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ABSTRACT

The digital computer can perform many functions in the junior college, from instruction through administrative operations and community service. Planning the computer center for institution-wide service requires particular attention to feasibility, organizational structure, staffing, physical planning, and financial implications. Depending on the extent of application and use, the cost of computer services will range from a few hundred to several thousand dollars per month. The computer can be the subject of instruction; in response to the demand for programmers by the computer industry, the junior college should establish a 2-year program of computer instruction culminating in an Associate degree. The program should be geared to the employment market two or three years after its inception. A junior college can provide the first two years of preparation for many computer related areas. In these cases, transfer requirements must be considered. The computer can also be a tool of instruction in mathematics, statistics, physics, and engineering, where it operates as a rapid calculator. In other areas, student and computer interact to perform drills and exercises. The computer can aid instructors in test preparation, scoring, and bibliographic searches. It can also greatly facilitate administrative procedures, including student registration. Sharing the cost of a computer with other nearby institutions may be desirable for small colleges. (MS)

The Computer and the Junior College

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Preface

This publication was developed by the Occupational Education Project of the American Association of Junior Colleges, with the assistance of the W. K. Kellogg Foundation. The Project expresses the Association's deep interest in providing guidance to the junior colleges involved in the development of occupational education curriculums.

Because of the nature of the modern computer — its versatility and use by many elements of the college — the National Advisory Committee thought this booklet should provide a setting for planning in the junior college. The Computer and the Junior College, *then, is not limited to a discussion of the computer and occupational education but instead seeks to provide a context in which decisions regarding the computer can be made campuswide.*

The Association later will develop other more specific publications to accompany this booklet, focusing on the occupational curriculum, facilities implications, etc.

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CONTENTS

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I. Perspective

By far the most [illegible] computer utilization is [illegible] systems design and [illegible]

The importance of the computer in today's community college cannot be overemphasized. The scope of its use must include every facet of operation from education and instruction through administrative operations and community service.

The report on *Computers in Higher Education,*[1] prepared by the President's Science Advisory Committee, emphasizes the role of the computer in the following excerpts:

- ☐ In all parts of education, government, or industry, digital computer use has come about because it is an effective tool.
- ☐ In attempting to assess the educational need for computers in colleges and universities, we find ourselves compelled to believe that within a decade essentially all university and college students will require some basic understanding of digital computation.
- ☐ Every such institution will require on its staff enough faculty with computer experience to teach computer use and provide computer experience in various disciplines.

National growth

In 1959, the annual value of computers used by business, industry, and government was approximately $500 million. By 1969, that figure had grown to over $4 billion, and projections indicate that the value of computers shipped to business, industry, and government will exceed $4 billion a year for the next several years.[2] In 1959, fewer than 50,000 persons were employed in the nation's computer centers; in 1969, nearly 500,000 people were working as machine operators, programmers, and systems analysts. It is estimated that between 1969 and 1970 more than 120,000 persons will be needed to fill the rapidly expanding job market in America's computer centers.[3] The personnel shortage is acute. In a recent issue of *Business Automation* it was stated that the most serious problem confronting the data processing industry today is the shortage of experienced practitioners.[4] The community college must accept the challenge and help fill the need through sound technical education programs in business data processing. Furthermore, this contribution to the welfare of the nation will be more than just economic as indicated in the report on *Computers in Higher Education:*[5]

- ☐ Computers and computing are simultaneously an American resource and a challenge to America. Here indeed we have a lead on the world, a lead which gives us an intellectual as well as an industrial advantage.

Since we are living in the age of technology and change, it becomes readily apparent that the cause must also be the solution. Education should and will use the computer and allied technology to more effectively meet the needs of society; so the real question becomes not "if" or "why," but "how"?

The rapid growth of computer utilization has in effect prevented needed time and study to develop the answers that would prevent wasteful duplication and repetition. We are actually living the history of the past fifteen years, and, like any living history, it is fraught with many myths, untruths, and unsolved problems. Similar to other problems, those connected with computer utilization are partially solved through definition and the discussion of appropriate questions that lead the way to solution. Those two elements, that of definition of the problem and the discussion of the relevant questions, form a major portion of this manual.

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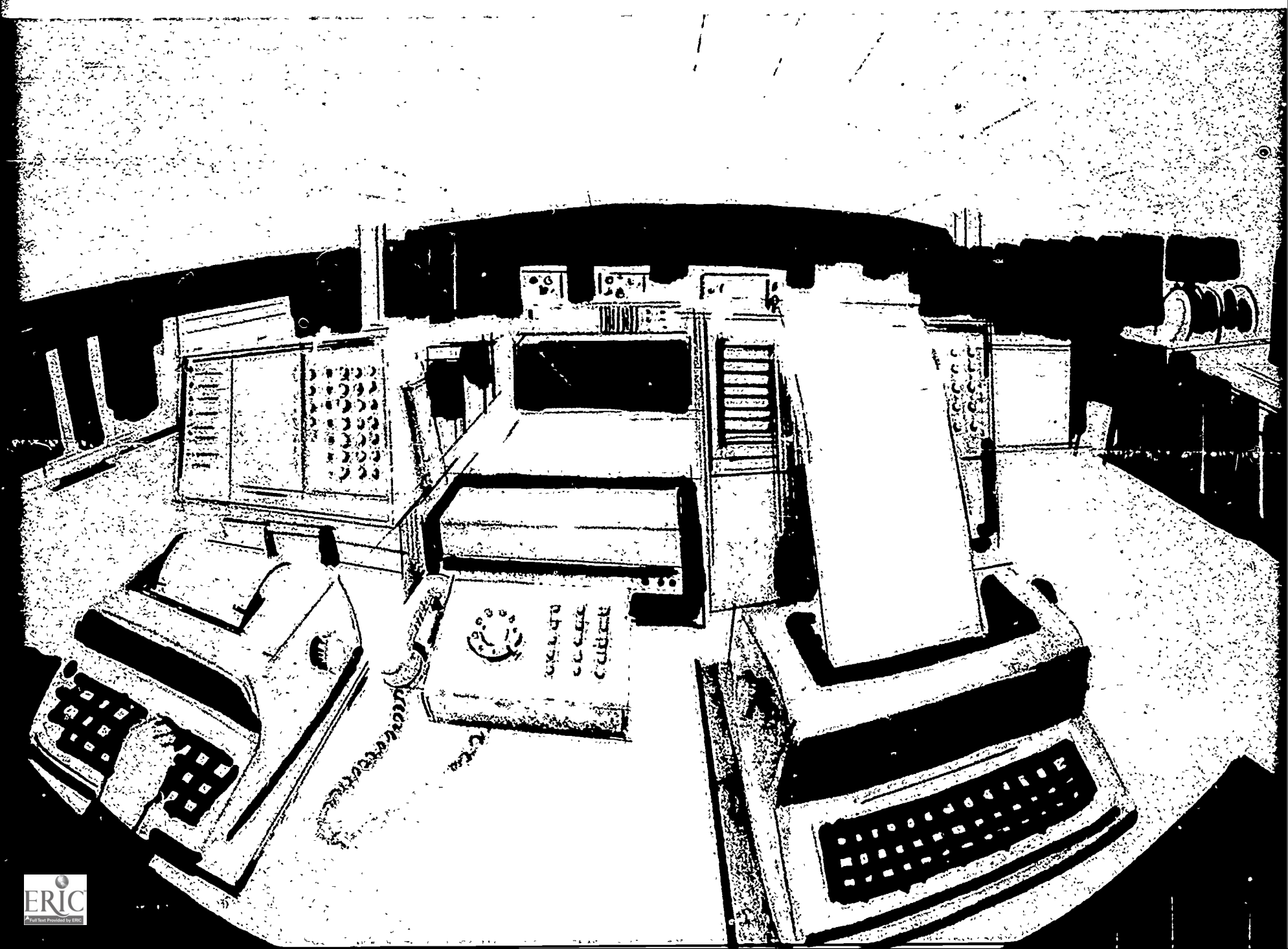
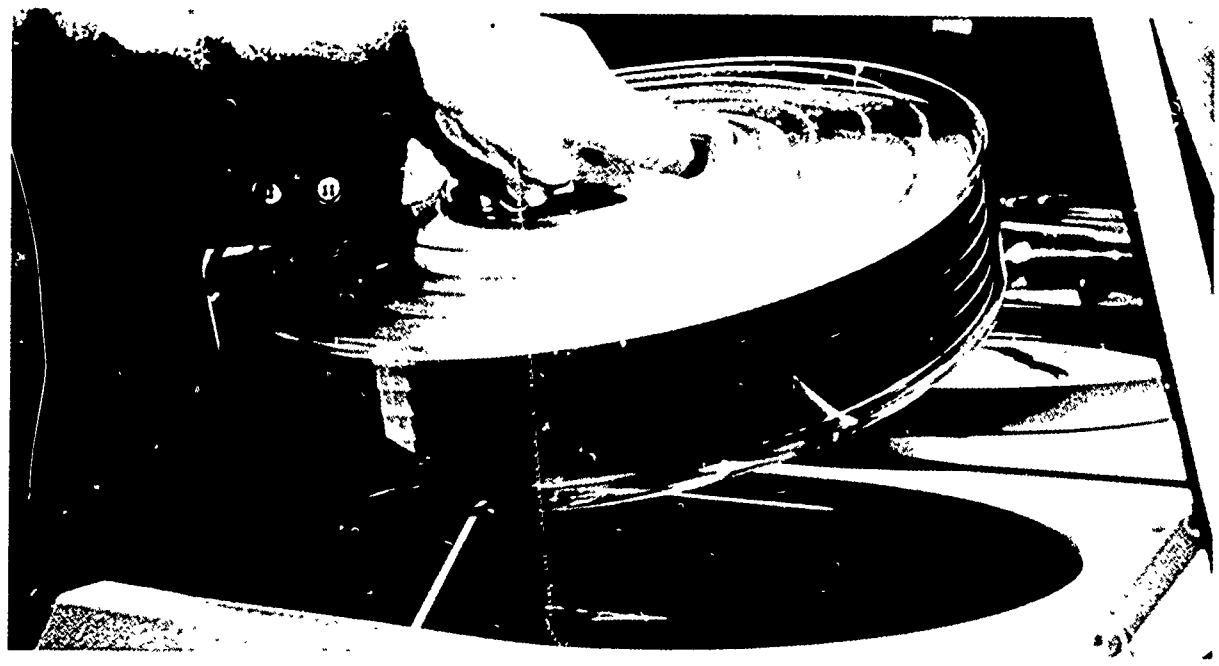
[1] President's Science Advisory Committee, *Computers in Higher Education.* Washington, D.C.: U.S. Government Printing Office, 1967.

[2] *Computer Education Directory, 1969,* Pasadena: Data Processing Horizons, Inc.

[4] Drattell, Alan. "The People Problem." *Business Automation* 15: 11; November 1968.

[5] Op. cit., p. 2.





Even with the different specific subjects, it becomes readily apparent that there are several central themes or overall facts and concepts that are reasonably always true. Among these are the following:

1. By far, the most critical factor for success or effective computer utilization is competent professional personnel, especially in the area of systems design and application implementation.

2. Concurrently, the most often overemphasized element of utilization is the equipment, especially a specific computer or type of hardware.

3. It is both possible and practical for the same computer system to be an instructional and administrative tool.

4. Dollars and time invested in planning are returned manyfold in effectiveness and economy of utilization.

5. All educational activities and functions are directly affected by computer utilization, both on and off the college campus.

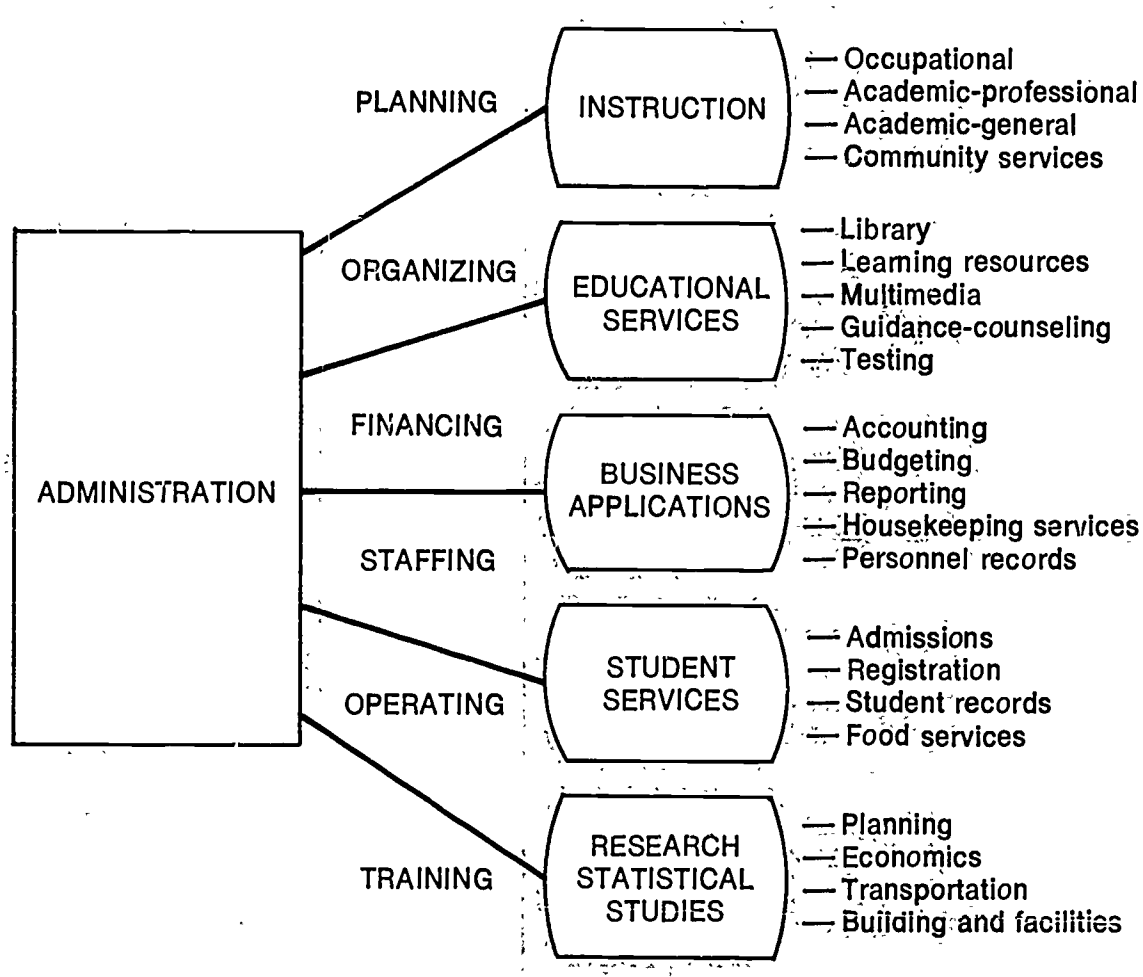
6. It is necessary for all college officials, administrators, and professional persons to become actively involved and educated as to "how," "why," etc., to obtain maximum efficiency.

