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9. ABSTRACT

Much that has traditionally been honored in conventional educational practice is obsolete and irrelevant, yet the nation has not injected in its university system a center and program to make use of an engineering approach in applying new knowledge to improvements in the human learning process. That would be the function of a national university center for educational technology. Such a center would offer a Master's degree in educational technology, and would conduct research and service activities as part of an interface with other universities, lower schools, government agencies, and the community at large. Educational technology is defined as the systematic integration and utilization of knowledge, research, and invention in the facilitation of the human learning process. Important concepts and techniques in this approach include systematic management and planning (PPBS, PERT, cost-effectiveness analysis), individualized instruction, performance objectives, criterion-referenced evaluation, instructional design and validation, programmed instruction, instructional radio and TV, computer applications (CAI, CMI), peer tutoring, and other largely unutilized new techniques. The Master's degree program in educational technology would offer specializations in curriculum development, teacher education, media design and production, research and evaluation, or planning and management. The planned functions and facilities of the proposed center are described in some detail.

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DRAFT MODEL FOR DEVELOPMENT
OF
A NATIONAL UNIVERSITY
CENTER FOR EDUCATIONAL TECHNOLOGY

June, 1973

CENTER FOR EDUCATIONAL TECHNOLOGY
College of Education
Florida State University

DRAFT MODEL FOR DEVELOPMENT

OF

A NATIONAL UNIVERSITY

CENTER FOR EDUCATIONAL TECHNOLOGY

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I. RATIONALE FOR DEVELOPMENT

Most educators, political leaders, and ordinary citizens of nearly all nations in the world are in agreement on at least one issue--the inadequacy of their educational system. In the socially and economically advanced nations as well as in the developing nations, educational systems increasingly cost more, and respond less adequately to the needs of their societies. Societal problems, advancing technology, growing urbanization, increasing demands for educational opportunities, and rapid changes in the nature of manpower needs have in effect rendered obsolete and irrelevant much that is traditionally honored in conventional educational practice.

There are, however, current developments in education which offer promising solutions to problems faced in this sector, even though they are not yet in wide operational use. There are research findings and developments in the social and behavioral sciences plus those in management science and industrial/military training which appear to have much promise for and applicability to education. This research and development has led to the emergence of a "technology of education." This technology has emerged as a problem-solving process requiring a high level of educational engineering in planning for educational change and improvement.

Technological innovations in education must be placed in a proper perspective if they are to be appropriately exploited, and if they are to make the contribution which their cost demands. Educational technology has been defined in many ways and the words seem often to connote equipment,

hardware, and mechanical apparatus. However, for purposes of developing new approaches to the solution of national problems and for the training of specialists in this area, educational technology is herein defined as the systematic integration and utilization of knowledge, research, and invention in the facilitation of the human learning process.

A nation's educational goals must provide the framework and direction for its educational programs. Its progress toward these goals must, however, be considered in light of its economic conditions as well as its human and technical resources.

How many people, educated to what levels, in what specific areas of competency, will be needed by the society to maintain or achieve a desired rate of economic growth and social development? What percent of the Gross National Product can, or must, be allocated to the educational sector? How does this ratio change through time? What are the social and humanitarian implications involved in such decision-making? Because of the complexity and range of specific variables that must be considered in such an educational planning and design effort, the analysis requires an interdisciplinary team approach. In addition to systems management expertise, competencies must include expertise in educational administration and logistics, in teacher training, instructional technology, human learning, and educational economics. An analysis of the political and social environment in which a school system operates must also be an integral part of the planning process.

There are several conditions which militate against good and well-intentioned educators taking an engineering approach to such educational problem-solving. Perhaps the single most important condition

is that the traditional educator simply does not have the experience or training for this type of planning.

Another condition which reduces the problem-solving effectiveness of many contemporary educators is a lack of information about some of the current developments in the technology of education. They simply do not know about some of the more recent developments and their potential applicability to educational practices.

An absolute prerequisite for educational change in any nation is the purposeful development of a cadre of educational leaders who possess the technological competence and information with which to plan and institute new approaches to education. These leaders must also have attitudes and a philosophy attuned to innovation in education. They must be prepared not only to build upon and retain the best of the traditions in education, but to go beyond the well-mapped traditional frontiers of educational practice when it is demanded by the nation's goals for education.

The need for the training of such a cadre of leaders, and the need for relevant research and its immediate application is so pressing, that joint undertakings by responsible leaders which can result in new institutional efforts and arrangements seem long overdue. Universities must establish new "centers of excellence" in both training of educational leadership and in providing research capabilities and research results applicable to the solution of recognized problems. Government bodies responsible for program implementation must not only have access to the trained personnel and their research findings, but must also provide the

channels through which such personnel and research relate directly to the solution of "real" problems related to the achievement of national educational plans.

If a National University is to establish such a training and research capability in the field of educational technology, its own design and planning must be carefully done. This is true from the point of view of the quality and quantity of the faculty, the space and equipment required, the identification of specialties needed, and the interface (both internal and external) necessary to make such a program both viable and productive for the University and for the national needs it wishes to serve.

The Florida State University's Center for Educational Technology (CET) has prepared a general draft model for developing such a program in educational technology. It is conceived of as a multidisciplinary program located within a National University having a direct relationship with a National Department or Ministry of Education which is seeking to apply educational technology as a cost-effective means of solving educational problems. The specific purpose of the university program will be to provide a Master's Degree, and above, program in educational technology, offering specialization in several different areas. In addition, research and service activities are planned for as both university-related efforts and as a part of an interface with other universities, lower schools, government agencies, and the community at large. It is proposed that the program will enroll approximately 200 selected

graduate students. These students will be solicited from and intended for high level positions in educational administration and instruction.

The program as described in the following pages would greatly facilitate the production of trained personnel and research in educational technology and, furthermore, would create an effective vehicle for expanding the transmission of knowledge, new educational models, and educational design and planning expertise to both the planning and implementing agencies within a national program. It would also provide a continuing flow of expertly trained personnel for assignment into responsible positions with the operational school systems in the nation.

II. EDUCATIONAL TECHNOLOGY CONCEPTS

Educational technology has been defined as the systematic integration and utilization of knowledge, research, and invention in the facilitation of the human learning process. The effect of educational technology within the field of education, then, is to synthesize broad concepts and their many and varied elements into an operational mode of facilitating learning. Three major concepts are integral to educational technology. These are: systematic approaches to management and planning; the individualized instructional system; and delivery systems which locate and access a broad array of resources for instruction.

As the term "systematic integration" suggests, these concepts of educational technology are interdependent and their elements interact. In the following descriptions of each of the three broad concepts, their overlapping will be apparent.

Systematic Management and Planning

Systematic approaches to planning and problem-solving in education involve more than the design of instruction and simultaneously demand more in the design of instruction than has been traditionally applied. Additionally, operational management and personnel management are subject to redesign by new techniques. Program Planning and Budgeting Systems (PPBS), Systems Analysis, Cost-Effectiveness Analysis, and Program Evaluation and Review Techniques (PERT) are byproducts of the space age and only recently have come to be found in the training programs of educational administrators and developers. The application of the management concept

"systems analysis" and associated use of PERT are of demonstrated value to educational planners. These approaches to planning and decision-making were developed by the defense and aerospace industries out of necessity. Their design, development, testing, and production problems on such pieces of equipment as the supersonic transport or the Saturn rocket were of such enormity as to render totally obsolete the conventional management wisdom of the past. No one person or even a whole corporate organization possessed enough knowledge, technological competency, or memory to think through and monitor these development efforts. Because of its origins, systems analysis is sometimes viewed with trepidation and suspicion by educators. However, the use of the systems approach is not restricted to defense and space development efforts, but is applicable to the planning and design of any complex task. And few things are more complex than a nation's educational system.

