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# Emerging trends in computer information systems and their impact on offices of registrar and admissions

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## Abstract

Every office using computers has become accustomed to change. Rapid development of new technologies, applications, and functions of computerization has produced organizational and procedural shifts in administrative computing activities at most colleges and universities. The lowering costs and increasing power of microcomputers are causing the decentralization of campus computer resources. Several trends have forced institutions to reexamine their academic administrative computing services. Computer networking, advanced message systems, expanding on-line application application systems, integration of voice and data technology, use of "smart cards", and optical disk storage are examples of the technology available to colleges today. Integration of campus resources that use new technologies is a sound business policy because of the potential for waste and duplication if acquired separately.

# EMERGING TRENDS IN COMPUTER INFORMATION SYSTEMS AND THEIR IMPACT ON OFFICES OF REGISTRAR AND ADMISSIONS

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Every office using computers has become accustomed to change. Rapid development of new technologies, applications, and functions of computerization has produced organizational and procedural shifts in administrative computing activities at most colleges and universities. The lowering costs and increasing power of microcomputers are causing the decentralization of campus computer resources. Several trends have forced institutions to reexamine their academic administrative computing services. Computer networking, advanced message systems, expanding on-line application application systems, integration of voice and data technology, use of "smart cards", and optical disk storage are examples of the technology available to colleges today. Integration of campus resources that use new technologies is a sound business policy because of the potential for waste and duplication if acquired separately.

The effects of computer usage can be observed in many areas of student affairs, but none so evident as in the offices of registrar and admissions. These two departments work closely together, have similar data caretaking responsibilities, and are often combined in various institutions. Most registrars are responsible for maintaining the permanent academic record for all

students, registering students for classes, and providing several other student services. As such, their usage of computers should be significant. However, a recent poll of over 1100 registrars revealed that a large portion did not have a positive opinion about computers. This presents some question as to whether they are sufficiently comfortable and capable with computing to implement new technology (Brewer, 1988).

Expanded access to administrative data, including downloading of mainframe files for internal and external use, has threatened the traditional role of registrar and admissions offices. They have been the custodians of student data, responsible for preventing misuse of confidential information. Increasingly, they must deal with more requests for student data, security of that data, and less control over it. Further, there is a rising pressure to eliminate manual processing of paperwork to increase speed and productivity. Administrators of these offices need to keep abreast of current technology and its potential applications.

This paper will address current trends in the application of computers that may impact the offices of registrar and admissions. The considerable move toward decentralization of computers on campus will be

examined. Examples of an open access approach to computer information will be discussed. Some of the applications of networking, voice response technology, and optical disk storage systems will be reviewed. Finally, some organizational concerns will be addressed. A brief history of administrative computing in higher education should serve as a starting point for this examination.

## HISTORICAL USAGE

The concept of "thinking machines" was demonstrated on paper in 1936, and the feat of storing data and instructions mathematically without human intervention was accomplished in 1943. The method employed was invented many years earlier. Herman Hollerith of the U.S. Census Bureau unwittingly set the size of computer punchcards to be used for the next 80 years when he devised an electro-mechanical counter in 1880 using tabulating cards cut by an adapted greenback dollar cutting machine. The IBM Corporation marketed this system well into the 1960s (Chachra & Heterick, 1982). The University of Pennsylvania installed its first computer in 1946 (Hawkins, 1989). It was an analog device which calculated by measuring, and these were prominent until the 1960s, although production did not stop until 1976. Analog computers require a high

level of mathematics to use and are not as precise as digital computers. Digital computers calculate by counting, and the first operational version was built in 1949 (Chachra, 1982).

In 1951, the UNIVAC I became the first commercially available computer. The first generation of computers used vacuum tubes, punch card access and magnetic tape storage. Its mode of usage was batch processing; it was used for advanced research at first, then some administrative record keeping operations in the business and registrar's offices. Some advanced institutions used computer punch cards in their arena registration process. These computers were usually centrally located and under the control of a computing services organization which performed the operations requested by departmental offices. Thus, a division of labor developed between the programmers and the actual end users which would continue into the present.

The advent of a second and third generation of computers brought transistors, magnetic core memories, and monolithic integrated circuits which increased computing speed tenfold. Telephone line time-sharing and on-line transactions became common. End-users, such as an admissions officer, were directly linked to the mainframe computer through terminals. Registrars,

in the early 1970s, began to implement on-line registration systems. The computer services organization programmed the schedule of classes and the student data base, and these were accessed and updated by registration staff (Auston, 1987).