7. Specific organizational plans for new institutions and organizational structure changes for established institutions are necessary to obtain desired computer effectiveness.

8. Administrative philosophy of the use of computers is more critical than the technology itself.

9. Information processing and computer-technology services necessarily must be centralized. This fact is becoming more vital as new, more powerful and flexible equipment is becoming available.

10. The computer utilization function is tending to move higher in the organizational hierarchy and is somewhat neutral in the sense that it is not specifically functional such as administration, instructional, etc. (Centralization and hierarchical location do not necessarily mean centralization of decisions or authority — only service.)



The sophisticated equipment and the technical and professional staff involved in the college center operation will represent a substanial portion of the general operating budget of the college. If this investment is to return maximum benefits to the college, careful attention to adequate preplanning is essential.

The concept of the computer center as an institution-wide service agency has several implications and considerations for planning. ***Five of the most important considerations, which will be discussed in detail, are: feasibility, organizational structure, staffing, physical planning, and financial implications.***

Feasibility

Initial consideration revolves around early preplanning. The planning is not for the computer or how it will be used, but rather should it even become a part of your institution? In other words, is it feasible to utilize a computer on my campus? The rest of this document describes in some detail how to organize, implement, and operate a campus-wide computer center. Our first concern, however, is how one goes about determining if a computer is an absolute necessity. Even though statistics indicate the need for computer-related personnel, it may not be within the capabilities of every institution to attempt to produce such individuals. And even though computer processing of administrative records is acknowledged to be an entirely desirable and economical undertaking for most institutions, it may not be true for your campus. What then, should you do to determine the feasibility of a computer at your institution?

Team visits seem to work extremely well, including on the team, representatives of administration, instruction, service personnel, and policy makers.

First would be to read and try to understand this book and others related to or referenced by it. Through this effort you will become familiar with the major considerations involved in operating a computer on a community college campus.

Secondly, visitations to similar institutions and talking with other college administrators will provide insight into problems and advantages associated with the computer. Team visits seem to work extremely well, including on the team, representatives of the adminstrative, instructional, service and policy-making areas of your institution.

Establishing a community advisory committee is an additional activity which is strongly recommended. As you will see later in this document, a data processing advisory committee is recommended to assist in the review of the ongoing program. The committee referred to here is suggested to be different, in the sense that its function is not to evaluate the performance of an operating center, but rather to gather certain information relative to the feasibility of establishing a computer center. Representatives should come from the community at large, the institution, and generally follow the AAJC guidelines established for the use of such advisory committees. *(Refer* to AAJC publication *the Role of the Advisory Committee in Occupational Education in the Junior College.)* These objectives should be clearly understood and the function fulfilled through a final report containing the committee's recommendation. The committee should be discharged, with a new one formed -- if and when a computer is selected. It is possible, in fact desirable, that members of the feasibility committee become members of the data processing advisory committee.

Using outside consultants to conduct a feasibility study and make recommendations on the utilization of a computer is another step which is suggested in reaching a decision. Many have found that the advisory committee functions well in this role, but others have found that more extensive and detailed analyses need to be made. Initial observations may suggest that a computer is not necessary, but through in-depth analyses, particularly in the operation of a management information system, justification in both cost and production suggest that consideration be given to a computer. Many studies have shown that access to a computer is a necessity, and that access may be obtained through service bureaus, time-sharing services, or regional education centers.

If you already have a computer, then the decision on its relevance and importance to your educational program has already been made. If a computer is still in the planning phase, individual study, visitations, advisory committee and outside consultants may be necessary in order to utilize and honestly determine the feasibility of a computer on your campus.

Organizational Structure

Formal Organization

Establishing the organizational structure for computer operations on campus is the second major planning consideration. Perhaps no other single factor will have more effect on the successful implemention and operation of computer technology on campus than the organizational environment in which the data processing, administrative, technicai, and teaching staff work. Obviously, the lines and boxes on a formal organization chart will not automatically insure a successful operation. Yet, other factors being equal, improper organization of people can inherently destroy any potential for a successful operation.

- **Organizing for Administration**

The organizational structure of any institution is established for the specific purpose of accomplishing the objectives of that institution. The major objective of the college computer center should be "institution-wide integration of computer services." The placement of the computer center within the organizational structure must, therefore, reflect this objective.

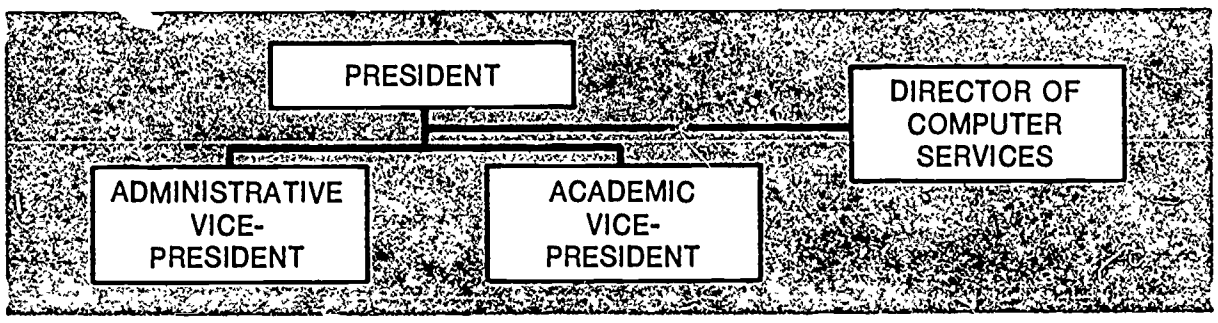
The Center as a Staff Unit

In view of the variety of administrative and instructional applications of the computer center resources, a "service agency" function for the center readily becomes evident. It is suggested that this service function can be accomplished best by establishing the computer center as a staff department rather than as a line unit. Furthermore, the staff function should be placed in the upper level of the college administration with the director of computer services reporting to the president as shown in the chart. The primary advantages of this structure are:

1. The director of computer service does not report to a line department, such as the business office, registration and admissions office, or an instructional department, which may have a vested proprietary interest in a single function of the college. Therefore, the director will be able to allocate better the center's machine and personnel to the needs of the institution.

2. The resources of the center are under a single administrator who is in a position to work with all departments to determine needs, both present and future, and establish a master plan for development, implementation, and expansion of the computer center.

A typical structure with illustrative titles is depicted below.



Line Authority Within Center

Under this structure the director of computer services has line authority and responsibility within the computer center. All operational, programing, systems, and supervisory staff will be responsible to the director.

Implementing computer services within the institution can result in problems arising from normal resistance to change, automation, and computers. The use of an internal committee composed of representatives from instruction, student services, administration, and the computer center director can provide valuable assistance in meeting this resistance. Such a committee will tend to offset his lack of line authority over various departments and divisions. In addition, it is a useful mechanism for communication and "getting others involved."

The instructional staff, under the suggested organizational pattern, would not necessarily be directly responsible to the computer center administrator. The major concept of the structure is one of providing a central resource of technical programing and systems staff, and computer capabilities for all instructional, administrative, and community service functions of the college.

- **Organizing for Instruction**

The organization of instructional personnel is obviously dependent on the institution's concept of total organizational structure. No single method necessarily will produce the same results within given institutions, for the ingredient mix will vary from one to another — the ingredients being the institution's operating philosophy, the needs that accrue from this philosophy, and the people that implement the philosophy. Regardless of previous organizational concepts in vogue, it is imperative that substantial thought be given to the following organizational questions:

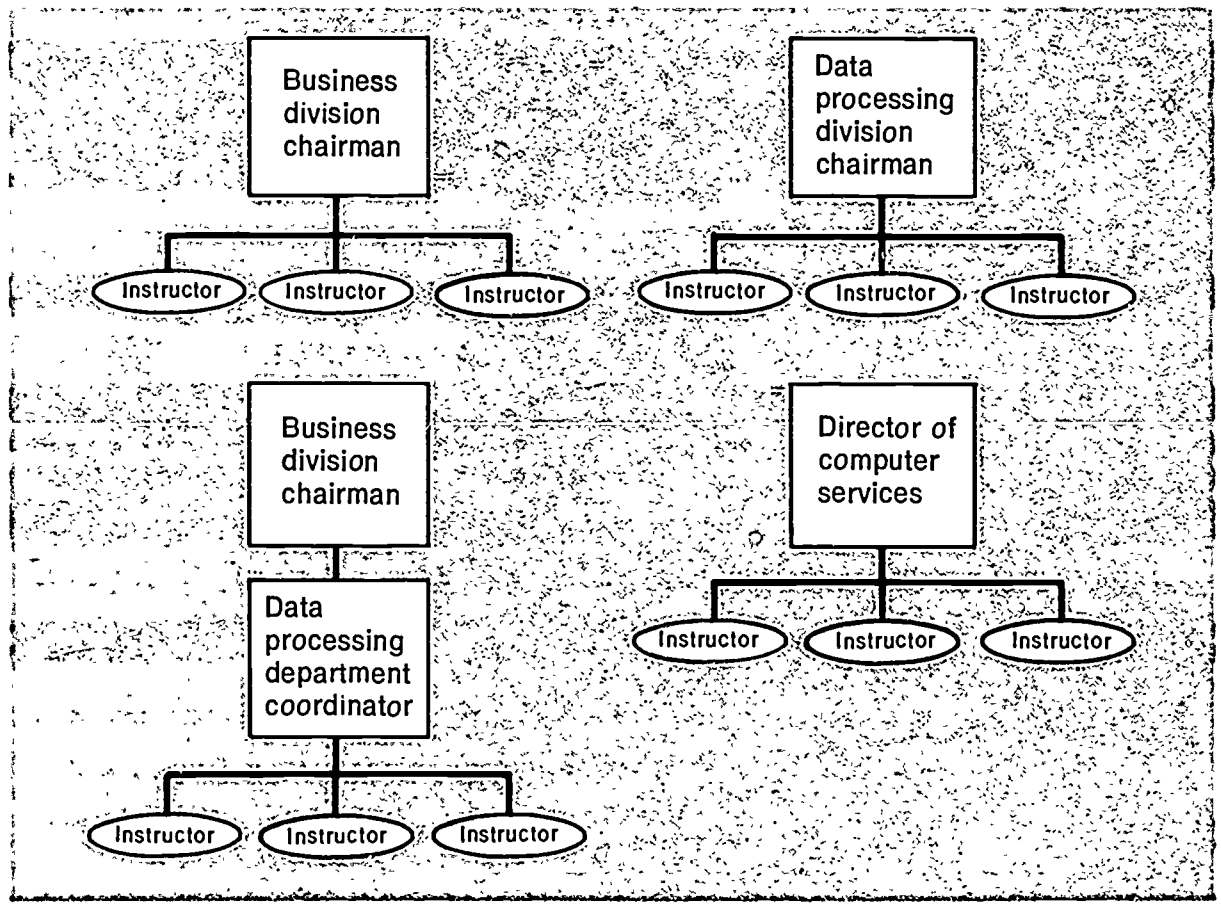
Questions to Answer

Who will have responsibility for the technical-occupational program, commonly referred to as "data processing?"

Who will initiate and coordinate the use of the computer in disciplines other than data processing?

Whose responsibility is it to see that all students are exposed to the computer and its uses — perhaps the requirement of an introductory course in computer fundamentals?

Traditionally, organizational structures have been oriented only to the technical-occupational program in data processing. There have been four distinct organizational plans for instructors in this area, structurally conceived as follows:



The above frameworks have been successful in various colleges, but each administrator must examine and analyze these approaches within the framework of his organizational philosophy.

Although the technical-occupational program in data processing is a desirable and necessary program involving computer utilization, it should be considered only one of the areas of computer use. Computer utilization in instruction appears to be evolving as a discipline in its own right; it should be administered as a discipline, most likely as a separate division. Its use in instruction includes both occupational and transfer programs.

The treatment of the computer as a discipline, permeating the entire instructional program, raises questions of organization as mentioned above. Perhaps the answers can be found with an approach that achieves a coordinated effort to solution. Since the dean of instruction has responsibility for all instructional programs, an internal advisory committee on the "computer in the curriculum" could be formed to provide the dean with suggested solutions. Committee members should include the director of computer services, instructors from courses using the computer, an administrator concerned with curriculum development, and interested faculty from any discipline.

The objectives of such a committee would be concerned with total integration of the computer into the curriculum and the organizational structure most suited to effective implementation. The answers are not easy, but a coordinate approach will elict the participation required for overall computer utilization. An organizational structure best suited to your institution will result.

Teaching is a full-time responsibility; likewise, planning, developing, organizing, and operating administrative computer services are all full-time responsibilities.

Staffing

Staffing for data processing personnel, be it administrative or instructional, has the same goals as staffing for any other position: Find the best qualified person for the job, with consideration for operating philosophy and budget capabilities. The achievement of these goals for data processing, however, can be a formidable task due to two factors somewhat unique to the profession:

- ☐ *The rapidly changing environment the data processing industry is experiencing.* In the short span of 10-15 years, the computing equipment has gone through three "generations" of changes. These technologial advancements have caused concomitant skill advancements required for personnel. In addition, as more sophistication in application and use of computers is attained, more talent and sophistication is required by the users.
- ☐ *An unprecedented demand by industry for all levels of computer-oriented expertise* ranging from keypunch operators through computer operators, programmers, analysts to data processing management. As is usually the case where demand exceeds supply, salaries have kept pace with the rapid growth, and have attracted much diverse professional and nonprofessional talent into the data processing environment.