Systems approach. Nations have historically permitted their educational systems to be vague and inexact. In contrast, the first step in the systems approach is a statement of the educational task and specific definition of outcomes or results. It is essential as a matter of national policy that the educational goals of a nation be explicated so that these goals can be translated into specific objectives for the several levels of the educational system. These goals should become decreasingly abstract as the focus narrows to the school, the classroom, and the student.

The next step in applying the systems approach is to analyze the many component variables that appear to have potential for contributing to the performance of the system (the relative costs of means,

feasibility of their use, and predictableness of their results). Following this analysis a selection is made from the alternative means and the system is designed, built, and implemented. When it is built and tried out, it is possible to determine with some precision the disparity between the desired output and the actual outcomes. Changes can then be made in the system which will serve to reduce this disparity. The product should be a plan, or alternate plans, that say to the educational decision-maker, "If you put these resources together in this particular way, you may expect to achieve these results at these costs."

Other elements. The systems approach, based upon this sequence with minor variations, also contains the elements of research, theory, and cost analyses. Research and theory supply knowledge and information about the learner, the learning process, and the task, both by performing studies and by synthesizing results. Although definitions of cost-effectiveness analysis vary, it can be said to be concerned with assessing the cost of obtaining a given set of objectives. Cost-benefit analysis is concerned with measurement of the stream of benefits to society or to the individual produced by an investment in education. It is the ratio of the cost of a project to the monetary benefits derived from it.

The systems analytic approach, a major management and planning technique in educational technology, is also a critical technique in the design of individualized instructional systems, the second major concept in the field.

Individualized Instruction

The individualizing or personalizing of instruction, one of the most promising current developments, is based upon the systems

approach to instructional development. Critical elements are performance objectives, criterion-referenced testing, instructional design, and iterative evaluation for validation.

A generalized description can be made of systems of individualized instruction. Teams of local faculty members work with specialists and outside consultants, developing specific performance objectives for the entire curricular offering. There are terminal performance objectives, the sum of which make up a defined course of study, and interim performance objectives, a sequential group of which lead to a terminal objective. After developing the objectives, the team analyzes the instructional materials available in the system and encodes portions of these materials against the objectives. For certain objectives, no materials may be judged suitable, and the team may develop its own instructional resources. The next step is to develop instruments or techniques for determining whether or not a performance objective has been attained by a student at the specified level of proficiency (criterion-referenced testing).

Finally, the products of these efforts are organized for the learner so that he is aware of what is expected of him in objective terms; what resources (including teachers) he might fruitfully employ in achieving these objectives; and, finally, how he is to be evaluated on the objectives. The learner then proceeds at his own rate, calling for assessment on any given objective whenever he feels he is ready. Learners who are able to demonstrate proficiency on some of the terminal objectives at the beginning of the sequence avoid spending time on things they already know. Efforts to provide both remedial and enrichment materials to

vary instruction for individual needs are a component of the individualized system.

Performance objectives. Once identified, objectives of instruction need to be defined in terms that are unambiguous and reliable. Methods for accomplishing this task are readily available, and have been described by a number of investigators including Mager, Gagné, and others. Essentially an instructional objective includes statements defining: (a) the task the student will have to perform, (b) the conditions under which the performance will occur, and (c) the criteria that will be used to evaluate the performance. Carefully defined objectives provide information concerning the type of learning to be undertaken, and they also make possible the design of the tasks to be used in assessing the outcomes of learning. In the former function, they serve as the instructional tasks representing convenient components of a course of study, to be analyzed in the manner described by Gagné to reveal sequences of skill attainment which are prerequisite to the learning implied by the objectives. In the latter function, they become definitions of classes of performance to be assessed by means of criterion-referenced items and tests.

Criterion-referenced evaluation. One of the more powerful recent concepts in instructional technology is that of criterion-referenced evaluation, which contrasts with traditional or norm-referenced evaluation. Norm-referenced measures (tests) are designed to permit examiners to distinguish among students--to compare them with each other. Conversely, criterion-referenced measures compare each student against instructional objectives and ignore individual differences among students.

Criterion-referenced tests are especially formulated to provide decision-making information about both the individual and the instructional program. The test can be used to decide whether a learner has mastered a criterion skill needed before he moves on in an instructional sequence or to another sequence. If a decision is to be made regarding an instructional treatment, the criterion-referenced measure would be designed to reflect a set of objectives purportedly achieved by the instruction. The performance of a set of appropriate learners following completion of this sequence should demonstrate the efficiency of the instruction. Criterion-referenced measures are critical for maintenance of absolute quality control of instruction.

Instructional design. One of the early and difficult problems faced by the instructional designer is that of obtaining agreement on the content to be taught and the level of proficiency to be required of the trainees. Instructional designers must ultimately depend on specialists for these decisions. Qualified practitioners, instructors, and other subject matter experts decide these questions of content and required proficiency in consultation with each other and with instructional technologists. Generally, this team arrives at the objectives and the standards of performance through a judgmental process and negotiation. Then the instructional technologist completes the developmental process and submits materials and developmental test data to the appropriate official. Materials completion is judged by the process of validation.

Validation. The iterative process, fundamental to instructional development in systematic design, is the keystone of validation. Instruction is said to be valid when an acceptable proportion of students meets

minimally acceptable criteria or standards of performance. It is the job of the instructional technologist to build validated instruction.

The technologist develops materials and procedures to achieve given objectives. The units are then tried out on representative members of the target population, the specific group for which the instruction was intended. Results of the trials are carefully recorded as students progress and the data are analyzed to find which of the objectives have been achieved and which have not. It is at this point in the developmental process that the differences between traditional instruction and empirically designed instruction become most pronounced. The data collected on the students are used to grade the lessons, not the students. The instructional developer then assumes responsibility for revising the materials on the basis of these data until original design specifications are met. When the materials have been revised, they are again tested with a target population to see if the revisions have resulted in improved performance. This iterative process is repeated until the nominal performance level is achieved.

The integration of systematic individualized instructional development into educational technology, with its developing elements of performance objectives, criterion-referenced testing, instructional design, iterative processes, etc., requires and relies upon the third concept, that of delivery systems which include a broad array of resources.

Delivery Systems

If educational resources are to include any resource that can help a student learn, these resources can be taken from those specifically designed for instruction, or from the world at large. The inclusion of and

increasing movement toward accessing the "real world" is characteristic of educational technology; delivery systems therefore include an unconventionally wide selection of resources for education. For present purposes, the following brief overviews of resource applications are of programmed instruction, television, radio, computers, and peer-tutoring.

Programmed instruction. The concept of programmed instruction (PI) is that instruction should be designed and presented in order to lead to intended outcomes. Early linear programs tended to follow a fairly rigid format, with the material broken into small, sequenced steps, and stimulus information presented to the learner with a response required by the learner. He was then shown the right answer with which he could compare his own. These three elements--stimulus, response, and knowledge of results--were intended to lead the learner to the attainment of the objectives.

Based on experience, a different approach has evolved which does not specify the form of the instruction, only the outcomes. It does not require large numbers of steps, but it does require sufficient interaction on the part of the learner to insure mastery. This empirical development procedure can be applied in varied media.

Radio. It is clear from a review of literature that radio can be used effectively to teach a variety of subjects under a variety of circumstances. Radio has been successfully used not only to teach knowledge and information but also to increase various skills of the listeners. If one is to believe the trends in advertising, it is also true that radio can influence the decisions people make in obvious choice situations. Investigations have yet to be made in techniques such as programmed radio,

materials support, and people support. In programmed radio, radio broadcasts can be prepared according to the general empirical approach used in programmed instruction. This approach includes the use of behavioral objectives, overt/covert responses where necessary, and tryout and revision of materials until they reach prior-specific goals. The radio instruction can be accompanied by instructional materials to be used in conjunction with broadcasts: textbooks, workbooks, diagrams, note-taking guides, physical displays, etc. Also, people support, such as teachers and monitors, can be used at the point of listening. Although programmed radio has apparently not been tested, experience with programmed instructional television has indicated that the empirical development methodology has been effective in improving performance.