The early 1970s also saw the influx of mini and microcomputers to the campus. Minicomputers are basically smaller versions of older mainframe computers, often with the same power due to newer technology, such as the use of hard and soft magnetic disc for instructions and storage. Microcomputers are literally desktop computers. While these computers have increased in power, they have decreased in cost at a compound yearly rate of about 25%. According to one survey, minicomputers were 6% of university computer hardware expenditures in 1970, 19% by 1980, and leveled off at 20% by 1987. Microcomputers were 19% of expenditures in 1980 and equaled mainframes at 40% by 1987. At the same time, software went from one half as much as the hardware costs to 50% more than they are, and personnel costs now equal the sum of hardware and software (Zimmerman, 1988).

Another survey of 1753 institutions showed annual increases in computer facility budgets of 6% to 10%, with their total percentage of the 1985-86 education

and general budget to be 3.0% in two-year colleges and 2.7% in universities. The average workload of the central computer facility is 51% instructional, 38% administrative, 8% research, and 3% other functions. It was not reported whether the funding allocation followed the same percentages. The same survey revealed that the number of microcomputers purchased in 1986 increased 53% over 1985 (Warlick, 1986). The proliferation of microcomputers, also known as personal computers, has signaled the end of the centralized computing systems.

## DECENTRALIZATION

Computerized information systems of educational institutions are no longer located in one spot and directed by a computer "czar". Equipment is located in users' offices and is under their control. Earlier uses for this equipment were primarily individual, such as word processing and producing spreadsheets. Now, increasingly sophisticated and inexpensive software is making some complex operations more cost effective than shared access to a mainframe. A new generation of languages for data base programs, formerly only found on mainframes, is being "sold off the shelf" at computer stores. Computing has outgrown the centralized control center and is no longer restricted

to computer professionals. In fact, decentralized systems often got started when someone in the local office became literate with the newly acquired computer and software, became the office computer "expert", and soon was keying all data, running reports, and setting up programs.

This haphazard method of acquisition and training led to problems of an uncontrolled variety of equipment and software, data incompatibility, and integrity, validity, and security questions (Sholtys, 1987). These issues surfaced when the office "expert" inevitably turned to central computing staff for program support. Personnel frictions also arose when this person discovered that his/her counterpart in the center was earing much more money. He/she often transferred to the center, eventually leaving a void in the local office.

The University of Southern California (USC) attempted to deal with this situation in its Admissions and Financial Aid Office. USC's solution involved consolidating and conserving resources by establishing a distributed computing office called Administrative Information Resource Systems (AIRS). This office provided local support and acted as liaison with central computing (Olson, 1986). The staff developed

some of their own systems, along with interfaced ones, and soon were supplying "in-house" requests for information more quickly than central computing. Other offices learned of this, and outside requests began to inundate the AIRS office. The AIRS office and central computing began to experience some political friction, and there resulted some duplication of efforts and inconsistent results. Effective communication proved to be the only tool to define responsibility and address territory issues.

While some experts may claim that the era of the COBOL mainframe computing center is coming to a close, most would at least agree that some decentralization of administrative computing is inevitable. Top management in each institution must accept and support this development in order to decide whether and how much to manage it. Reasons for maintaining institution-wide coordination of decentralized computing are for: (1) harmony and synchronization of interdepartmental operations, (2) similarity of reported data forms, (3) less competition for staff, authority, and budget, and (4) serving as a leader in the cooperation of interdepartmental computing (Alley, Shaub, & Willits, 1987).

Decentralization and centralization are not

mutually exclusive. It must be decided what functions and processes are best managed in a decentralized or in a centralized mode. Mainframe computing is appropriate where a broad cross-section of users, such as administrative record keepers and library users, must access the same data, where high cost special purpose software is used, and where high priced peripherals are used. Examples of such peripherals are laser printing, high resolution graphics, microforms, photographic media, typesetting, and high volume storage of machine read data (Heterick, 1986).

At Virginia Commonwealth University (VCU), administrative information services were provided by a central administrative data processing unit until that responsibility was decentralized in 1985 (Batchelder & Gleason, 1988). Then data processing staff and associated resources were assigned to each major administrative unit along with the authority, accountability, and responsibility for information services. This staff used packaged software systems and only had access to administrative data under the unit management. Integrated data needed to be requested from central computing, and priority, volume, and communication problems made this a slow process. To improve this situation, the university began to look at an open access approach.

Open Access

It was decided at VCU to create universal access to the student information system for all faculty and staff through purchase of the IMAGINE software system (Batchelder & Gleason, 1988). This required widespread understanding and agreement over individual privacy rights and a university policy statement on security. Ongoing data education for end-users required data "custodians" to share knowledge of the system previously considered proprietary. To prevent incorrect presentation of data, only designated offices, such as admissions and registrar, now provide data externally.