As a result of these conditions, administrators are forced to explore many facets to attract, train, upgrade, and retain personnel. What factors must be considered? How do you find — and keep — the right personnel?

• Staffing for Administrative Computer Services

Avoid Dual Roles

One of the most critical aspects of establishing administrative computer services is that of staffing — particularly adequate and timely staffing. The staff responsible for developing, implementing, and operating administrative information systems will be technical as opposed to instructional personnel. Individuals with technical skills in systems analysis and design, computer programing, computer operations, and keypunching and clerical functions will comprise the staff. It is important that staff responsible for developing administrative system not have teaching responsibilities. Experience has shown that situations in which instructors are given part-time responsibility for administrative systems development frequently result in highly fragmented, inefficient information systems. Teaching is a full-time responsibility; likewise, planning, developing, organizing, and operating administrative computer services are all full-time responsibilities.

Employ Director Early

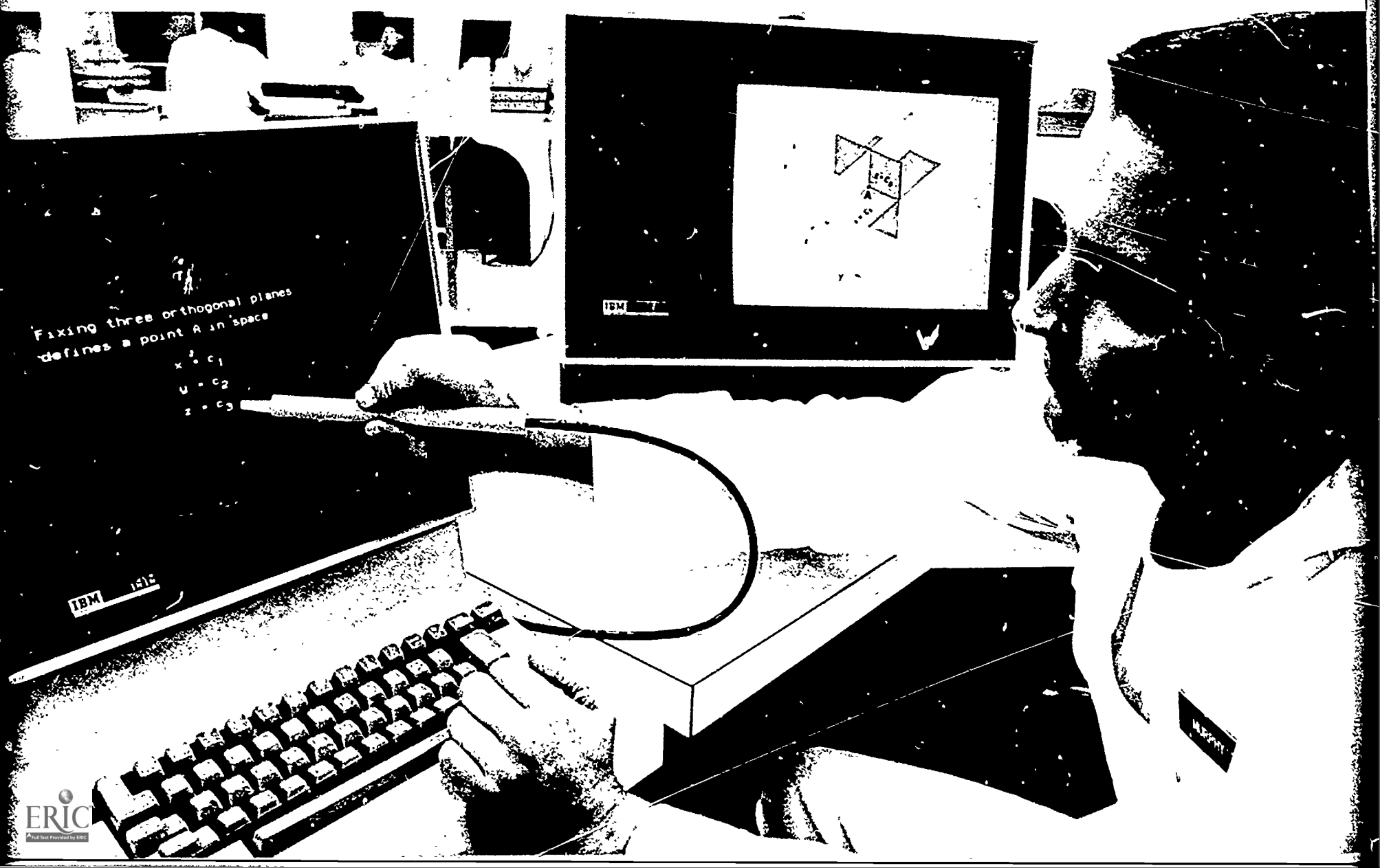
The time to employ key administrative and technical staff is well in advance of the installation of equipment. The director of computer services should be employed very early in the initial planning stages. His technical knowledge certainly will be needed in determining the general role and function of the computer in the institution, in planning the physical facilities, in selecting equipment, and in organizing the computer center. It is recommended that the director be employed *at least* a year in advance of the delivery of equipment.

Systems analysts and programmers should be employed from six months to a year in advance of installation of equipment. This time can be profitably invested in systems development activities which will enable the college to begin using the computer for administrative information processing soon after the equipment arrives. Also, in a new institution, this approach can eliminate the time and effort spent on developing manual reporting systems and then a year or two later, having to redesign the system for computer application — a cost savings to the institution.

The number of staff members needed will be a function of the number and complexity of administrative services and information systems to be developed and implemented, and the time limit set for development and implementation.

One word of caution is relevant at this point. Proposals for computer equipment often include an agreement to supply systems and programing personnel to assist the college for a period of time. Vendor systems and programing personnel can and should be important resources for training college employees — both instructional and administrative technical staff. The systems and programing personnel of the vendor also can provide valuable advice and consultation in the design of college information systems. However, there are inherent hazards when a college relies fully upon vendor-supplied personnel to design and program administrative information systems. Vendor personnel are often not familiar with educational administration and organization and often are working under company pressures to complete the task and "move on to the next account." The net result may be a system which is inadequately designed, inefficient in operation, and insufficiently documented — value returned commensurate with value invested.

Computers help with simulation and gaming models as demonstrated by this midshipman at the Naval Academy in Annapolis.



- **Staffing for Instruction**

Unexpected Implications

In staffing for computer instruction, the high level of technical experience required and the continual retraining facing the instructor must be considered. Technological changes in the computer industry are not similar to the changes made by community college mathematics in the early 1960's. That change involved some terminology and a few new concepts with the majority of course content remaining the same. With a technological change, the curriculum must be completely revamped. Courses will be deleted and new ones added. The remaining courses will be modified both content-wise and philosophically. The instructor who works from last year's notes is inadequate, and the one who plans to set up a course and use the notes for the next five years is unacceptable and a detriment to the program.

Industry vs. Teaching

Another condition precipitated by the rapid growth of computer technology is the demand for trained personnel by industry. Many instructors who gained a measure of technical competence were lured away from education by more attractive salaries and administrative positions. The search begins anew. The problem is acute and will continue to be.

Staffing for computer use in instruction can be partitioned into three categories — recruitment, training, and retention:

1. *Recruitment*

Other Sources

Recruiting instructors for computer programs requires varied approaches; one such approach is to tap the industry's sources of trained personnel. Top salaries are a prerequisite as evidenced by the following advertisement from a recent trade publication:

- ☐ New and growing junior college 90 miles southwest of a large metropolitan center needs data processing instructor in two-year curriculum which trains programmers and programmer-analysts. Prefer master's degree and recent business or industrial experience. Bachelor's degree and experience acceptable. Previous teaching experience not necessary. Benefits includes paid hospital and medical insurance, excellent retirement system, academic and cultural advantages of college community. Will join four-man staff in department.

These people will be trained in current systems and equipment but, in many instances, may have difficulty in becoming certified and with pedagogical techniques.

Other sources include moving instructors from other departments or divisions, or hiring from other schools. More than likely, this type of personnel will be certificated and will have developed the teaching skills but will be faced with learning a new discipline.

The Prospective Instructor

For the administrator who is initiating a new instructional program, the question must arise — "How do I select a qualified and capable staff if I have no one on the staff who knows or understands the field?" Two possible solutions could be:

Organize an advisory committee (refer to AAJC publication *The Role of the Advisory Committee in Occupational Education in the Junior College* for information). Use the members of the committee to assist in interviewing prospective staff.

Bring in a consultant for a day or two to interview candidates on a scheduled basis. This consultant might be a computer professional selected from the local community or, perhaps even more appropriate, a division chairman from another community college with a successful ongoing program of computer instruction.

If a director of computer services has previously been obtained, he would be the logical one to assist in recruiting additional personnel.

2. *Training*

Keeping Up with Technology

Continual on-the-job training is imperative for all instructional staff members. The instructors not only must be aware of new developments in computer languages and applications but also must be knowledgeable enough in these areas to make judgments as to how, where, and when these new concepts are to be integrated into curriculum. A theoretical knowledge of the equipment and techniques is not adequate in a technical-occupational program. The instructor must master idiosyncrasies of the equipment and language for proper operational procedures and problems the manuals fail to cover. In academic programs, these requirements are not as important.

As the field expands, textbooks lag. The instructor is forced to provide supplementary material and example for his lectures and laboratories. New texts are usually restatements of the manuals with a few examples. For the staff member, the major source of programing techniques and applications are the professional journals and meetings.

With the exception of specialized summer institutes and a few senior college programs, the training of new staff members and updating current staff is limited to manufacturer or vendor schools, programmed-instruction courses, in-services training and team teaching, private computer schools, and independent study.

3. *Retention*

The retention of trained instructors is of vital importance to a successful program; otherwise, you will find yourself a training ground for someone else's benefit. The administration must be willing to support a competitive salary structure for instructors, not only to acquire but to retain competent personnel. Once established, salaries will need to be constantly evaluated to maintain a commensurate status with industry. Surveys made in industry over the past four years indicate an annual salary growth rate of 6 per cent per year for technicians in computer operations.

Salary Schedules

Salaries for trained instructors should be equivalent to what a computer professional in industry would command, dependent on geographic area and complexity of equipment. These salaries are in the upper limits of most community college salary schedules and often place the administration in a defensive position with other disciplines. A dichotomy exists between computer-related instructional staff and other instructional areas and the former has a competitive skill it can sell to industry at any time for equivalent or greater compensation. This is not true for most other disciplines.

Keeping Instructors Updated

Another implication to consider is the fact that instructional personnel in computer technology have very few senior institutions in which to pursue additional training in certain required skills. Although systems training and other skills in computing science are offered, these areas are not geared to the level of instruction in community college programs. Consideration must be given to released time for instructors to obtain training in vendor schools, technical seminars, or independent study.

Student Lab Assistants

A major source of support for instructors may be found in the effective use of student laboratory assistants. They can be a great help in the development of department programs and the devices continually used by the program. The maintenance of student exercise files, supplies, and the stocking and distribution of coding forms and cards can easily be administrated through the use of laboratory assistants.

From an educational standpoint the student assistant may serve as an aid to learning. He is often easier to approach than the instructor. Since the assistant is not involved in the grading process, students find he is easier to ask "silly" questions and will repeat points covered by the instructor. He can act as a screen, intercepting and answering many questions.

Maintaining a staff of laboratory assistants also should be a two-way street. The student assistant should be given ample opportunity to develop and mature on the job. For them the position should invoive a working introduction to system operations. Feedback from these students is an important contribution in developing modifications in the program.

Effective computer utilization in instructional programs, whether occupational or academic, is dependent on a qualified, competent staff; without such, a quality program will not exist.

Physical Planning

Factors to Consider

Physical planning consists of three major elements — planning for student work space and staff offices, planning for facilities to house the computer and related equipment, and selection of equipment.

Some specific considerations can be set forth regarding the location of the computer center on campus. Ease of student and faculty access should be the most important consideration; this would suggest a relatively centralized location. Locating the computer center in the "main stream" of the campus will have the additional advantage of "making the computer an everyday part of campus activity" and thus reducing the aura of scientific mysticism often surrounding the computer.

Ideally, the computer center would be designed as an integral facility occupying a floor or section of a building. Specific square footage requirements for the center will depend upon the number and size of student workrooms, number and size of administrative work spaces, and the general design of the total facility.