Instructional television. Many delivery modes are widely used for distribution of instructional television materials: airborne telecasting, UHF and VHF broadcasting, instructional television fixed service, closed circuit cable and microwave, satellite telecasting, the use of portable videotape recorders, and VTR cartridge players. Television, particularly when mixed with other media like radio, telephone, and facsimile, presents new opportunities for instructional strategies planning individualized, team, and mass instruction. It is possible to plan not merely a television system, but an innovative instructional system making optimum use of television. Television distribution systems allow mass scale instructional programs to be transmitted with uniform opportunities for all students.

Computer applications. The use of the high speed computer in education has been the most dramatic and publicized application of

technology to instruction. The distinguishing characteristic of computer-assisted instruction (CAI), which has been investigated by a group of researchers, is that the machine and the learner interact, with the machine performing an instructional role. This instruction may take the form of drill and practice, or the computer may perform as a tutor with characteristics of the branching program.

A more recent trend in instructional application of the computer is computer-managed instruction (CMI). Studies of CMI differ in a variety of ways such as reliance on off-the-shelf materials as opposed to developing new instructional resources. These are similar in that all are designing learning interventions based on carefully specified behavioral objectives, and all are using the computer to mediate between the student, his individual performance on the objectives, and the inventory of instructional resources related to the objectives. A principal interest in CMI is that, since the computer's function is to prescribe and schedule, it could serve thousands of students daily, and the operational costs of CMI would probably be less than traditional instruction.

A consensus of computer technology experts is that there are a number of nonexotic but useful functions which could be furnished to schools with the available technology, and that expected newer functions could be added at a future time with minimum disruption and systems modifications.

Peer tutoring. One of the techniques of individualizing instruction while tapping human resources is the system of peer tutoring. Although human resources also include use of the nonprofessional adult to expedite and individualize learning, use of peers as tutors in schools is being studied. Tutorial models in which peers are provided with training

to allow them to become an integral part of the individualized instructional system show promise, as the systematic training of the peer tutors appears to be a method of overcoming disadvantages encountered in early programs. Although PI, teaching machines, and other delivery systems are designed for the individual, the peer tutor has an advantage over PI with the nonreader, and over the poorly prepared machine materials, etc.

Summary

Each of these concepts has been employed in many different educational settings with varying degrees of success. Indepth research is needed in order to determine which concepts have the most effective utility within a specific environment.

Application of these educational technology tools within that specific environment requires the training of a cadre of professionals who can apply specific skills in each major area of specialization. The following section (III) outlines the areas of study and curriculum requirements for training these types of specialists.

III. RECOMMENDED DEGREE PROGRAMS

Any National University wishing to develop a degree program at the graduate level in Educational Technology will be faced with many decisions relative to the quality and quantity of staff needed, the research capability to be developed, the space requirements, the technical equipment and library resources that must be provided, etc., for both the initial program development and its continuing expansion and support.

The nature of the degrees offered (M.A. - Ph.D.) and the undergraduate training program upon which such graduate study must be based are and must be of vital concern to the planners. Areas of specialization within such degree programs must be carefully designed both in terms of objectives and content, and in relation to national educational development needs.

Five specialized programs are recommended as a Master's Degree program. All of these programs would have the following common characteristics:

A. All entering graduate students would complete a "core" of professional courses which this plan assumes would be common to all graduate students in the field of education. The purpose is to introduce the prospective educational technologist to a broad scope of educational concerns and problems. Such a core program should include:

1. Basic Education Problems Faced by the Nation
2. General Concepts and Principles of Educational Research

3. Sociology of Educational Change

4. Comparative Developmental Education

B. Each major in Educational Technology will enroll in an introductory course which would specifically relate "systems concepts" to the area of specialization.

C. During his or her professional training, each degree candidate will participate in a multi-semester workshop in which students participate in projects that will enable them to apply concepts learned in the courses.

D. Every degree candidate would present a culminating thesis in which many of the concepts taught in the recommended program are brought to bear on a specific project.

The following program outlines do not attempt to assign credit hours to the specifically named courses. However, the courses are generally conceived as carrying 3 to 5 credit hours each. Following the course listing for each specialization there is a brief description of the competency level a graduate of the program is expected to possess.

The following pages contain outlines of the five recommended programs of specialization.

Program One:

Specialization in Curriculum Development (Instructional Systems)

Suggested Courses:

1. Theory of Systems Approach to the Design of Instruction
2. Workshop on the Development of Prototype Instructional Materials
3. Identification and Analysis of Educational Goals and Objectives
4. Individual Differences and Their Effect in Instruction
5. Formative Evaluation of Instructional Materials
6. Selection of Media for Instructional Systems
7. Design of Individualized Instructional Systems
8. Effect of Social and Environmental Factors on Instructional Systems
9. Course(s) in Subject Area Specialization
10. Thesis: Development and Evaluation of Instructional Materials

Competency Level:

The specialist in curriculum development should be able to apply a general systems approach model to the design of instruction. He will be able to design appropriate evaluation instruments and utilize the data collected from students to revise the instruction. These skills can be applied to the design and development of a total curriculum or individual instructional modules.

Principal roles of curriculum development specialists would be as team members on projects to design, develop, and evaluate materials for elementary or secondary schools. They would also be contributors to large-scale projects designed to assess the effectiveness of various instructional approaches.

Program Two:

Specialization in Teacher Education

Suggested Courses:

1. Theory of Competency-Based Teacher Education (CBTE)
2. Workshop on the Design of a Competency-Based Teacher Education Program
3. Identification and Assessment of Teacher Competencies
4. The Design and Evaluation of Individualized Instructional Modules
5. The Use of Media in CBTE Programs
6. The Management of CBTE
7. Research and Practice on CBTE Programs
8. CBTE and Teacher Certification
9. Course(s) in Subject Area Specialization
10. Thesis: Development and Evaluation of a Component of a Competency-Based Teacher Education Program.

Competency Level:

Major competencies of these graduates will be in the design, development, and implementation of individualized, competency-based teacher education programs. The specialists would team with curriculum developers, media technologists, and evaluators to develop new teacher education programs which emphasize the use of educational technology by teachers. Teacher education specialists might also participate in in-service training of teachers, and assist in the development of concerned preservice, in-service teaching centers.

Program Three:

Specialization in Media Design and Production

Suggested Courses:

1. Theory of the Systems Approach to the Design of Instruction
2. The Role of Media in Instructional Systems
3. Workshop on the Development of Instructional Media
4. Selection, Acquisition, and Utilization of Audiovisual (AV) Equipment
5. Production of AV Materials
6. The Evaluation of Media Systems
7. Effect of Social and Environmental Factors on Instructional Systems
8. Administration of Educational Media Services
9. Techniques of Television Production

or

10. Uses of Computers in Education
11. Thesis: Development and Evaluation of a Media-Oriented Instructional Sequence

Competency Level:

The media specialist will be able to design, produce, and evaluate mediated instructional materials. His special skill will be translating specifications for instructional sequences into media packages. In addition to AV production skills, he will be able to administer a media resource center and its associated services.

The media specialist might be a team member on a curriculum development or research project, or work directly with schools or colleges on the utilization of media in the instructional process.

Program Four:

Specialization in Research and Evaluation

Suggested Courses:

1. Research in Systems Theory and Implementation
2. Workshop in Design of Research and Evaluation
3. Descriptive Statistics
4. Inferential Statistics
5. Theory of Measurement and Evaluation
6. Design of Criterion-Referenced Evaluation Instruments
7. Design of Instructional Research
8. Design and Evaluation of Field-Based Research
9. Use of Computers in Data Analysis
10. Thesis: Design and Evaluation of an Instructional Research Project

Competency Level:

The research and evaluation specialist will be able to design appropriate studies to assess both the formative and comparative effectiveness of educational innovations. He will have specific skills in the development of appropriate evaluation instruments, experimental designs, and data analysis procedures.