Boston College (BC) has adopted an even broader policy of open access to all administrative information systems (Gleason, 1988). BC's intent is to apply the notion of a free resource library to this information. Students have access to their personal records, such as tuition account, financial aid, and grades. Employees can access their personnel and payroll records, and faculty can access individual records of their student advisees. Other information data bases can be accessed through standardized, function-based menu screens designed for uninitiated users. Suggestions of what these public information data should include are

historical and current enrollment statistics, course openings, calendar and catalog information, admissions statistics, faculty salaries, major and minor information, and degrees awarded. Security clearance is recalculated at the start of each session based on the location of the users' modem, their job title, and other executive management authorizations. The goal is to distribute access and security as close to the user level as possible.

That is one step toward a longer range goal of providing a true end-user computing environment where all transactions and information are entered directly into the system by the originator instead of an intermediary. Professors enter grades, students register for courses, advisors retrieve degree audits, and course descriptions are entered by their designers. The resulting reduction of clerical tasks and paper transmission in the registrar's office can cause significant personnel changes (Gleason, 1988).

Such changes are a reality at the Virginia Polytechnic Institute and State University (VPI), where two clerks have been transferred from the registrar's office and five part-time scheduling clerks are no longer needed (Carson, 1987). Source-point data entry, enabled by the distributed access system, has made this

possible. The theory is that no forms should ever be forwarded to another office for simple data entry, because terminal operators who provide no value-added features are unnecessary. Most authorization to the system originates from the registrar's office, which has somewhat increased the upper management time spent making the authorization decisions. The advantage is eliminating production, distribution, and filing of one half million paper forms a year at VPI. More savings are expected with the release of inquiry and update functions to students. None of these functions would be possible without the introduction of computer networking on campuses.

Networking

With the explosion of personal computers it was recognized that you could not perform many applications without moving data from one computer to another. People began by connecting small office networks and later trying to expand them. Thus, the growth of networking was from the bottom up rather than from the top down. "Leading edge" institutions have now solved networking applications, and even conservative institutions are beginning to implement it. It is beyond the scope of this paper to discuss the technicalities of networking, but the previously cited

IMAGINE software is one example of an on-campus networking package. This software links personal computers to each other and to campus mainframe information systems, allowing the flow of information, transactions, and messages. In addition, hundreds of institutions are now members of national networks such as BITNET and EDUNET, which allow communications and sharing of research unimpeded by delays and missed contacts. The messages are on the system, to be read at the user's convenience.

Some consideration should be given as to whether the networking should be mainframe based or micro based. Each can support communication, but there are situational and functional differences. Also, any communication strategy needs to consider to what extent voice and data will be merged and whether video capabilities may become necessary. Electronic mail/messaging services are an important component, and provisions for gateways to outside networks should be investigated. Decisions made about networking capabilities will determine the extent of decentralized computing and the type of services which can be provided by an admissions or registrar's staff.

The possible applications of software within networked systems are tremendous. Three examples are

automatic auditing, telephone registration, and electronic grade reports.

Automatic auditing. The first occurs at Los Rios Community College District in California. The three separate colleges of Los Rios are networked together using several available microcomputer based programs. Admissions counselors in any office can use their micros to access/run transcript printouts on any student. A "progress check" feature can create for that student a list of required courses yet to be taken to complete his/her major. The program considers graduation requirements of any four-year institution and the appropriate articulation agreements (Steed, 1989).

A number of colleges now use an automated on-line auditing system. The above plan brings this to the microcomputer level, making additions less complex, infrequent transfer requests more cost-effective, access to information localized, and on-line time with the mainframe less extensive. Each admissions office must still enter its own data on course equivalency. It would be a misconception to think they could share another college's software, because each course entered is specific to that institution.

The Los Rios system is an example of a

micro/mainframe computer networking link. Mainframe computers still represent central data banks which can provide consistent, valid, unambiguous data, while personal computers can be a vehicle for access and flexibility in using those data. Colleges can replace "dumb" terminals with on-line personal computer workstations which can: (1) be collectors and editors for transactional data which is then passed to the mainframe for data base, (2) extract and download mainframe data for off-line analysis and reports, (3) serve as terminals, and (4) use available software to deliver data to another micro through the mainframe (Sholtys, 1988).