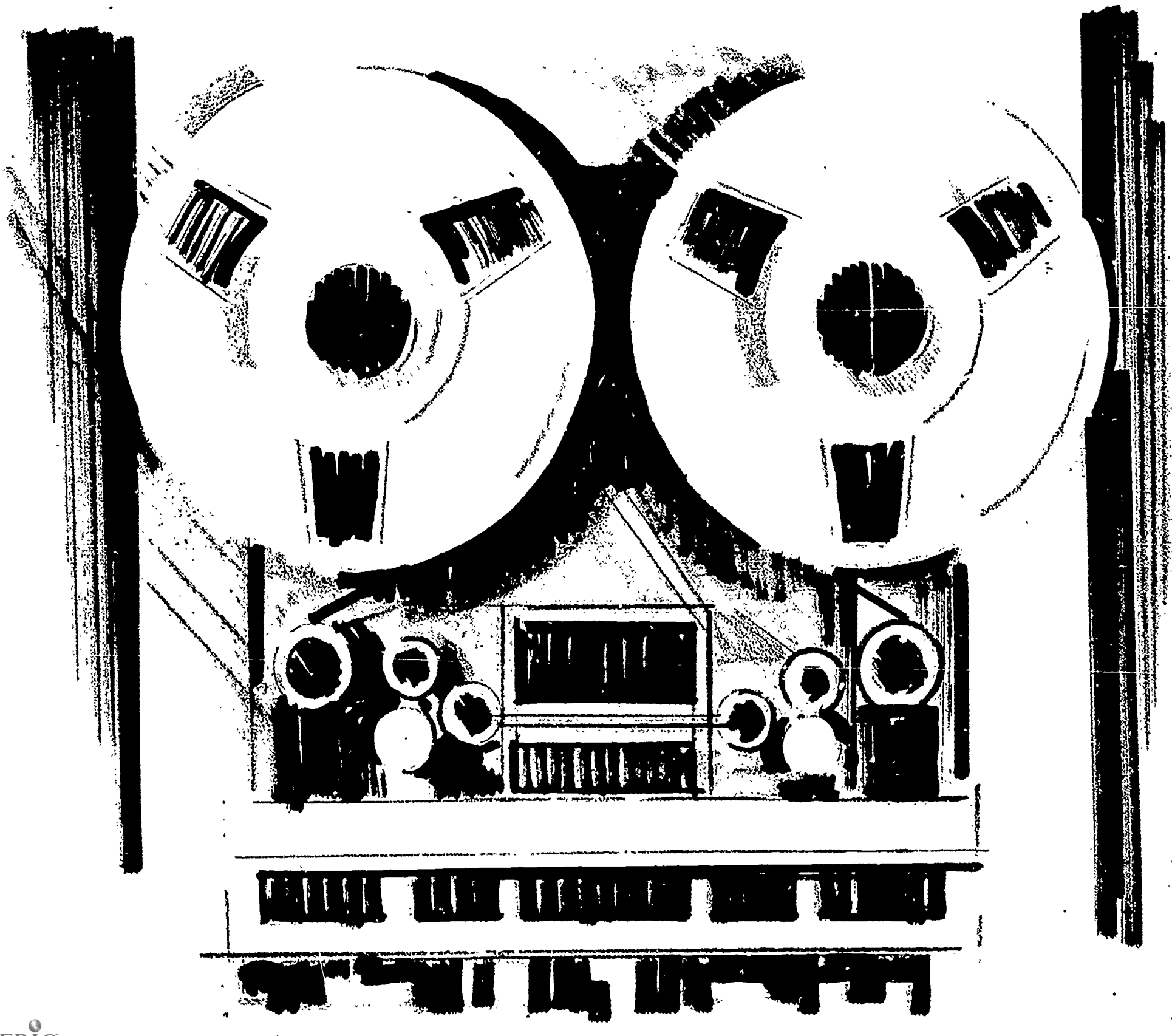
The computer center will house very sophisticated and expensive equipment. This equipment will be used and operated by students, faculty, and technical staff. It is important that a pleasant, efficient working environment for people be a major consideration in the location and design of the facility if maximum production from the machine is expected. Important factors to consider include acoustical control, air-conditioning, lighting, and ample work area.

- **Facilities for Students**

Within the total computer center facility, there is need for adequate work space for use by students as they prepare program material and input data for computer processing. The rooms should be equipped with tables rather than tablet-arm chairs and should be located in close proximity to the computer room for convenience and efficiency. Generally, these rooms would not be used for regularly scheduled classes. In addition, a second room housing keypunches, remote terminals, card sorters, and other card handling equipment should be provided. Because of the noise factor, the machine room should be a distinct separate facility from the general work space described above. Ideally, it would be located adjacent to the general student work room near the computer room.

- **Facilities for Staff**

The second type of space required in the computer center is administrative work space. Adequate clerical work space for coding clerks, keypunch operators, and secretarial assistance must be provided and should be sufficiently large to house card file cabinets and general correspondence files. A work area for systems analysts and programmers separate from the general clerical work area will have to be provided. This space should be in close proximity to the computer room but need not be adjacent to it. Offices for the director or manager and other supervisory staff should also be provided in the computer center. A storeroom for cards, computer forms, and other similar supplies should be provided near the clerical work area. It is important that the storeroom be properly air-conditioned and humidity controlled to minimize problems with card and forms as they are processed on the computer and related equipment.

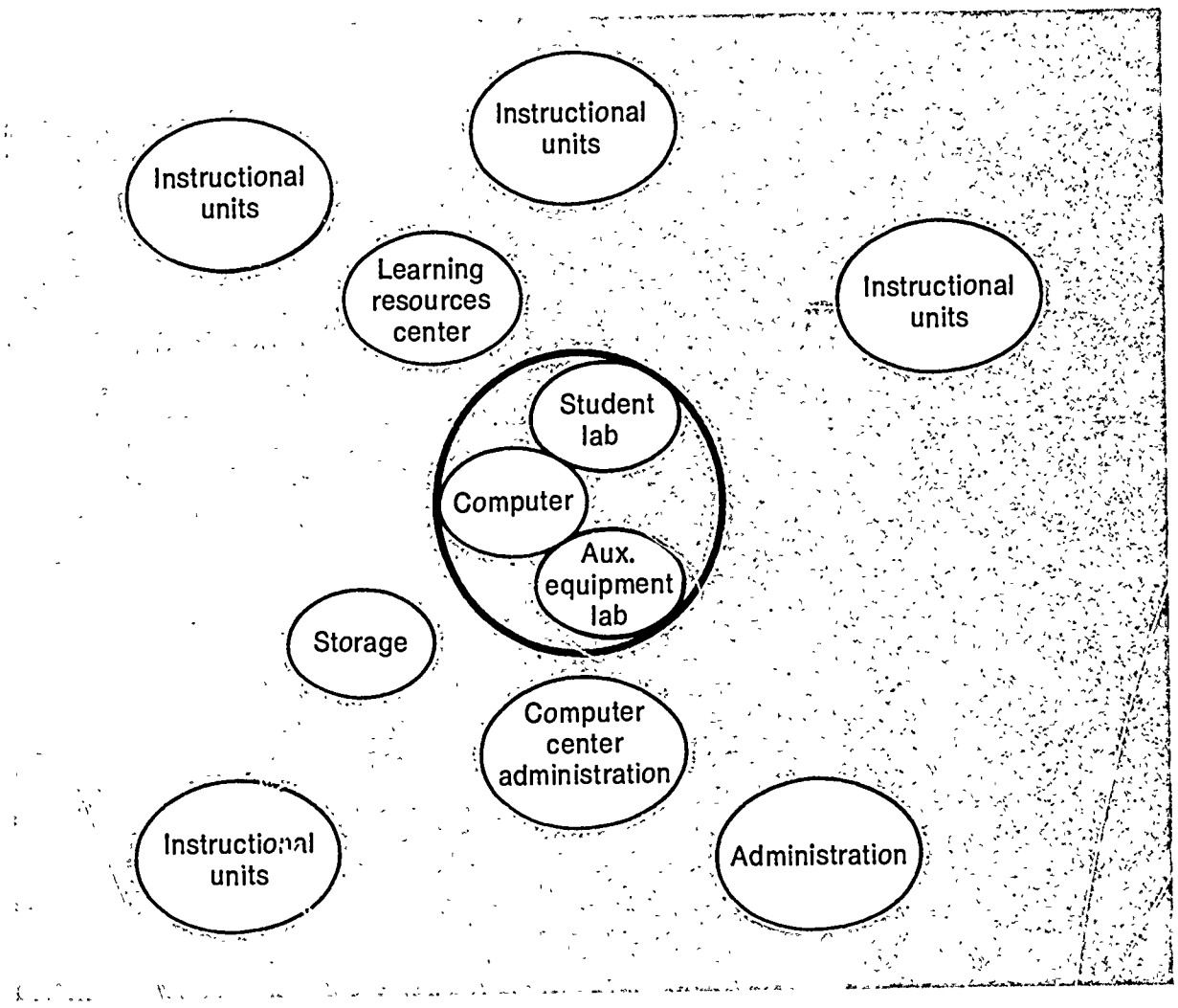


- **Facilities for Equipment**

The third type of space requirement in the computer center is a room to house the computer equipment. This room should be sufficiently large to provide ample space for the computer components, a keypunch, files for programs, and disc or tape storage cabinets. Sufficient space must be provided to allow for group instruction and/or demonstrations to students in various educational programs. Therefore, the college computer room will be larger than the typical industrial or business computer rooms. Oversizing the room initially will eliminate many future problems as the equipment is upgraded to larger capacities.

Properly raised flooring for cable connection of various system components, adequate air-conditioning and humidity control, adequate electrical service, and good lighting control are essential elements in the computer room design.

Computer equipment vendors provide specifications for electrical service, air-conditioning, and humidity control requirements for their equipment. However, at best these are minimum standards and should be adjusted upward for the educational environment.



- **Selection of Equipment**

Needs Determine Equipment

Selection of computer equipment must receive careful attention from the faculty, administration, and board. Many technical details are involved in selecting computer hardware. Therefore, it is recommended that the director of computer services assist in all planning activities.

The specific size and type of computer system for a given college will be related to total institutional needs. Obviously, these needs vary from one institution to another and, therefore, a "cookbook" approach to the selection of computer hardware is not advisable.

An outside consultant can provide valuable assistance during the planning phases even if the college has its own technical staff.

The process of selecting computer equipment consists of three general steps — determining the institution's needs for computer services; preparing specifications for vendor proposals; and analysis of proposals and final selection.

The first step is to prepare a plan of all uses and applications of computer technology for the entire institution. This includes not only the specific uses but also the approach that is used in providing computer capabilities to the user. The use of remote terminals is an example of one factor that will affect directly the type and size of the computer system needed.

Three Factors Affecting Capacity

After needs have been determined, three major factors affecting capacity must be considered:

1. Time — the length of time that it takes the computer to do the work — hence, the total amount of work accomplished in a given time period

2. Variety — the number of different kinds of tasks you expect the system to perform

3. Volume — the amount of work that must be performed in a given time period.

The second step is that of preparing detailed specifications to be used by vendors in submitting proposals for hardware. Careful attention in preparing specifications will eliminate many problems encountered in attempting to analyze vendor proposals. The specifications will, at a minimum, include technical details on minimum acceptable performances capabilities of the hardware. In addition, the proposal specifications must include an explanation of planned application and uses, and details on auxiliary services to be provided by vendor, such as staff training and technical assistance during and after installation.

The third step involves analysis of vendor proposals and ordering of equipment. The analysis of proposals is extremely important and requires the talents of an individual with considerable background and experience in computer systems. If the college does not have a technically qualified person on its staff who can perform the analysis of proposals, the use of an outside consultant is highly recommended. It is suggested that an outside consultant can provide valuable assistance during the planning phases even if the college has its own technical staff.

Other Equipment Needed

In addition to computer hardware, other items of related equipment will be needed. Keypunching machines, card sorters, forms bursting and decollating machines, special purpose storage cabinets, card files, and general office furniture are examples of related equipment needed in support of the computer. Initial units of these items should be ordered for delivery at the time the computer is installed.

Financial Implications

The cost of providing computer capabilities on the campus will range from a few hundred to several thousands of dollars a month. The exact cost will depend upon the extent of applications and uses, the resulting computer hardware needed to provide these services, and the availability and cost of technical personnel in the immediate college area.

Instructional Needs

The size and characteristics of the computer provided for instruction in the technical-occupational curriculum will be determined, to some extent, by the requirements of the potential employers of the graduates. Specifically, if the college expects to teach programing fundamentals, higher-level languages, and operating systems, it must have a computer of sufficient capacity to accomplish these objectives.

Other factors to consider are:

1. What is the extent and quantity of administrative services to be provided by the computer center?
2. What will be the volume of the work load for these administrative services?
3. How will the institutions information system design affect the size and type of equipment needed?

Once the needs for computer services on campus have been determined, they can be translated into cost factors through the capacity of the equipment necessary to meet these needs — the larger and more sophisticated the system the more it will cost. There is also a direct relationship between the amount and capacity of computer equipment and the size and complexity of the physical facilities needed to house the equipment — facilities also cost money.

Commitment to People

Perhaps the single most underestimated aspect of information systems is the commitment that has to be made to the people who staff the system and the time they need to make the system truly productive. Computers cannot be simply plugged into the wall and started. In planning the acquisition, one must expect to pay *as much* for the people as for the machines — perhaps more if the system is a small to medium-sized one, or less if the system is very large. This commitment *should not be minimized*. Plan to begin the system planning before the computer arrives and expect that the costs of writing programs will always be a substantial part of the financial obligation. An expensive computer will not satisfy the needs of the institution if it is being handled by an inexpensive or inadequate staff. The cost of directors, analysts, and programmers is related to their talent, initiative, and experience. Since computer employees are in high demand, salaries are often higher than for other members of the college staff. Faced with the institutional needs and the desire for effective computer utilization, the obvious questions are: How much is needed? How much can we afford? The answer is — acquire as much computer as can be profitably used for a two- to three-year planning period. At the same time, also plan for the next system and anticipate how it will be integrated into the overall growth of the institution — both financially and physically.

Plan Ahead

The financial investment represented by the computer facility and personnel will provide many benefits to the institution. Undoubtedly, the greatest benefit will be in the educational program. The report on "Computers in Higher Education" makes this point quite clear in the following excerpt:[6]

Benefits

- We believe that undergraduate college education without adequate computing is deficient education, just as undergraduate education without adequate library facilities would be deficient education.

The use of the computer to provide technical education programs will open up many rewarding and worthwhile career opportunities for the students. This benefit is immeasurable. Not only will the student benefit but the business and industry in the community will benefit as well from the manpower resource the programs will provide.

The use of computer technology in the administrative service area will benefit the college by providing information for better decision making. Information properly applied in the decision-making process will enable the institution to more fully utilize its financial, facility, and faculty resources in the educational processes. Long-range planning will be improved through the use of sound information upon which to base projections and forecasts for future physical and financial growth.

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[6] Report of President's Science Advisory Committee, *op. cit., p.* 10.

III. Instruction

When industry changes, the technical program must follow suit or lose its training capability.

How can the computer be utilized effectively in instructional programs in the community college? To answer this question, we need to reexamine the purposes and/or objectives of an educational program which would harness the power and versatility of the computer and utilize its capabilities and talent most effectively.

We can think of the computer as a dual personality in the instructional program. Its dominant character is portrayed as a "subject of instruction," but another important trait does in fact exist — the computer as a "*tool for instruction.*" To effectively employ the computer in the instructional programs, we must tap the full resources of both personalities.

Program Goals

In examining the purposes or objectives of an educational program utilizing these resources, goals can be described as one or a combination of the following:

1. Technical-occupational preparation for job entry upon completion of the one- or two-year programs
2. Preparation for transfer to senior institutions leading to a baccalaureate degree
3. Preparation for students using the computer as a "tool for instruction" in a variety of disciplines not often associated with computers. This use is effective in both technical-occupational and transfer programs.

The Technical-Occupational Program

To be responsive to community needs, which are precipitated by the demand for programmers caused by the unprecedented growth of the computer industry, the college should place a high priority on establishing a two-year program of computer instruction culminating in an associate of arts degree. In this program, the computer would serve as a "subject of instruction."