The research and evaluation specialists could play a wide variety of roles. These would include membership on a large curriculum development project team, as well as on a planning and evaluation team. Their data analysis skills could be used in a variety of positions in a ministry of education, university, or school system.

Program Five:

Specialization in Planning and Management

Suggested Courses:

1. Systems Theory Applied to Planning and Management
2. Workshop in Planning and Management
3. Needs Assessment and Goal Setting
4. Project Planning Techniques
5. The Role of Computers in Planning and Management
6. Cost/Benefit Analysis Techniques
7. Allocation of Educational Resources
8. Human Relations in Planning and Management
9. Manpower Planning
10. Thesis: Develop and Evaluate a Management Plan for an Innovative Instructional Project.

Competency Level:

The specialist in planning and management will be able to apply a large variety of systems techniques to innovative projects from their initial design stage to their final evaluation. Skills in needs assessment, cost/benefit analysis, and computer utilization will be of specific importance.

The planning and management specialist would most likely be employed in large organizations such as universities, the ministry of education, or other government agencies. Certainly he would participate on planning and evaluation teams, as well as on large instructional design projects.

IV. SUGGESTED INTERFACE ACTIVITIES

Just as any modern university must maintain deep roots and strong lines of communication within the social, economic, political, and cultural milieu in which it functions, so a subunit such as a National University Center for Educational Technology must be alert to its responsibilities and resources both within and outside the institutional structure. A Center, training leadership as it does for the practical application of knowledge and know-how to real situations, should continuously seek to establish and maintain effective linkages with agencies, units, and institutions inside and outside of the university, in order to carry out its essential research, service, and public information functions.

Internal linkages. Within the university, the personnel of a Center for Educational Technology should involve faculty and staff members from other units and colleges in order to exchange information, plan cooperative projects and programs, and effectively utilize existing university resources. Particularly close relationships should be maintained with the college of education from which a Center will draw heavily for its key personnel. Additionally, Center staff members should work cooperatively with research units and faculty members in other discipline (e.g., the social sciences, communications, etc.), to provide access to the latest research and knowledge in all related areas.

Most importantly, Center leadership personnel should seek the advice and counsel of a central university advisory board composed of key persons from the college of education and from the university at

large. Such an advisory council provides major assistance in maintaining both interdisciplinary liaison and policy perspective.

External linkages. Outside the university, a Center should establish and maintain an even more varied network of relationships. These external relationships are part of the Center's reason for existence, as they provide for the dissemination of information, the opportunity for applied research, and the opportunity to offer services to the educational community taken in its broadest sense at both the formal and informal levels.

Effective operational links with some, or all, of the following agencies are desirable outside relationships: the Central Department or Ministry of Education; the responsible State Department of Education where appropriate; specialized educational units responsible for special projects such as educational radio or television or adult education; the National Department or Ministry of Communications; the National Department or Ministry of Planning; private educational agencies or research centers; private and public film producers and broadcasters; and other selected universities at home and abroad who have both interest and expertise in educational technology.

Particular situations may suggest other relationships, in addition to the foregoing examples, which are important to the Center's role as a leader in the area of educational technology.

Linkage planning. Because linkages and relationships do not develop optimally without planning, a Center's personnel should specifically designate some of its staff to carry the major responsibility for development and maintenance of a complex network of coworkers and clients

at home and abroad. Through these established internal and external linkages, a Center's personnel should carry out missions in the following areas of research, services, and public information.

Research Activities

The viability of any university-related unit such as a Center for Educational Technology depends in part on the provision for related research activities. These efforts can be described along two developmental lines: (a) basic research, furthering the field of educational technology as a specialization, and (b) applied research, pursuing solution or management of actual problems in real situations.

Basic research. Since such programs are part of the teaching-learning process, the students and the instructional staff at a Center for Educational Technology should work cooperatively on the research problems that are basic to the development of the area. Examples of basic research programs are the exploration of applicability of programmed instruction to specific curricular areas, the effectiveness of various combinations of audio and visual presentations, and the cost calculations and comparisons among various instructional modes and media. This research program is responsive to needs of the "state of the art," and to the abilities and resources of its own students and staff.

Applied research. Applied research is in contrast to basic research but complementary to it. A Center's personnel should carry out applied research as a service in the community working toward the solution of actual problems within the realm of educational technology

and its related areas. For this type of research, a Center's personnel should contract with varied clients and agencies to provide cooperative research efforts directed toward solving high priority problems at local, state, or national levels. Among the types of applied research that might be carried out are such projects as the evaluation of a new instructional television program, the development of a fundamental instructional system for a specific target population, or the development and evaluation of an urban education and orientation program for workers who have recently migrated to urban centers.

Services

In addition to the regular educational technology academic program, a Center for Educational Technology should be capable of offering a carefully selected range of services which will: (a) serve specific needs in education in the nation, and (b) further the dissemination of the basic approach underlying educational technology as a field of specialization. Among the services a Center can offer are the following:

Consultant services. Personnel and advanced students of a Center represent a valuable human resource which can be shared on a planned priority basis. Its consumers are educators and others who need expertise, advice, and guidance on specific problems in field situations, where the application of educational technology promises to offer effective management or solutions to administrative and instructional problems.

Special training programs. Regular degree programs should be offered by a Center through its regular university and college

programs. In addition, experience in established centers has shown that there is a constant demand for training programs which fall generally into one of three categories: (a) short term training, (b) training focused on a particular aspect of educational technology to the exclusion of other aspects, or (c) training required for selected personnel for a particular task. Such programs as these provide individuals or small groups with the skills they need without requiring academic formalities usually associated with university programs. A Center, in offering such nondegree programs, provides valuable services to the nation, and to particular teachers, supervisors, and other education personnel. These individuals would not otherwise be able to obtain in short time periods the required knowledge and skills necessary to achieve the kind of educational effectiveness brought about by educational technology.

Information resource service. A Center's evolution as a viable unit will include its capacity to collect, organize, store, retrieve, and disseminate information on all aspects of educational technology as an applied field. In its role as an education instrument, the Center should make these resources available outside its own research staff to persons, agencies, and governmental units that could utilize such specialized information. The provision of such information and related materials, both print and graphic, is a service which should be made available through a planned capability to national and international information consumers.

Public Information Unit

Essential to the continued support of a specialized unit such as a Center for Educational Technology is the provision for a forward-looking, well-organized public information unit within the Center. This unit is distinguished in two ways from the information resource services previously described. First, the public information unit offers a general information service to the public regarding various aspects of educational technology, rather than a scholarly resource. Second, the public information unit maintains an ongoing flow of information to extend to the public at large the meaning of and activities underlying the Center's educational mission. By contrast, the information resource services are to disseminate only highly selected information to specific recipients in the professional community.

Such a public information unit within a Center should communicate with the public about the range and variety of services in educational technology and how they are available and useful to the public.

In summary, a National University Center for Educational Technology should do more than just produce graduates. Research, service, and public information are essential elements of keeping the training of personnel related to the problems of development within the nation; of staying current with "the state of the art" in the everchanging inventions and innovations that should be applied to the learning process, and of carrying on a continuing dialogue between theorists, inventors, planners, and practitioners.

Three major guidelines should be adhered to in planning for the implementation of the research, services, and public information activties

in a Center:

1. Each unit (research, services, and public information) is a function in its own right. Specific fulltime personnel must be assigned the major responsibility for performing each function.

