similar. The skills of scientific observation stressed in science are similar to the behavioral constructs of attending behavior within human relations. Many other such parallel examples could be presented.

In viewing similarities of structure in the learning process which is teacher education, it may be possible to develop new concepts of teacher education itself. One possibility might be a curriculum based on entirely on skill areas such as observation, classification, and analysis. These three components could be used in all five subject matter areas of the elementary training program. As

performance criteria are relatively small, discrete units, it is relatively easy to reorder presently existing materials into new organizational structures. One can visualize the value to the student in a program in which the structure of each content area is parallel to other areas.

A structural approach such as this has many implications. The first and most obvious is the ease for students who once they learn a basic structure can use this same structure to solve problems in many discrete areas. As presently instituted, each time a student enters a new curriculum area, he has to learn both the content and structure of that area. If structures were parallel, the program can focus more quickly and easily on basic content.

A second and less obvious implication is that like the two-edged sword, this structural approach to curriculum "cuts two ways." Students, if bound to one structure may be unable to visualize alternative ways of restructuring the curriculum and could actually lose flexibility within this approach. As such, it seems essential that one component within this program is theory and practice in structure building. Students would be encouraged to develop alternative ways of restructuring curriculum units both for themselves in the METEP program and in their own teaching practice. At higher levels, students and staff could develop new ways of restructing the entire METEP program to meet relevant needs.

For example, if societal needs stress the importance of environmental pollution as a major problem, the concepts and performance curricula of the subject matter fields could be organized around this one concept. In a teacher training program which centered on concepts of environmental pollution the performance criteria areas could be restructured around this problem without loss of content from the basic areas. (However, it is expected that the "basic areas" might soon themselves be restructured into new relationships and dimensions). As a new idea is developed, the curricula might again be restructured, perhaps around the constructs of anthropology, physics, or even life in space.

This latter material may perhaps sound vague, futuristic, and perhaps even a bit schizophrenic. However, it is presented with the firm belief that the major value of the performance curriculum concepts is that it makes possible the restructing of educational and social environments in ways that before were impossible. This restructuring is always done with an intelligent eye to the past and no single restructuring actually is seen as an end in itself. Too long the present curriculum areas have been viewed as established tradition. The concepts of the performance curriculum make possible the development of many new and alternative ways of restructuring the educational environment.

In summary, the views for long-term development may be stated briefly as follows:

1. The presently existing performance curriculum has required the pedagogical teams to "break-down" their specialities into specific components.

2. Components in each field have been discovered to be similar, and in some cases exactly the same, as components in other fields.

3. If components are parallel, it is possible to teach aspects of different subject matter fields within one performance criterion. For example, model building in social studies, classification in science, and decision making in human relations all involve many of the same interpersonal and knowledge skills.

4. If components are similar, it should be possible to restructure the elementary teacher education curriculum around these specific areas which are analogous one to another.

5. Such a structure makes it possible for students to see more clearly the relationship of subject matter fields and eventually a deeper emphasis on content may be possible.

6. It is believed that there is no final structure for the curriculum and it is anticipated that restructuring within this basis would be an on-going and constant activity.

In summary, then, METEP is concerned with developing an organizational process that will be responsive and adoptive to change. This function will be called Client Analysis (see Management Section), and will involve assessing client needs and environmental changes which could affect the METEP program.