Program Objectives

Program objectives could be defined as:

1. To prepare the student to be competitive in the labor market and productive on his first job
2. To provide the educational foundation to enable the student to learn and master new equipment and systems to which he will be exposed during his career.

Due to the dynamic growth of the data processing industry and to the technological improvements constantly developing, the planning of the technical program must be a continual process. During the last fifteen years there have been three generations of computers and computing systems introduced. The arrival of the fourth generation is imminent.

These technological changes have produced faster, more powerful computers with decreasing costs for equivalent capabilities. These rapid changes in computer systems affect the technical program more than any other program of the campus computer users. The training objective of the program requires access to computers and systems which are currently in use. When industry changes, the technical program must follow suit or lose its training capability. Past history indicates a major industrial change each five years. Therefore, major curricular changes will be required each five years if the program is to meet its training objective. The planning of the technical-occupational program can be divided into two phases: initial program planning and curriculum modification planning.

- **Initial Program Planning — Curriculum Content**

Planning a Good Program

The initial curriculum should be designed to match the employment market two to three years after it's inception. It should not be designed to meet the needs of the marketplace last year or guidelines published by some agency five years ago. A satisfactory device for measuring the employment demands two years hence is through the use of interviews and questionnaires to employers in the district surrounding the college. Another technique that can be extremely helpful in developing curriculum is to form an advisory committee consisting of representatives from the varied industries in the community. (Refer to AAJC publication on formation.) Industrial representatives are a vital and necessary resource in formulating a curriculum since they are most aware of their needs in computer technology. Structure and content of the program should be flexible to meet their ever-changing requirements. The advisory committee approach establishes good community relations and generally results in stronger, more readily acceptable programs.

Curriculum Requirements

Another source for curriculum development is the operation of reference programs in other colleges. Examples of these curriculums can be obtained by writing to the American Association of Junior Colleges for copies.

Each of the duties, skills, and activities in the employment market should be examined to determine their feasibility in the curriculum. Certain facts, concepts, and thought processes are independent of current technology, while other training requires an understanding of the computer and systems associated with a particular function. The training should be comprehensive enough to make the student productive without extensive on-the-job training.

This curriculum would normally emphasize the skills necessary to communicate with the computer — the conversational medium being the "programing languages." There are many such languages used by industry to instruct the computer; the particular language used is sometimes associated with the function to be performed. Characteristics of languages are different, but they all serve the same end — to communicate with the computer and direct it to the task at hand. Selection of the languages to teach in the program should be oriented to needs of industry.

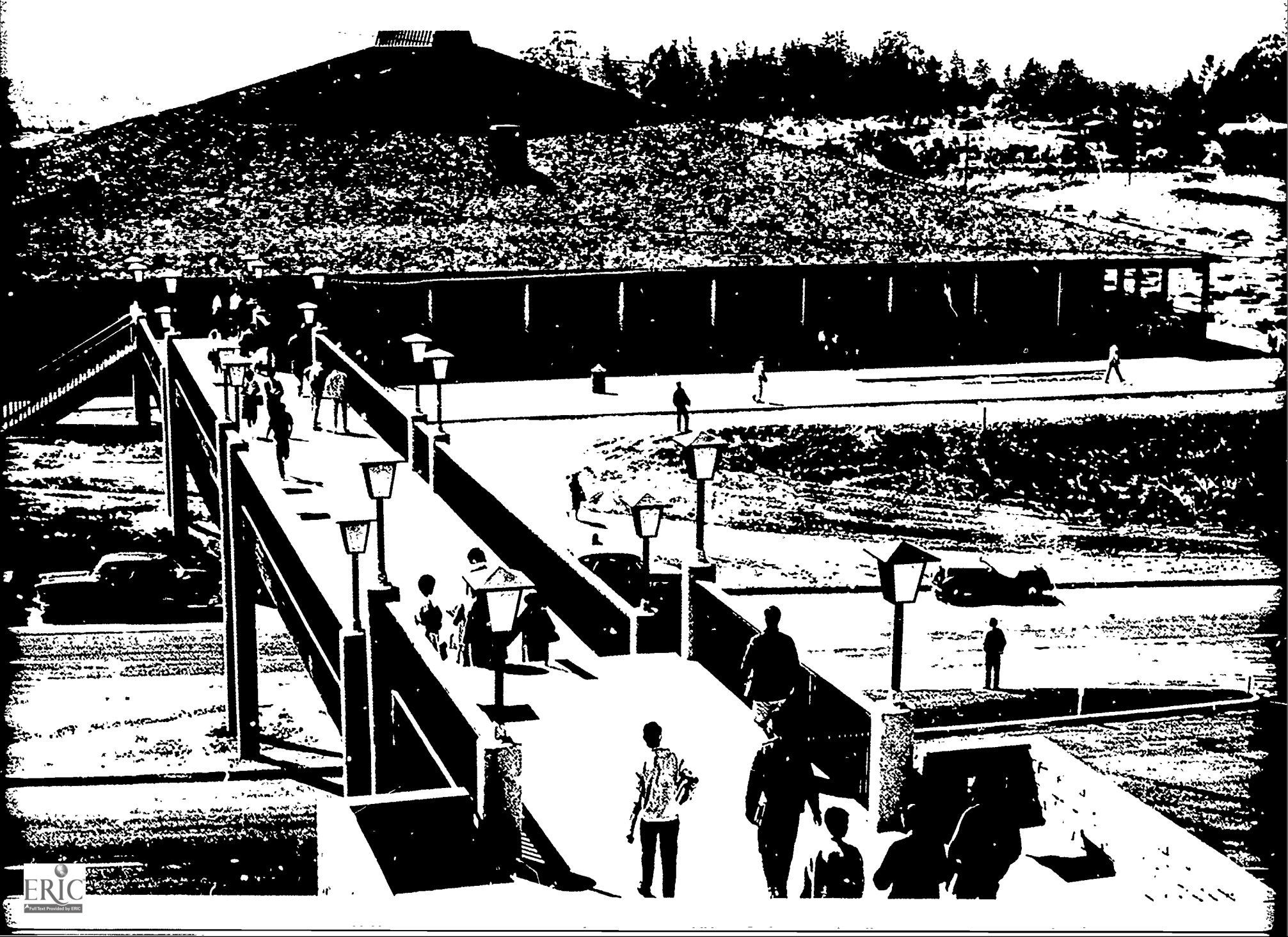
If possible, the computer selected for use as a "subject of instruction" should contain capabilities equivalent to those found in industries where the majority of graduates would be employed. If this is not practical due to economic considerations, it may be advisable to plan for computer support of the program from regional centers (perhaps larger schools within a radius of 50 to 100 miles with more powerful computers), or local firms with spare computer time. With this approach, a combination of off-campus support integrated with on-campus facilities may be chosen for the curriculum.

- **Curriculum Modification Planning**

Once the initial program is implemented, planning for major curricular changes should be initiated. What the technological change will entail and its effect on the technical curriculum will be difficult to ascertain until two or three years after its announcement. Time and money should be budgeted each year to allow the instructional staff to evaluate the new developments and restructure the current curriculum to current needs.

A commitment must be made to allow instructor attendance in manufacturer's schools and professional computer conferences. This is necessary to give the instructional group a feel for new developments and how they may be integrated into the curriculum. Use of team teaching techniques and the rotation of instructors through all classes in the curriculum will provide a firm base to make the transition to the new techniques when necessary. Time is required if the staff is to keep current on present developments in the field. The use of periodicals to keep up to date is a standard practice for professional data processing technicians; perhaps it is also the best method for the technical-occupational instructor. Periodicals must be made available and assignments given to read and use. Teaching loads should be calculated with this in mind.

What concepts will survive and what concepts will require change is the difficult question to answer as technology moves on. There should be a body of knowledge which can form the core curriculum of today and tomorrow. What this core curriculum should contain is subject to constant reevaluation.



Preprofessional Education

With the advent of the computer has come a number of new opportunities for technical and professional careers in computer-related areas. Educational programs for these career opportunties have been incorporated into the curriculums of both community colleges and four-year institutions. As was indicated in the preceding section, some of the training programs are structured for a two-year technical program culminating in an associate of arts degree; other programs of a professional nature require the baccalaureate degree. As in many other fields, the first two years of preprofessional preparation can be obtained in the community college. Design of a program for preprofessional data processing must include the following considerations:

Program Design

- The nature and content of four-year programs offered by senior institutions serving the community college student
- The nature of transfer problems related to moving from one institution to the other.

Each of these problems will be examined in turn. In general, the programs in these institutions are developed from one of three major areas of emphasis.

1. The computer science program emphasizes the adaptation of computer software and hardware to mathematical problem techniques (and, in fact, to the quantification of computer design itself). The major thrust in these programs is the application of sophisticated computerized mathematical techniques to problem solving in all disciplines. The community college student preparing himself for transfer to such a program must be exposed to the basic mathematical tools of analysis including matrix theory and linear algebra. Of particular significance in the computer science curriculum are basic computer systems, computer programing, and programing systems.

2. A second type of program to which the community college transfer may wish to gain admission is business administration. In such a program, emphasis is placed upon use of the computer in the business environment. The business administration program includes coursework in the functional areas of business — marketing, finance, personnel, and production; in the environmental systems within which business operates — the economic, social, and legal environments; and the tool areas of business — statistics, accounting, and other quantitative management techniques. In addition, management theory, organizational theory, and decision making are included. Emphasis is given in this type of management program to computer systems, computer programing, systems analysis, and techniques of simulation, operations research, and quantitative analysis techniques. Output from such a program is the potential business leader or "manager."

3. Transfer from the community college to a third type of program is also possible. This program, although described by a variety of titles, includes preparation for careers in systems. Such a program includes computer programing, programing systems, systems analysis and design, and computer design and operation. Most of these programs are supported with applied mathematics including statistics, simulation, gaming, and areas of probability theory. Output from the major in systems is the computer systems professional.

Transfer to one of three widely varied programs necessitates planning for the potential transfer student.

a. In the computer science curriculum, the community college will likely include emphasis in mathematics, computer technology, and foundational liberal studies areas. Transfer will be to a computer science program which is typically offered in a college of mathematics or engineering at the four-year institution.

b. Similarly, transfer to the four-year school of business administration will entail a study of lower-division requirements in business schools. A carefully designed curriculum of specific courses will enable the potential transfer to the four-year business administration program with a minimum amount of credit loss.

c. Colleges and universities offering the four-year systems major also present transfer potential for the community college graduate. As in the two preceding transfer programs, the community college curriculum will provide two years of liberal studies plus lower-division mathematics and information systems requirements.

Regardless of the nature of the four-year curriculums, the basic guideline applicable to the two-year curriculum planner is that courses offered in the freshman — sophomore levels will be transferable credits from the community college.

The Computer As An Educational Tool

- **Student Use**

In education, it is becoming apparent that the use of the computer as a "tool for instruction" is an important and desirable adjunct to its use as a "subject of instruction." This usage of the computer in the community college environment is virtually untapped and has almost unlimited growth potential in any disciplines.

Basic Functions

It has been widely recognized that the computer can play an active role in teaching mathematics, statistics, physics, chemistry, and engineering courses. The basic function of the computer in these fields is that of rapid calculation, making problem solving an analytical experience leading to quicker synthesis of ideas rather than a burdensome process of mental and manual number pushing. The student, via a programing language, can command the power of the computer to aid him, rather than being concerned with the computer as a subject area of its own.

The capability of rapid solution to complex numerical problems or of the rapid assimilation of large quantities of data has made the computer a newly accepted tool in other disciplines, especially in the social sciences, business, medical services, electronics, and the library-technician field. In these and other areas the computer can be used to simulate a particular situation or environment and allow students to become involved in "decision-making" exercises or games. They can explore many possible solutions and immediately be aware of their effect through simulated techniques.

The introduction of the computer into these subjects consists of teacher training in computer concepts, course preparation, student training, and logistics. How much can be accomplished by students will depend heavily on the willingness of instructors to commit considerable energy and time to course planning, and especially to the preparation of instructional materials that easily can be related to computer by the students.

All students can benefit by an introduction to computer concepts; introduce the computer in all disciplines where effective use can be integrated.

Teacher Training

It should be established in the planning phase which areas will wish to use the computer in courses and which instructors will take the initiative in implementing this usage. Success depends heavily on the ability and enthusiasm of key individuals. Their computer training can be gained from courses offered by the computer manufacturers, from university courses, or from programmed texts with considerable practice and experimentation. Sufficient time should be allowed for this period of preparation — probably six months to a year before student usage is to begin.

Course Preparation

A course in mathematics, physics, business, etc., that is to feature computer usage will require a more imaginative set of instructional materials and problems than may have been used previously. Typically, the student can be expected to accomplish more sophisticated types of problem solving and will be more likely to ask complex questions when the solutions are feasible. Publishers of instructional materials have been slow to catch up with this trend; therefore, instructors often find themselves in the position of writing their own texts. Once again, the instructor who takes on such an assignment should be given sufficient time to create new problems, test them, and document their various aspects well before the course begins.

Student Training

All students who will use the computer for problem solving must have a short course which teaches the language that they will use to describe their problems for the computer as well as some introduction to computer concepts. The latter is important to enable students to use the computer most effectively and to keep to a minimum the frustrations created by mistakes that are unique to computing. This training can be provided by formal courses over a quarter or semester, short cram courses, or self-taught methods with tutors available for questions. The last technique has had considerable success. Help must be available to get students over the hurdles that they inevitably encounter in their first days with this new experience.

If the use of the computer is for simulation or gaming, such as managing a retail store, the student would not require programing skills to effectively use the computer. All students could benefit by an introduction to computer concepts.

The use of the computer by the student as a tool will be varied depending on the institution's ability to provide; the prime consideration is to introduce the computer to students in all disciplines where effective use can be integrated.