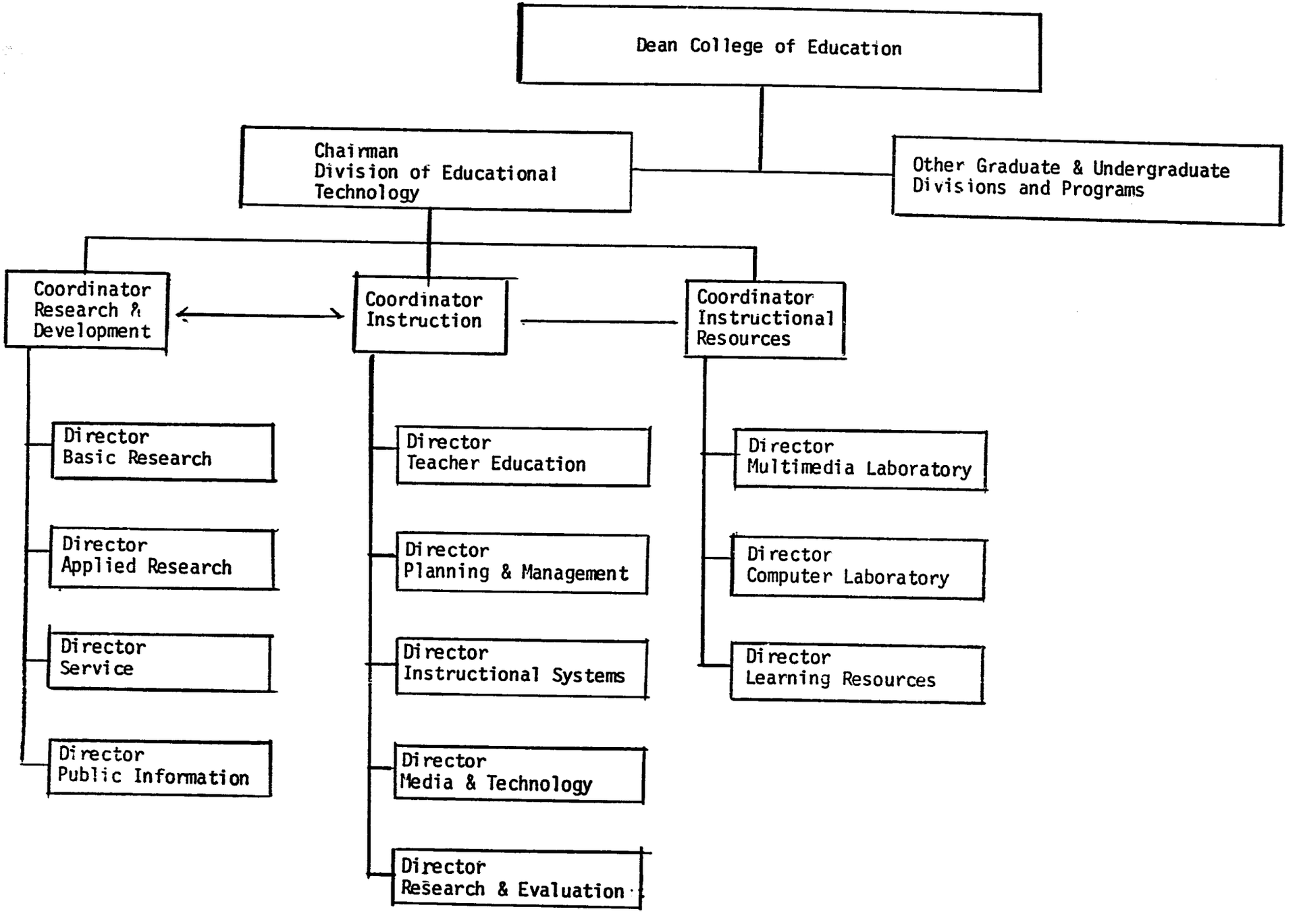
2. The Center's research and service areas must be clearly identified. Involvement in projects and programs then can be confined within the scope of the Center's activities, preventing involvement in projects outside the priority or development range.

3. All of these activities must be regarded as learning experiences to be correlated with and integral to the more formalized course training of the graduate students enrolled in the programs.

V. ADMINISTRATIVE ORGANIZATION AND STAFFING

The administrative organization of a National University Center for Educational Technology may take a variety of forms. It should always be subject to the scope of the activity and the purposes to be served by its program. It is further delimited by the administrative character of the University itself, as well as by the already functioning components within the University which may be called upon to contribute to and/or become a part of the Center effort. The multi-disciplinary character of a training program in Educational Technology, and the application of basic concepts of the "systems approach" to the solution of educational problems make it imperative that the administration of the Center be carefully planned, and that the organizational structure possess the characteristics of both flexibility and order. Research, teaching, service, and resource use must be interrelated if each aspect is to become a viable part of a total program. Any management plan must operate with these principles in mind.

The draft model of an administrative organization being described herein cannot take all of these elements into account. Thus, a general organizational diagram has been drawn to reflect a functional structure within a College of Education. The diagram follows:


Dean College of Education
Chairman
Division of Educational
Technology
Other Graduate & Undergraduate
Divisions and Programs
Coordinator
Research &
Development
Coordinator
Instruction
Coordinator
Instructional
Resources
Director
Basic Research
Director
Applied Research
Director
Service
Director
Public Information
Director
Teacher Education
Director
Planning & Management
Director
Instructional Systems
Director
Media & Technology
Director
Research & Evaluation
Director
Multimedia Laboratory
Director
Computer Laboratory
Director
Learning Resources

The foregoing diagram does not attempt to reflect even the interrelatedness of the component parts of this single organizational program, and certainly no effort has been made to show relationships which must exist between this program and other programs within the same College of Education. These relationships are vital; they are cost determinant, and are mutually supportive in terms of quality program outputs. They would have to be defined and planned, however, in relation to a specific program in a specific setting.

The diagram does identify 16 senior staff positions, one for each administrative unit and subunit of the Center as described. Additional staff requirements within each subunit would be determined by the scope of the effort envisioned by the University as well as how it might be able to deploy and utilize human resources between units. For example, where this diagram envisions a senior full-time professor responsible for program planning and implementation in each of the subunits, additional staff requirements might be met through the assignment of professors who are qualified to serve in more than one subunit (e.g., a professor who teaches in more than one program, and who might also serve as a basic researcher, or a media specialist who teaches particular courses in a specialized degree program). In addition, part-time specialists who work a major portion of their time in other divisions of a University, or outside the University itself, often can be used to teach appropriate courses or assigned to work in special research projects. The graduate students enrolled in the program also provide a certain

level of resource competency for support of particular activities and their appropriate use should be encouraged as a means of furthering their own learning.

Since the staffing of the Research and Development Unit and the Instructional Unit of the Division is so dependent on other factors, no effort has been made to detail their staff requirements further in this model. In the same sense, the amount or level of support staff (secretarial-clerical) for Instruction and for Research and Development have not been presented.

The development of the Instructional Resources Unit, however, is essential to almost any concept of a program and by its very nature calls for a wide range of technical personnel. In the following section of the model, the staff needs for this Unit are specified in the organizational charts.

VI. SPECIALIZED ENVIRONMENTAL AND TECHNICAL REQUIREMENTS

A National University Center for Educational Technology should constantly strive to stay in the forefront of the "state of the art" by both utilizing and developing new concepts in education. In order to do this, it is necessary for such a Center to have specialized equipment, space, and staff to carry out instructional activities as well as the production of prototype materials.