- **Instructor Use**

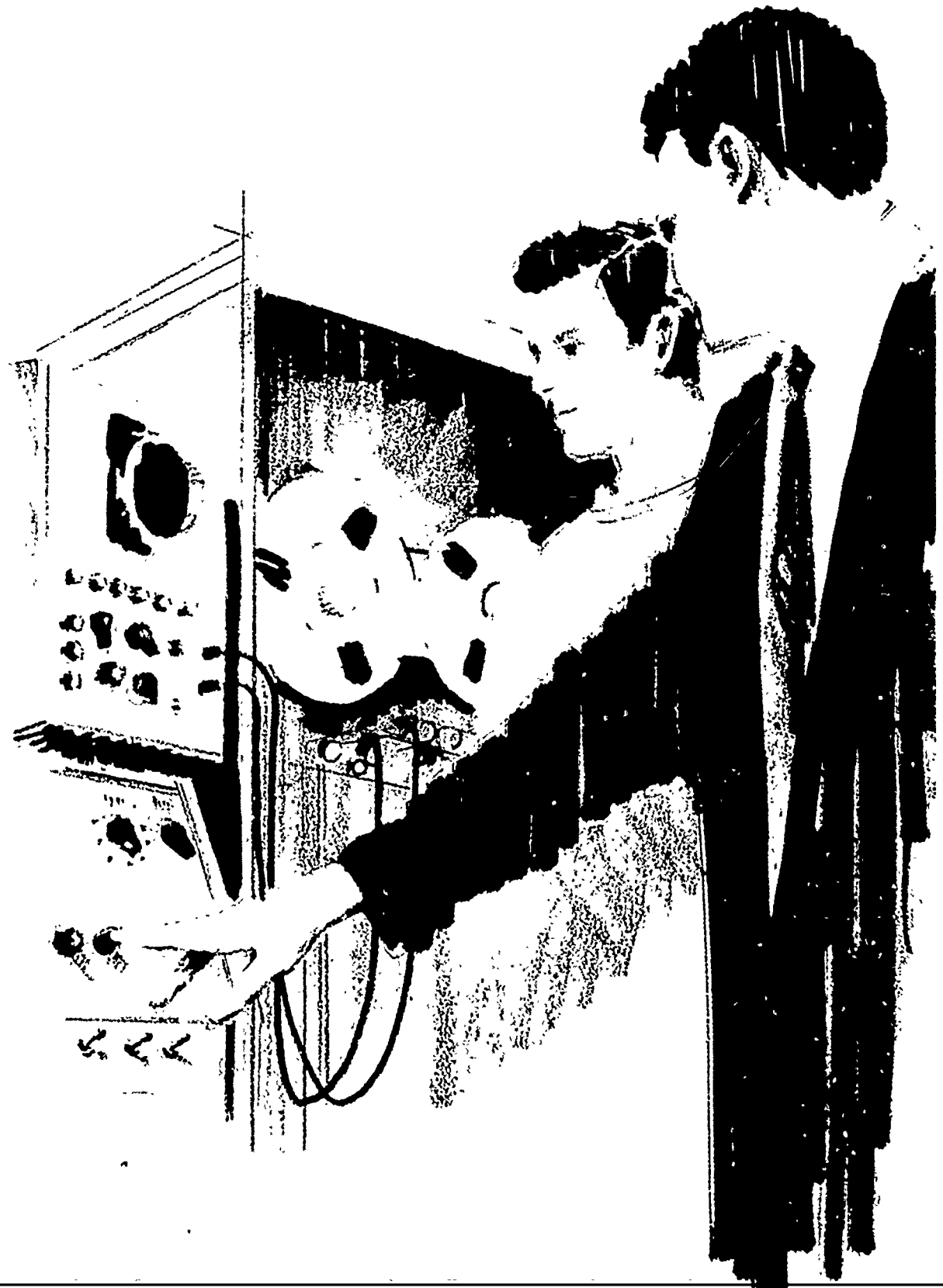
The term, computer-assisted instruction (CAI), has been receiving considerable emphasis in many educational publications. Computer-aided instruction and computer-based instruction are other terms commonly applied to the compuier as an aid or assistant to the instructor. Although the usage connotes different implications depending on the author's approach, there are two distinct categories of computer involvement:

The Computer as the Instructor

One category is to program the computer to communicate with the student through a typewriter-like device. This interaction of computer and student could be of a "drill and exercise" nature where the student receives either remedial or enrichment exercises on selected course modules. Much experimentation is being conducted at a higher level where the computer actually directs instruction in a tutorial approach with the student. Community college instructors in all disciplines can be of help in developing materials (programs) for the computer. Although most of the work in this area is still experimental, there are enough successful applications to indicate a promising future implementation.

The Computer as the Teacher Assistant

Another category often overlooked is a more indirect but time-saving computer-instructor aid. The computer is a valuable tool in such areas as test construction, test preparation, test scoring, and analysis. Another use is to employ the computer in a bibliographic search for reference materials available in the media center.



In either category, the benefits derived are the "freeing" of the instructor from many burdensome tasks allowing him to concentrate on those instructional services that cannot be provided by computer.

In summary, the computer in the community college can be employed instructionally as a "subject of instruction" as well as a "tool for instruction" for both students and teachers. All disciplines are permeated with possibilities of computer use; many are here now, others yet are to be developed.

Articulation

- **Senior Institutions**

As stated in a preceding section, it is important in the community college, academic, preprofessional program to structure the curriculum to conform to academic requirements of the senior institutions. Close coordination with representatives of the senior schools is desirable to assist the student in transfer of his courses.

The structuring of the technical-occupational program in computer training, however, should be approached with the goals and objectives of the program as the force behind curriculum content. The objectives of the occupational program are to prepare the student for job entry at a prescribed level of competence. Transfer to senior institutions is not an objective at this level. The responsibility of the community college in this type of program is to provide the technical training and general education necessary to meet industry requirements and standards.

There are occasions when students who have completed the technical-occupation program subsequently wish to pursue advanced training at a seminar institution. It would be desirable for them to transfer earned credits to a senior institution. In many cases, through close articulation, substantial coursework can be transferred. It is important that lines of communication remain open between the institutions for mutual understanding of program objectives.

- **Secondary Schools**

Entry to Programs

The technical-occupational program of the community colleges is already receiving students coming from the secondary schools with a modicum of training in the field of information technology and computer service. The quality of this training may be varied as the training provided by the community colleges throughout the nation.

If the secondary school program is of a high quality, the community college has an available resource of students who may be the backbone of their program and serve as competent laboratory assistants. Therefore, it is imperative that the community college coordinate with any "data processing" programs developed by secondary schools in its district. Good working relationships can be of substantial benefit to the student continuing in the community college technical program.

Articulation is also important in the academic program. Students entering with a knowledge of a programing language would adapt more readily to community college transfer programs utilizing the computer. Close coordination between the community college and "feeder" high schools will allow a smooth transition of computer knowledge and use.

IV. Administrative Services

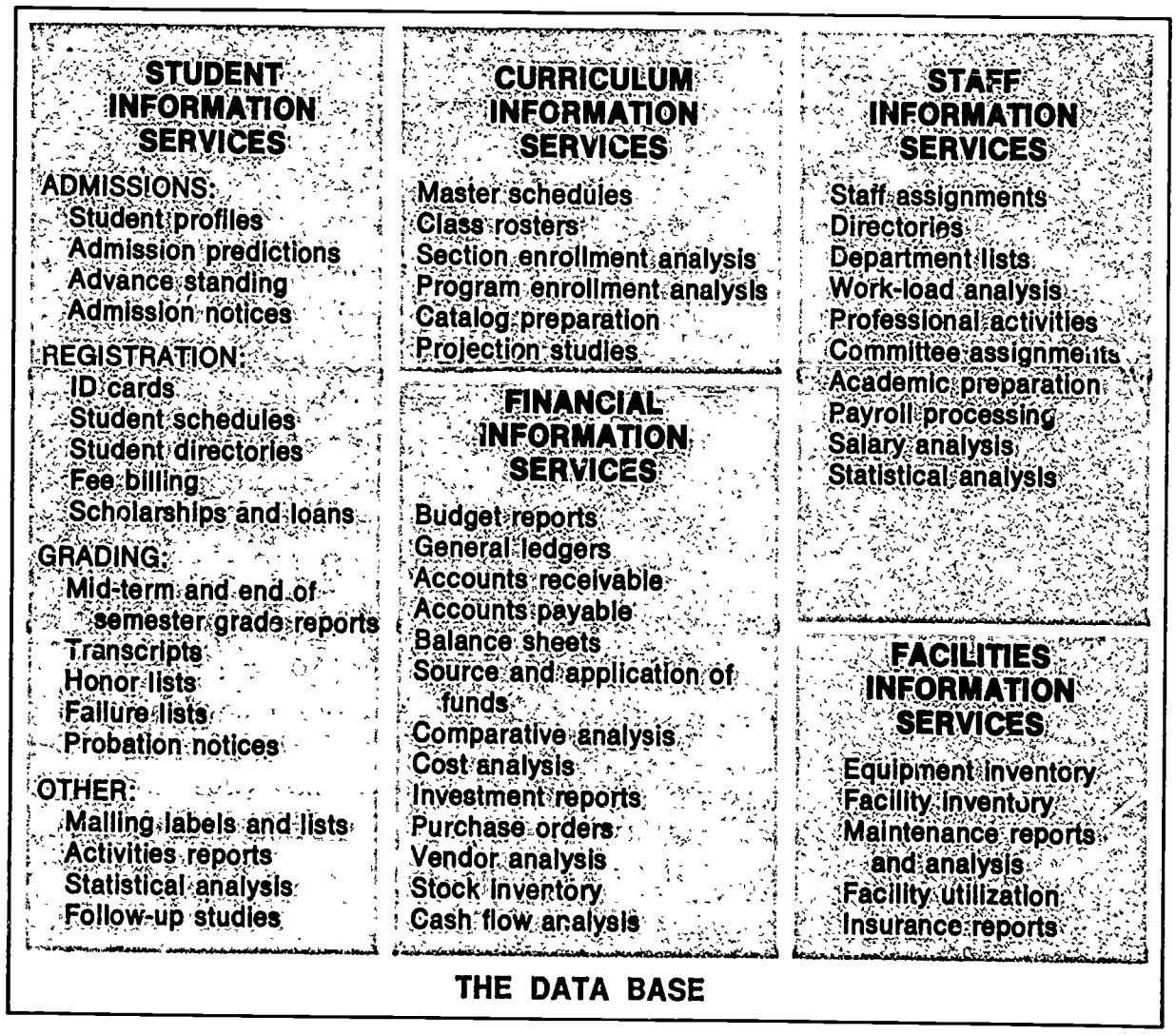
The Need

The New Era

Across the nation, community colleges today are facing a dilemma which can be described as the "student-cost squeeze." This situation is exemplified by community demands for high quality educational services for a rapidly expanding student population, accompanied by equal pressures to "hold the line on financial expenditures." These conflicting pressures have resulted in the emergence of the scientific era in educational administration. "The systems approach to educational administration," "operations research," "management by objectives," "planning programing and budgeting systems" are a few of the phrases used to identify the newer, more sophisticated techniques in educational administration. No matter what the technique is called, the central concept is one of decision-making based on the use of accurate, concise, complete, and timely data. The objective is the maximum utilization of limited financial, personnel, and facility resources without diluting the quality of educational services to the student.

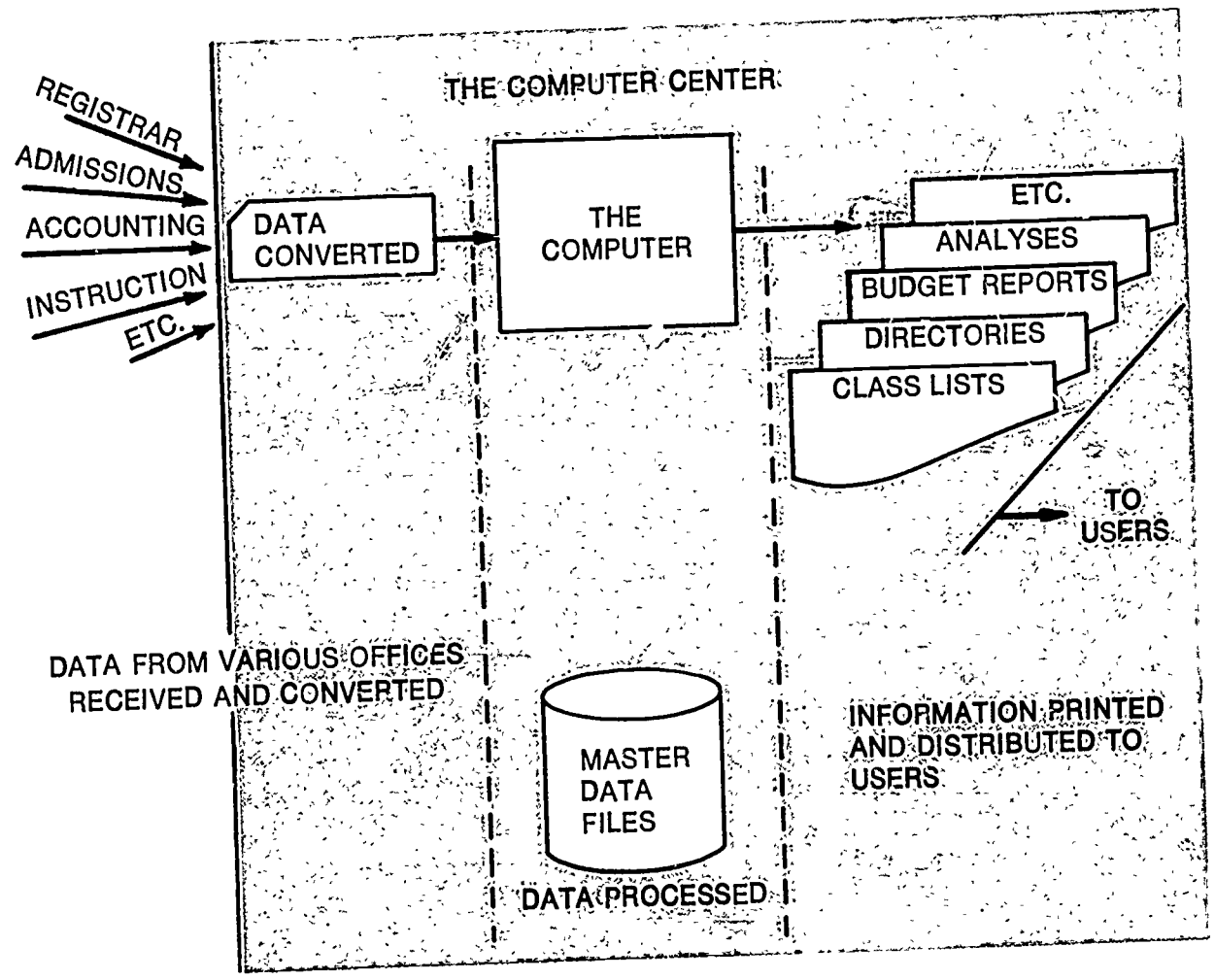
Where And How

The computer — with its unique ability to rapidly store, retrieve, process, and disseminate information — is proving to be one of the key tools of the modern college administrator. Today, computers are being applied to an ever-expanding range of administrative functions. The following chart presents some typical applications of the computer in administrative services.