The model presented here identifies the basic facilities needed, their general functions, space equipment, and staff requirements. Tables A, B, and C describe the basic components for the following major facilities:

A. Multimedia Laboratory

B. Computer Laboratory

C. Dissemination Facilities
(A floor plan of the Learning Resource component is included for this facility in order to show the innovative concepts in the function and space)

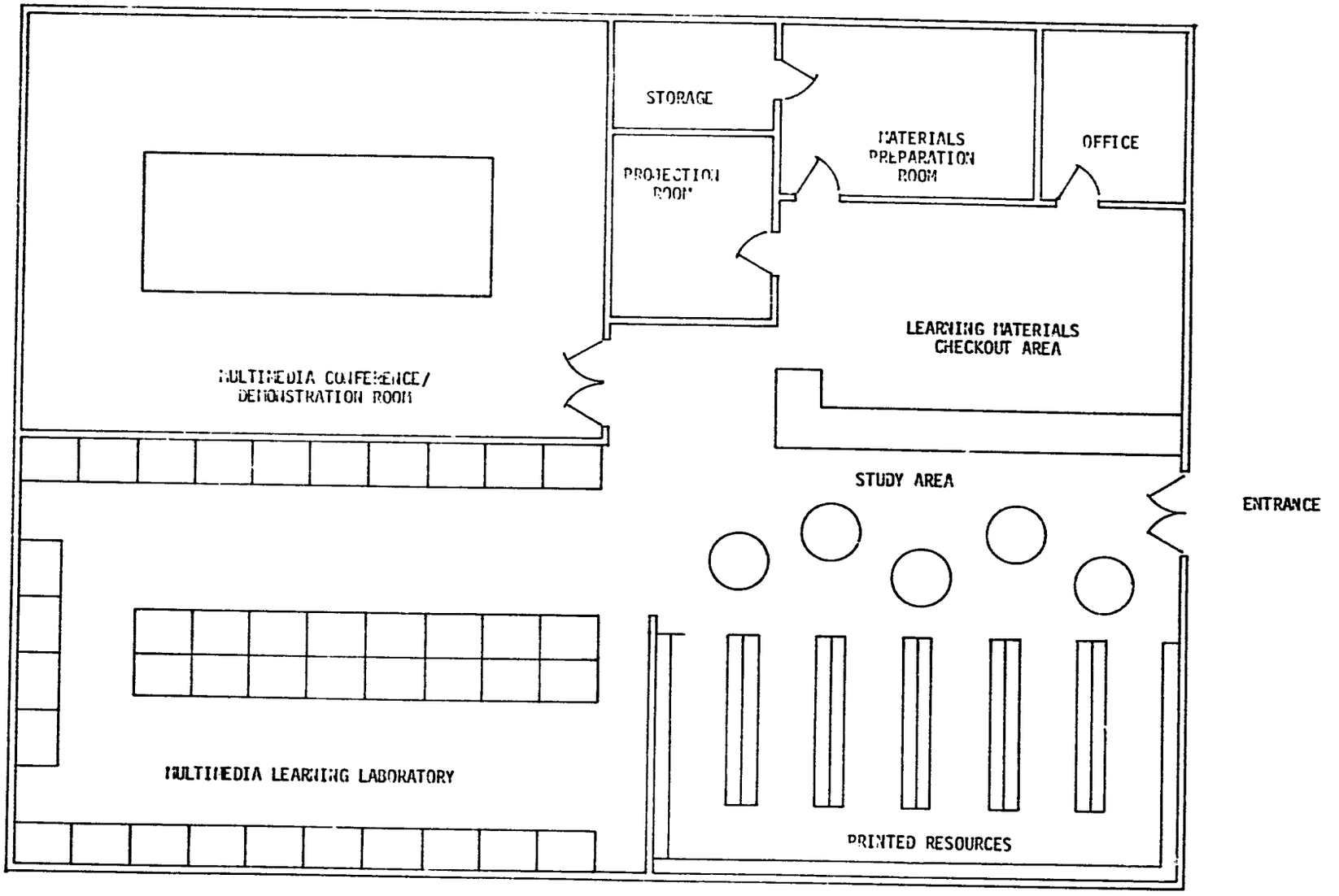
Tables A-1, B-1, and C-1 describe the staffing requirements and administrative organization for each of the three facilities described in Tables A, B, and C.

It should be noted that the Multimedia Lab, Computer Lab, and Dissemination Facilities are separate entities but are necessarily interrelated in that they are all service facilities to the total Center program, and each may depend on the other for carrying out certain activities.