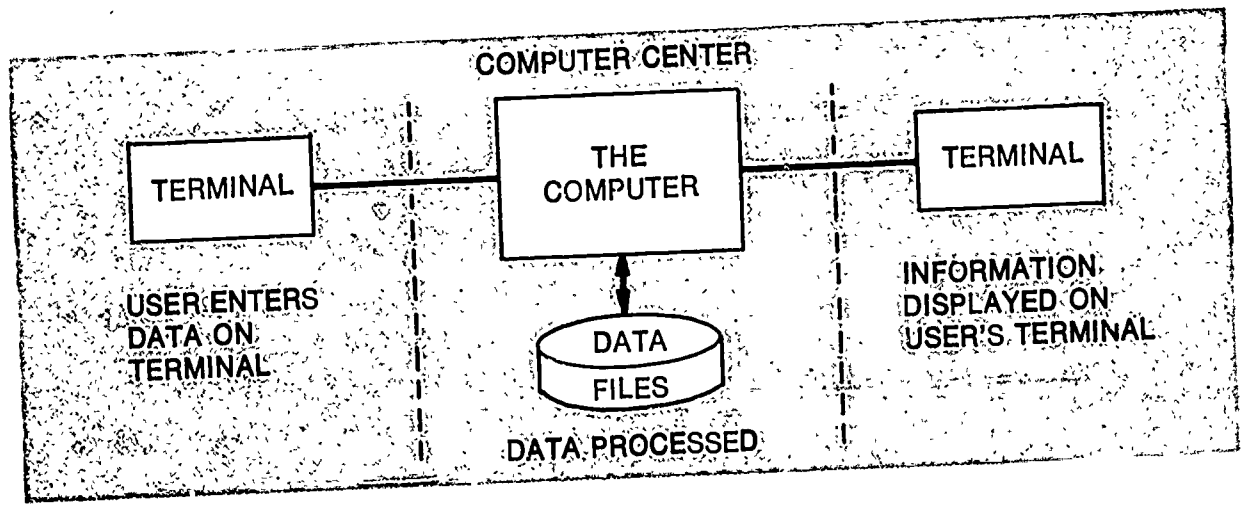
Method 1: "Batch Processing"

The essential element in an information system is the creation and maintenance of several data files from which the user information reports are prepared. Two approaches may be used to accomplish this task. The first approach, illustrated below, is one in which data is accumulated from various campus offices and sent in printed form to the computer center, is then converted to machinable form and processed, and information reports are printed and distributed to the users. This method is generally referred to as "batch processing."



Method 2: "On-line Processing"

The second approach creates an environment in which the user has direct and immediate access to the data files stored in the computer system. The access is provided through a communications terminal located in the user's office. The typical terminal has a typewriter like device for entering and receiving communications from the computer. Newer terminals may use a television-type screen for visually displaying communications to and from the computer. This method is generally referred to as "on-line processing." The following is an illustration of the second method.



The use of communications terminals to register and schedule students may result in a complete revision of the registration process.

The use of a remote communications terminal has added an important dimension to the computer based information system for decison making. Its capabilities give the user access to information at the time and the place, and in the format which is most useful to him. For example, the guidance counselor can have instant access to information about the students as he assists them in making decisions about their educational plans — the business manager can "look" at the total financial position of the institution at any instant — the purchasing agent can review an open purchase order while on the phone with the vendor — the department chairman can "look in" on the status of course or section enrollment during registration to determine if class sizes must be expanded or more sections added.

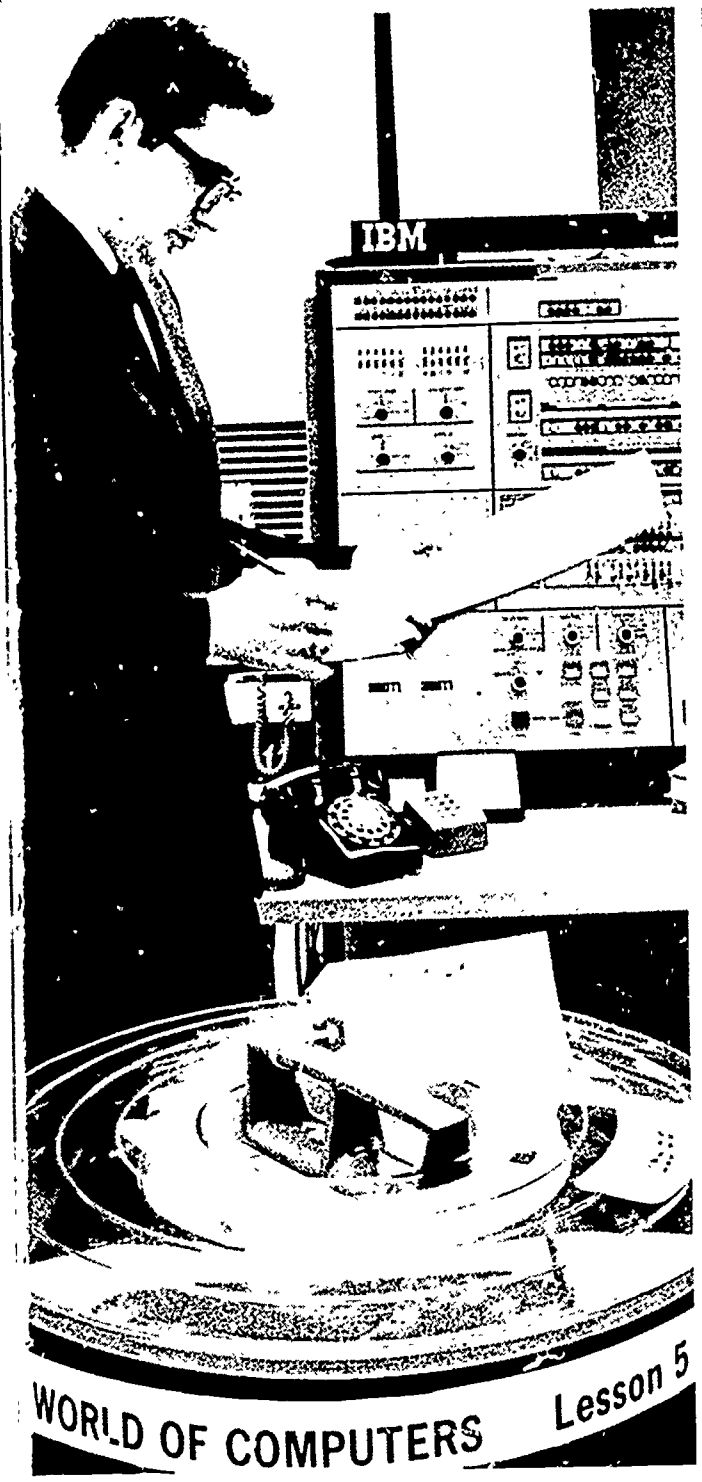
Some Alternatives And Considerations

Early in the planning phase, the administration will be faced with the decision as to which of the two approaches described above should be used in operating the institution's management information system. Obviously, the decision will involve an analysis of the "trade-offs" or alternatives available with each of the two methods. The following chart presents some of the trade-offs which should be considered.

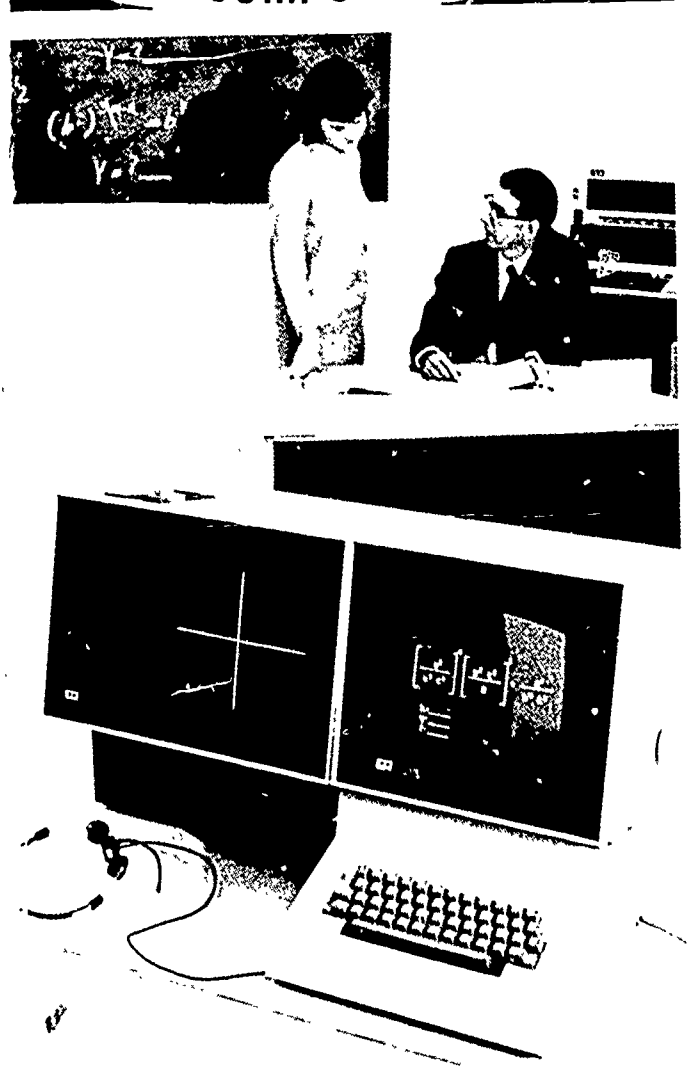
FACTORS	METHOD 1 "BATCH PROCESSING"	METHOD 2 "ON-LINE PROCESSING"
Cost factors Development Equipment	Simpler to design and program — less costly Less computer capacity required — less costly	More complex to design and program — more costly More computer capacity required — more costly
Information availability	Time delays waiting for data to be converted and processed	Immediate access No delays
Information reliability	Errors occur in converting data from original source	Data entered and edited Directly from original source — more reliable

Administrative Procedures

In addition to certain cost and efficiency considerations, equally significant considerations must be given to fundamental philosophies and approaches to the administrative processes of the institution. For example, the process of registering students via a computerized scheduling system can raise basic philosophical issues which must be resolved. The computer scheduling system generally promotes better section balance, utilization of faculty, and facilities. However, these advantages are accompanied by a loss of individual student freedom to select times and instructors for various courses, the philosophy regarding this freedom must be examined.



WORLD OF COMPUTERS Lesson 5



Similarly, the use of communications terminals to register and schedule students may result in a complete revision of the registration process. Such functions as preregistration, final registration, late registration, and course changes must be examined and, frequently, changed in some way.

Similar types of philosophical and procedural changes in all areas of administrative activity must be analyzed carefully when implementing a computer-based information system. Further, these changes must be weighed against the advantages of more complete, comparable, comprehensive, and timely information for more administrative decision making.

The planning, development, and implementation of an information system, like constructing a college campus, involves certain activities, people involvement, and time.

The first activity is to set forth the specifications for the system in terms of what information is needed by the college. This sets the stage for the physical environment for the system much like educational specifications determine the physical plant environment for a new college.

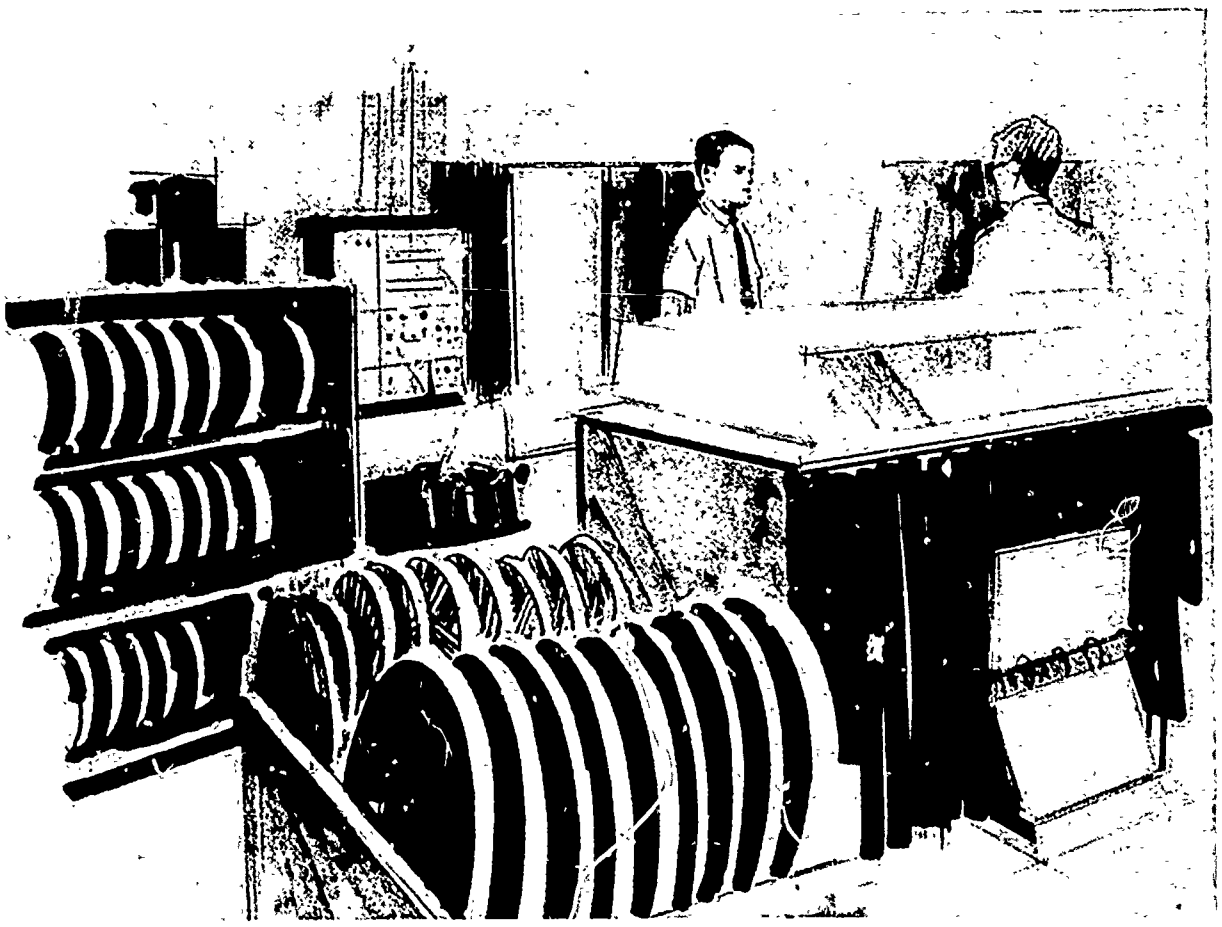
The second activity is to design the overall system and prepare detailed drawings of forms, file layouts, and procedures for operation.

The third activity is the actual construction — writing and testing computer programs, preparing procedure manuals, etc.

The final activity is the actual implementation, operation, and evaluation of the system — move in and "shake-down the new buildings."

The successful design and implementation of a functional information system cannot be accomplished by the technical staff alone. It is extremely important that appropriate administration and teaching faculty be involved. The systems analyst and programmer simply do not have the breadth of background or experience to determine the information needs of an educational institution and whether a given system will meet these needs.

Proper attention to planning and staffing along with an attitude of commitment and involvement on the part of key administrators and the board will lead to more and better information for decision making. The computer as an administrative tool simply becomes one more element in determining the total institution needs in planning for the computer center.



V. Community

The word "community" in community college has been interpreted with a variety of meanings. To some it carries a simple connotation of the geographical area served by the college. To others it implies a dedication of service beyond that of conducting a collegiate educational program. It is not unusual to find this connotation expressed in many facets of the college — from facility design to organizational structure. The computer center should be viewed as another important college resource which can be extended to the community.

Adult Education

The adult education program is a vital and necessary part of the total educational commitment of the community college. The introduction of new technology and techniques utilizing computers and information science has created a severe "knowledge gap" for many employees in business and industrial firms.

The college can provide a worthwhile community service through adult education by making its computer center resources available for short workshops and seminars designed to upgrade present job skills or familiarize employees with computer technology. Coursework would range from introductory courses through programing languages and advanced systems training.

Shared Facilities

Another way the computer center can serve the community is through cooperative ventures with local elementary and secondary schools in which the computer center facilities are used for instruction and administrative computer services. Many small school districts want and need access to computer capabilities, but are unable to finance even a minimal installation of their own. The college may have computer and personnel time which can be made available to other schools. In other instances, the college can provide additional computer capacity and personnel with the cost for these resources being shared jointly by the several individual schools.

Providing for use of the computer facilities and technical expertise in computer technology will enable those members of the community who may have completed their formal education many years ago to take advantage of new training and concepts at low cost and with no job inconvenience. It also enables smaller schools to benefit from computer utilization. These services are an important and appreciated contribution of the community college beyond the scope of formal education — do not neglect them.

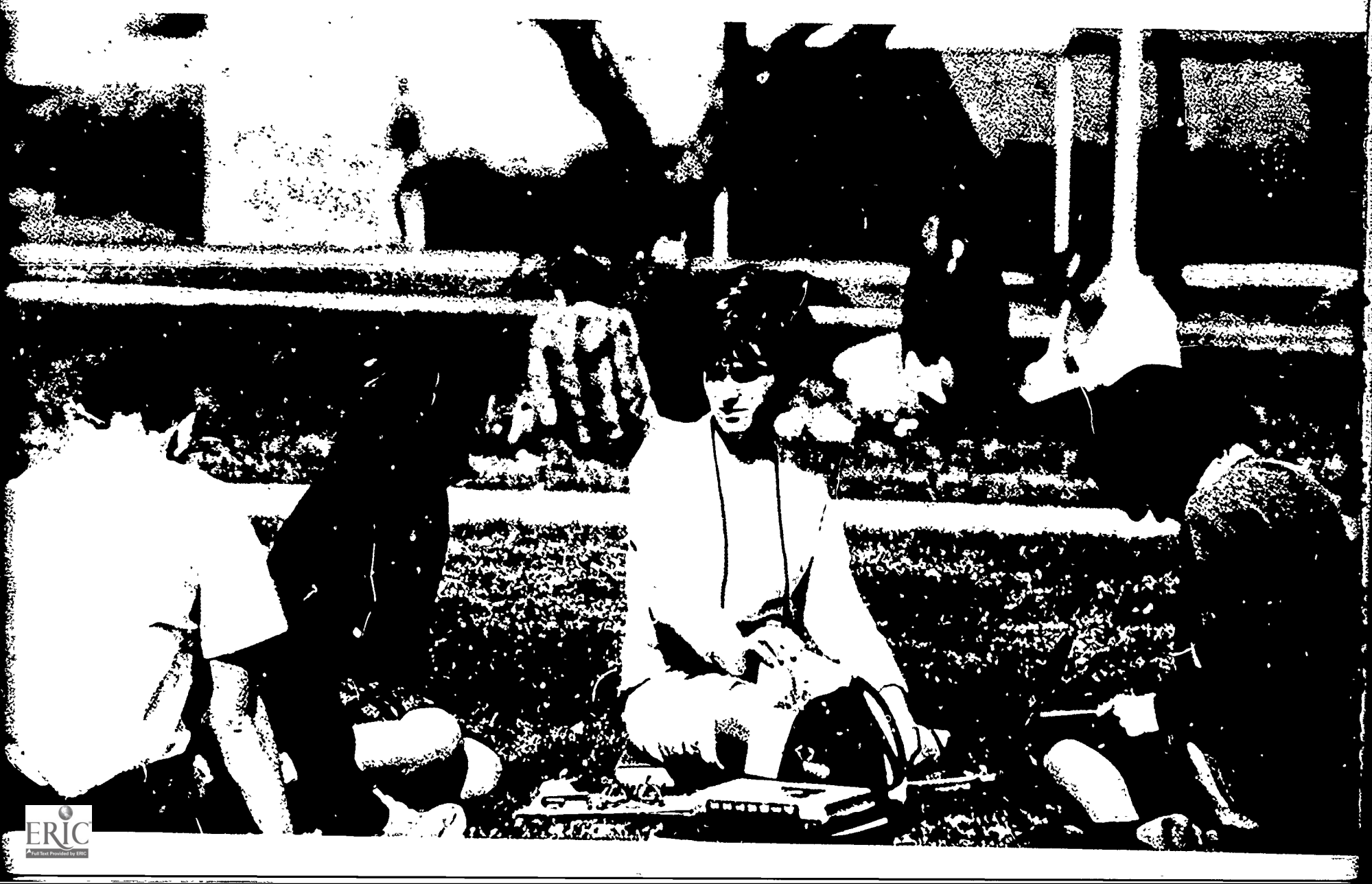
The computer revolution, a contemporary reality, has occurred in less than fifteen years with a greater, more rapid universal impact than any previous development in history.

Recognizing the growth and potential impact of the computer to all activities and personnel, leaders in all walks of life are stating that students and trainees must receive computer education in conformance with their specific academic and occupational desires.

Computers are playing an ever-increasing role in the administrative functions of education. The capabilities of the computer are being applied as an integral part of the new administrative procedures developed by business, industry, government, and education. The emphasis is on using the computer to provide more complete and timely information for the decision-making processes.

Recognizing these needs, many college administrators now are asking questions such as where do we begin? How do we get involved? Who should be involved? What will it cost? This document was prepared to assist the boards, administrator of education, and faculty not by providing specific answers but rather by clarifying some of the fiction and myths that have unfortunately become part of the computer growth. A few of the more critical issues which have been discussed are summarized below.

Very frequently, the computer is sold to management on the basis that it will reduce the number of administrative personnel needed in the organization. Many times, the installation of a computer requires both more



personnel and personnel with specialized and expensive skills. The payoff, with respect to personnel, is in the form of an overall reduction in the growth of personnel requirements to accomplish the increased work load as the organization grows larger.

The cost of the hardware, i.e., computer and auxiliary equipment, is often the only cost considered when planning an installation. Management then becomes disturbed to realize that other costs may equal or even exceed the cost of hardware.

A major cost in a computer installation is personnel — managers, systems analysts, programmers, and operators. One can predict fairly accurately that the cost of systems analysts, programmers, and operators alone will equal or exceed the cost of the hardware for a small- to medium-sized computer installation. Another cost not often considered is the time demands of people outside the computer center as they become involved in systems study, design, and implementation.

Another common fallacy is the idea that after the computer has been installed and all systems development and programing is completed, the institution can eliminate the expensive technical staff and retain only operator personnel.

After the computer is installed and basic applications and uses are implemented, the demand for more services will increase and, frequently, the technical staff will be enlarged. Another important factor is the rapid changes that have been made in the hardware itself. Over the last fifteen years, three major changes in the technical aspects of computer hardware have occurred. These changes have resulted in the need to reprogram all applications in order to utilize the improved performance capabilities of the new hardware.

Almost universally, the attitude of administrators and other faculty has been, "I don't understand computers, so I'll hire a data processing director and let him worry about it."

By and large, computer technicians are not educators. If left to plan and implement a computer installation without involvement, the technician may develop systems which do not meet the needs of education and may, in fact, hamper the true educational function of the institution. The attitude of both top-level administration and the board will have a significant impact upon the relative success of a computer installation. The president and other administrators, through their attitudes, actions, and words can create an atmosphere of "awareness," "need," and "must" conducive to the successful use of a computer on campus. This is particularly true in light of the dollar expenditure for computers and faculty demands for higher salaries.

Many times the computer is viewed as the "cure for all ills of education." The computer will not solve inherently the problems of the dropout rate, rising student militancy, shortage of good faculty, and all other problems confronting the educator. The computer is a tool just as much as a typewriter and the desk calculator are tools. It is, however, a much more powerful tool and through its capabilities to store, retrieve, and process large volumes of data for research, analysis, and evaluation will help create an environment for sound decision making on the problems that confront the educator.

The computer is often viewed as something that is only for the big colleges and universities with large schools of engineering and mathematics, and large applied research projects. The excerpts stated earlier support the need for computing power in *all* colleges, regardless of their size. This capability can be provided to the small college in a number of ways. The advent of the small computer — leasing for $1,000 to $3,000 a month — has brought computing power within reach of even the smallest institution. There are also many firms which rent time on a computer to other users who pay only for the actual time used, not the entire installation. Sharing the cost of a computer with other nearby educational institutions — e.g., local elementary and secondary school districts — is still another method of bringing computer power to the small college campus.

The community college today is preparing young men and women for the society of the twenty-first century — a society in which the computer will be as commonplace as the radio and telephone. The transition to that society is taking place *now,* and it is the transition that education must be concerned about. The work that people perform and attitudes toward work are changing; the environment of "things and processes" that we live in is changing; the process of teaching and the knowledge, skills, and attitudes taught are changing; and education has a responsibility for preparing our youth not for yesterday, not for today, but for the future.

New community colleges are being established across the nation at a breathtaking pace. Planning for the use of computers and computer capabilities must begin with the planning for bricks and mortar, curriculum and staff, and dollars and cents.

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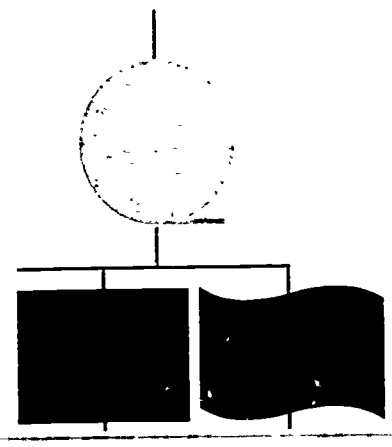

Glossary of Terms

Batch Processing: An approach to processing data where a number of input items are grouped for processing during the same machine run. Contrasted with on-line processing.

Computer Generations: Refers to the technological changes in manufacturing computer equipment which result in new models of machines with increased capacity, new capabilities, and generally lower costs for volume of work produced.

Computer Program: A set of logically arranged instructions to cause the computer to perform its various functions of data input, processing, and data output.

Computer Programing Language: A symbolic or English language designed to communicate program instructions to the computer. Common languages include COBOL, FORTRAN, PL 1, and Assembler Language.

Computer Systems: A network of interconnected machines consisting of a central processing unit, data input units such as card readers, data storage devices such as magnetic tape units, and data output devices such as printers.

Data Files: A collection of related items of data treated as a unit. Example: A student ID number is an item of data as is a course grade, home address, etc. Collectively, these items form a record for each student — the individual records of all students forms a data file.

Data Processing system: A network of machines and procedures capable of accepting data, processing it according to a plan, and producing the desired information results.

Hardware: The physical machines which comprise a computer system. Contrasted with software.

Information Science: A field of study devoted to applying computers to the problems of information needs, collecting and processing information, and preparing information for decision making. Typically includes advanced techniques of operations research, computer modeling and simulation of business processes, and numerical analysis.

Information Systems: A combination of data files, computer programs, and procedures to collect, process, store, retrieve, and disseminate various operating reports and analysis for use by administrators, boards of education, and teaching faculty.

Numerical Analysis: The study of methods of obtaining quantitative solutions to problems in which the elements of the problem can be expressed in mathematical relationships.

Numerical Control: A field of computer applications which center around the control of machine tools by computer programing.

On-Line Processing: A system (using remote terminals) in which data is sent to the computer and/or retrieved at the time and place most advantageous to the user. Contrasted with batch processing.

Remote Terminals: Devices for data input and retrieval to and from a computer. The device is located at some distance from the computer system and may be connected to the computer via a telephone communications system or by direct cable.

Software: The computer programs are prepared by either the manufacturer or the user to control the functions of a computer system. Contrasted with hardware.

Systems Analysis: The study and analysis of an administrative activity to determine the processes, procedures, sources of data, and elements of information that are necessary to accomplish the purpose of the activity.