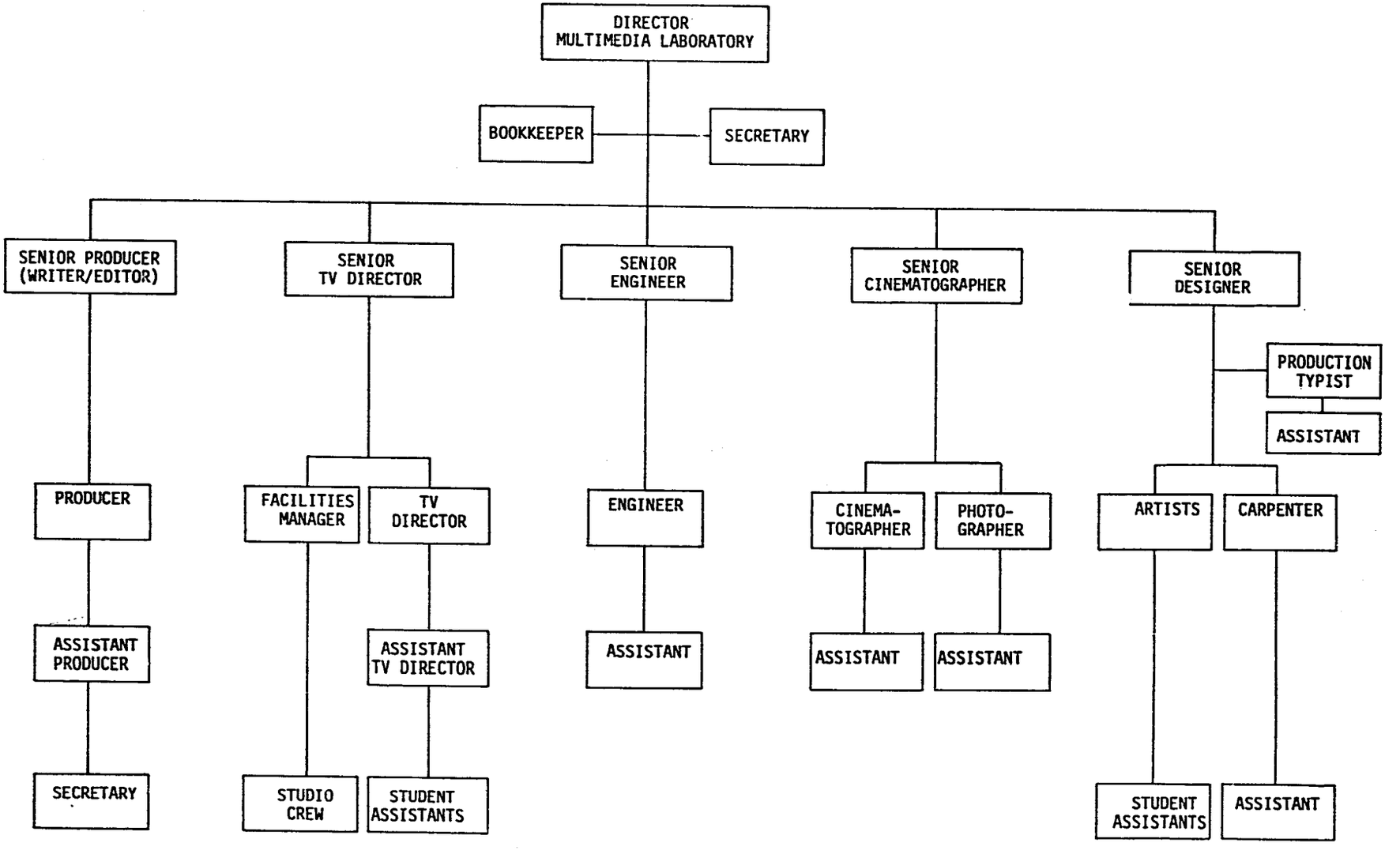
A. Multimedia Laboratory

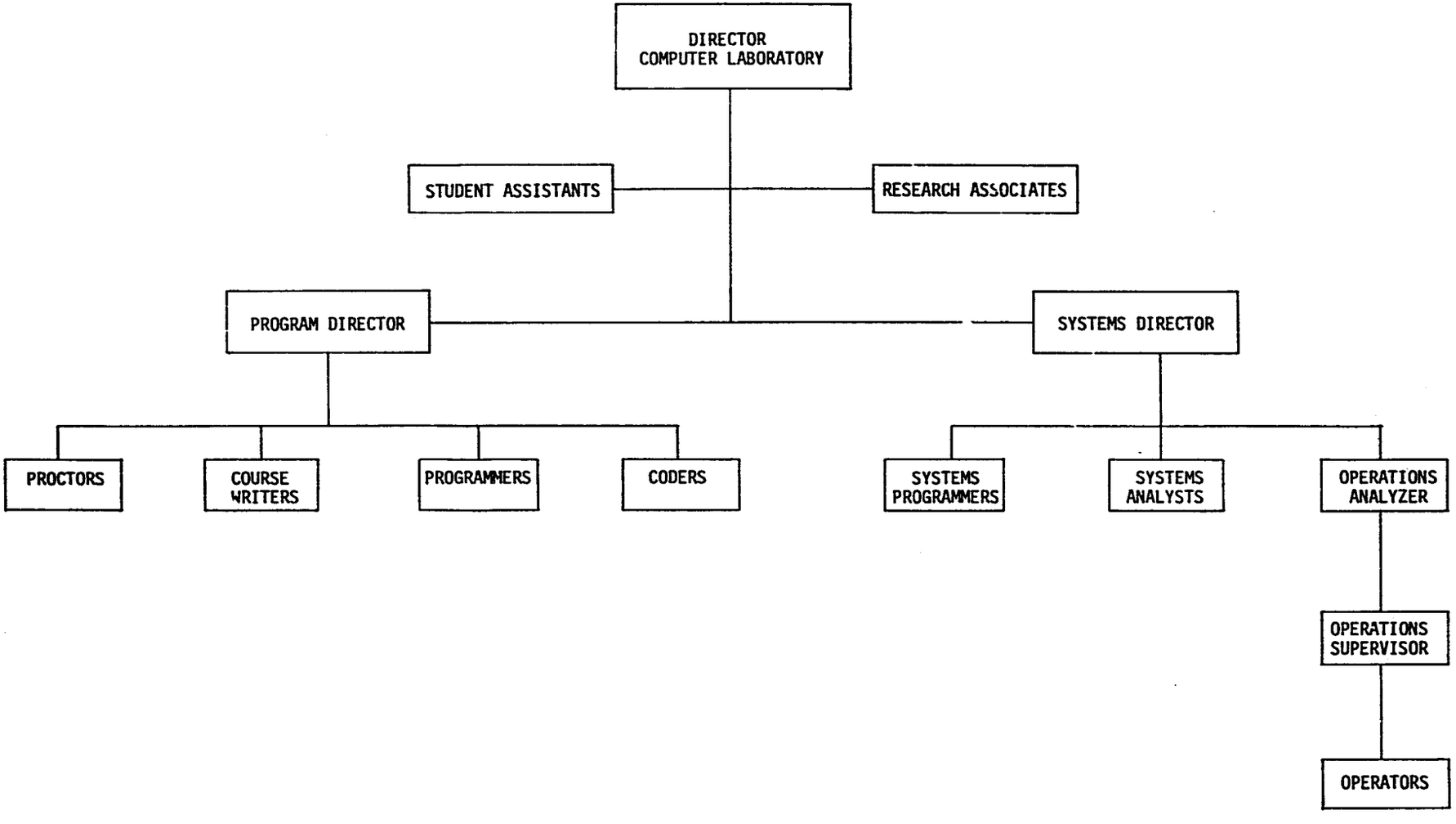
	AUDIO/VIDEO PRODUCTION		FILM PRODUCTION		DESIGN	
	TELEVISION	AUDIO	CINEMATOGRAPHY	PHOTOGRAPHY	GRAPHICS	PROTOTYPE CONSTRUCTION
FUNCTIONAL DESCRIPTION	For the production of video & cassette tapes for internal dissemination and outside distribution.	For the production of audio for: radio, television, filmstrips, reel-reel, cassette, film, slide/tape devices.	For the production of 8mm & 16mm films. Supports television.	Provides photographic support for: P.I. texts & other printed materials, television/cinema, slide & filmstrip presentations, displays & exhibits.	For the production of graphics for: P.I. texts & other printed materials, television/cinema-title cards, charts, graphs, illustrations, studio scenic & prop design, slide/tape, displays & exhibits, classroom charts/graphs, etc.	For the construction of prototype multimedia furniture, TV/cinema/photo props & scenery, displays & exhibits.
	← FUNCTIONS AS LAB/WORKSHOP FOR TRAINING STUDENTS IN DEVELOPMENT OF MATERIALS & RESOURCES →					
SPACE	Studio 2,500 sq ft Prod. Control 180 " Engineering 1,000 " Engineering Office & " Maintenance 600 Storage 600 " Production 300 " TV Director Office 300 " Total 6,980 sq ft	Announce Booth 60 sq ft Small Studio 144 " Production Control 180 " Office 96 " Storage 96 " Total 576 sq ft	Editing Room 600 sq ft Processing Rm. 180 " Office 96 " Storage 96 " Total 972 sq ft	Photo Lab 300 sq ft Dark Room 180 " Office 96 " Total 576 sq ft	Production Area 600 sq ft Printing Room 144 " Storage 144 " Office 96 " Total 984 sq ft	Shop 600 sq ft Storage 300 " Total 900 sq ft
EQUIPMENT	Complete color (broadcast quality) closed circuit television system: 3 cameras; 2-1" Video-tape recorders with electronic editing, special effects/production switches, 2-film chains (16mm, super 8mm & 35mm slide projectors), video cassettes (for internal closed-circuit use), associated electronics for processing & distributing video/audio signals, test equipment. Total $250,000.00	8 channel microphone mixer, four track R-R deck (10" reel) with record sync., 2-1/2 track R-R tape deck, 4-cart. recorders full track, cassette recorder deck, cassette duplicator, production control/studio monitor system, microphones, headphones & associated equipment. Total $15,000.00	16mm double & single system sound camera, recording equipment, double system projector, lighting equipment, 8mm dbl system camera & recorder, color film processing unit, film cleaning unit, editing equipment. Total $50,000.00	35mm (full & half frame), 2 1/4x2 1/4, 4x5 & 5x7 film formats, copy camera & stands, lighting, color processing equipment, color-head automatic enlarger, temperature controlled developing system, automatic printing system, dryer, dry mounting press, light tables, associated equipment (wide lense assortment, etc.). Total $15,000.00	Drafting boards, light table, hot press titler, sign machine, composer-typewriter, Lucygraph enlarger, photo-stat machine, associated drafting & drawing equipment. Total $10,000.00	Radial arm saw, table saw, band saw, electric hand saws, wood & metal lathe, planer, router, drill press, associated hand tools. Total $7,000.00

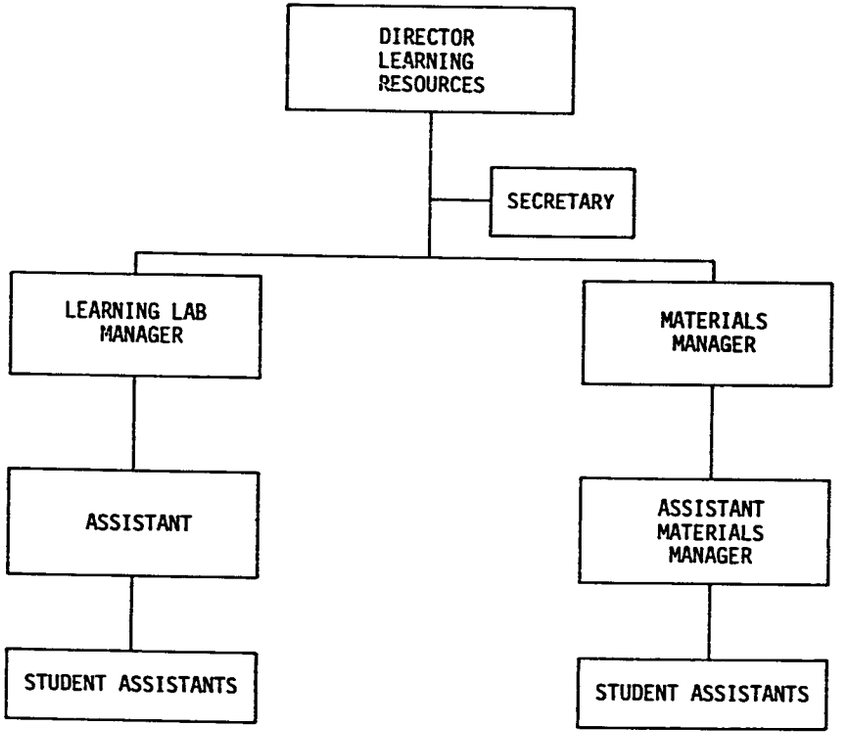
	B. COMPUTER LABORATORY	C. DISSEMINATION FACILITIES:				
		INSTRUCTIONAL AREAS		LEARNING RESOURCES CENTER		
		Multimedia Auditorium	Mediated Classrooms	Multimedia Conference/ Demonstration Room	Materials/Equipment Laboratory	Multimedia Learning Laboratory
FUNCTIONAL DESCRIPTION	40 terminal capacity for: instruction, research, training, data retrieval and analysis, systems activities, demonstrations, etc.	250 person capacity used for: lectures, multimedia presentations, seminars, etc.	30 person capacity used for standard instruction supported by media devices (available from Materials/Equipment Laboratory). Attached to each classroom will be a small room for observation and recording.	30 person capacity used for: small seminars, graduate examinations, multimedia presentations, conference, screening films, video tapes, etc.	Houses all internally produced materials. Collection & dissemination center for learning materials. Materials & equipment available to students & faculty for check-out.	60 person capacity. Used for individual study in mediated-learning carrels.
SPACE	Cathode ray terminal room - 500 sq ft Typewriter terminal room - 500 sq ft Conference & office space - 2,500 sq ft Computer equipment room - 2,500 sq ft TOTAL 6,000 sq ft	TOTAL 10,000 sq ft	4 classrooms @ 1,200 sq ft - 4,800 sq ft 4 observation rooms @ 150 sq ft - 600 sq ft TOTAL 5,500 sq ft	Conference/demonstration - 1,200 sq ft Projection/storage - 300 sq ft TOTAL 1,500 sq ft	TOTAL 1,200 sq ft	TOTAL 2,400 sq ft
EQUIPMENT	1 Computer central processor 1 Station controller 2 Tape drives 3 Disk drives 1 Card reader/punch 1 Printer 1 Key punch 20 Cathode Ray tube terminals 20 Typewriter terminals TOTAL $300,000	1 16mm projector 1 Super 8mm projector 2 35mm slide projector 1 Filmstrip projector 1 AV/Control system 1 Reel-Reel tape deck 1 Cassette Tape deck 1 Stereo power amplifier 1 Stereo Microphone mixer 3 Low Impedance microphones 4 Speakers 10 Color TV receivers (25") 1 24'x32' projector screen & control unit TOTAL $16,000	4 Black & White Vidicon television camera 4 Microphone mixer 16 Microphones 4 8" Black & White video monitors 8 Color television receivers 4 Projection screens 8 Chalkboards 4 1/2" Black & White video tape recorder TOTAL $7,000	1 16mm projector 1 Super 8mm projector 2 35mm Slide projector 1 Film Strip projector 1 Reel-Reel tape deck 1 Cassette tape deck 1 Stereo power amplifier 1 Microphone mixer 6 Microphones 2 Speakers 1 8x10 projection screen with controls 1 AV control system 4 Color TV receivers TOTAL $9,000	40 Audio cassette recorder 2 Dissolve units 5 35mm slide projector 5 Filmstrip projector 2 16mm projector 2 Super 8mm projector 5 Super 8mm cartridge projector 2 Slide programmer 2 Overhead projector 2 5' projector screen 4 Reel-Reel tape recorder 2 Opaque projector TOTAL $10,000	8 Video cassette player 8 Color monitors 8" 8 35mm slide projector 14 Stereo cassette deck 14 Stereo headphone amplifier 40 Stereo headphone 4 Super 8mm cartridge projector 10 Rear screen modules 4 Super 8mm sound proj. 2 Opaque projector 4 Sound slide projector 4 Sound film strip proj. 2 Reel-Reel tape deck 2 16mm sound cartridge projector 4 CRT terminals 1 Microfiche Reader/ Printer 2 Microfiche Reader 1 Microfilm Reader/ Printer 2 Microfilm Reader TOTAL $30,000



LEARNING RESOURCES CENTER FLOOR PLAN


DIRECTOR
MULTIMEDIA LABORATORY
BOOKKEEPER
SECRETARY
SENIOR PRODUCER (WRITER/EDITOR)
SENIOR TV DIRECTOR
SENIOR ENGINEER
SENIOR CINEMATOGRAPHER
SENIOR DESIGNER
PRODUCTION TYPIST
ASSISTANT
PRODUCER
FACILITIES MANAGER
TV DIRECTOR
ENGINEER
CINEMA-TOGRAPHER
PHOTO-GRAPHER
ARTISTS
CARPENTER
ASSISTANT PRODUCER
ASSISTANT TV DIRECTOR
ASSISTANT
ASSISTANT
ASSISTANT
SECRETARY
STUDIO CREW
STUDENT ASSISTANTS
STUDENT ASSISTANTS
ASSISTANT


DIRECTOR
COMPUTER LABORATORY
STUDENT ASSISTANTS
RESEARCH ASSOCIATES
PROGRAM DIRECTOR
SYSTEMS DIRECTOR
PROCTORS
COURSE WRITERS
PROGRAMMERS
CODERS
SYSTEMS PROGRAMMERS
SYSTEMS ANALYSTS
OPERATIONS ANALYZER
OPERATIONS SUPERVISOR
OPERATORS


DIRECTOR
LEARNING
RESOURCES
SECRETARY
LEARNING LAB
MANAGER
MATERIALS
MANAGER
ASSISTANT
ASSISTANT
MATERIALS
MANAGER
STUDENT ASSISTANTS
STUDENT ASSISTANTS

VII. PRIORITY DEVELOPMENTAL TASKS

There are several key aspects that must be addressed when developing a Center for Educational Technology within a particular university or some other special environment. Of primary importance are the initial tasks that must be completed in order to determine: appropriate relationships with other entities within the environment; needed resources; and, time and cost requirements. The specific tasks will, of course, vary according to the type and location of such a Center. Therefore, no attempt will be made here to identify tasks as related to a particular Center's needs. Rather, general tasks are stated that would enable a National University to identify priority considerations, problems, and needs necessary to establish such a Center. The tasks, as they are listed below, do not necessarily imply a priority or chronological order of accomplishment.

Tasks

1. Secure approval of the University and a National Department or Ministry of Education, and develop the essential policies for establishing the Center. This would include defining general program emphasis and initial authority relationships and responsibilities.

2. Define the interrelationship of the Center to the general environment in which it will be located (i.e., University). This should include the establishment of an Advisory Council representing members from strategic University and governmental departments.

3. Analyze available resources (i.e., staff, equipment, space, etc.).

4. Determine the scope and parameters of the Center program to be developed.

5. Analyze the nation's educational developmental needs.

6. From these needs, deduce and state the general objectives of the Center and the general objectives of each Center program. Consideration should be given at this point to the input and output of the program in terms of numbers and types of personnel to be trained.

7. Analyze and determine needed Center resources in terms of staff, equipment, space, costs, etc.

8. Prepare a development plan outlining the sequence of tasks to be performed and the estimated time and financial requirements of each.

9. Determine interface needed for the initial developmental activities (e.g., outside consultants needed, visits to other programs, continuing technical assistance, etc.).

10. Using data from all analyses, developmental plan, and any outside assistance desired, prepare a comprehensive document defining the specifics and cost of the total program and each component within it.