Telephone registration. Another development which appears to be gaining acceptance is telephone registration. Brigham Young University (BYU) is credited with introducing touchtone/voice response technology to higher education in 1984 (Hill, 1989). The software recognizes input from a push-button telephone and generates a "voice" response to the caller. Voice response systems are capable of applications like faculty load checking, reporting class schedules, checking financial aid information, and information bulletin boards, but most institutions use them primarily for course registration. These

systems generally use a minicomputer to answer the phones, generate the voice, and link to an on-line registration system within a mainframe. At BYU, 32 phone lines can be used simultaneously. Students save time spent waiting in lines, get immediate feedback, and have the convenience of registering 24 hours a day. Most schools report the need for fewer personnel and terminals in the registrar's office. The registrar at the University of Northern Iowa reported it would cost around $75,000 for a 16 line system there, and they would be one of about 130 institutions currently using touchtone registration.

Electronic grade reports. The most redundant and difficult task for registrars is the timely collection of grades. The registrar's office at Brigham Young University has successfully reduced this task by designing an electronic grading system all contained on a single diskette (Peterson, Quass, & Priday, 1985). The plan is for individual instructors to download class lists onto a personal computer. Using this program, they can manipulate any number of grading operations for each student during the semester. After computing the final grade, instructors electronically pass this back to a "grade holding" file in the university records system. The registrar then provides

a report to the instructor to verify the grades received. This simple system is one more example of how microcomputers networked to student information systems can change administrative procedures and reduce paperwork.

## COST-SAVING TECHNOLOGIES

A large portion of the cost for information dissemination is associated with paperwork. Independent word processing systems have reduced the costs of writing individualized letters to thousands of alumni and potential applicants. Advanced computer communication networks are opening new avenues to distribution. Future cost-saving technologies might be optical discs, automated tellers, and "smart cards".

### Optical Disk Storage

Data storage capabilities jumped tenfold with the introduction of optical disk technology. Optical disks and magnetic disks both use a disk medium for storing data, but the read/write heads of the former use laser optics instead of the electromagnetism of the latter. A laser beam basically burns holes in encoding data; the information is not erasable, and the storage density increases from 10,000 to 100,000 bits per inch. A 5 1/2 inch optical disk can store 500 million characters (Chachra & Heterick, 1982). This kind of

storage power makes huge data consuming functions like image processings possible. An entire admissions file, including copies of letters with official stamps and signatures, can be viewed electronically. "Leading edge" institutions are installing these optical systems now.

Basic forms of optical scanning technology have been used in higher education for years. In 1979, Ohio State University was scanning data from specially designed paper forms as an alternative to on-line keypunch entry. In the same year, Brigham Young University was scanning bar codes on student activity cards to release pertinent information, much the way bank cards are used (Price, 1979). In fact, the banking industry often serves as a model for the future direction of campus computing services. Credit institutions originated the magnetic strip on plastic cards which is read by a computer to permit charges. Now, many colleges use similar student I.D. cards as a means to access services such as library checkouts and computer usage. Banks established remote computer terminals where cards are used to perform transactions and receive a print-out of those transactions. A version of this may soon be seen on campuses.

## Automated Tellers

Some authors imagine machines similar to automated tellers scattered around campus; students could have 24 hour access to services using their card and a personal identification number. They could request a transcript; read electronic mail messages; get a tuition statement and even pay it by using a credit card; or register for classes, receiving a hard copy confirmation. The automated teller has the potential for becoming the registration clerk of the future (Austin, 1987; Gleason, 1988).

## "Smart Cards"

Another possibility is for admissions offices to use "smart cards" with their on-line degree audit systems. Smart cards are very small microcomputers packaged within plastic I.D. cards. A student's academic information can be downloaded from the mainframe via "smart" telephones and inserted in an associated reader at another college for review. This is currently being implemented as a demonstration project at the Riverside Community College District in California (Bell & Bjarke, 1988). The system works fine among the various campuses which comprise Riverside. It can go no further until other colleges accept the technology and organize for it. Choosing

what technology to organize for is only the first concern of administrators. There are other consequences to consider.

## ORGANIZATIONAL CONCERNS

The convergence of computer technology and communications has created a virtual revolution in information systems. As these are implemented, administrators of various offices on college campuses must be cognizant of organizational implications. As technology converges, organizational lines begin to blur. The increasing connections in and among colleges through networking tend to crumble the boundaries between them. There are redistributions of power. The old "knowledge is power" maxim still applies; those who can manipulate it become more powerful, while others lose power. There is more openness in management. Information that has been restricted tends to be forced out in computer systems where widespread entry and access occur. Issues of privacy and discretion must be addressed. There can be a growth of narrowly focused, quantitative thinking. Sometimes mood, style, and qualitative aspects can be overlooked. There are new problems with equity, not just in salaries, but in equal opportunity to access the technology. Finally, the technology allows many to learn with the aid of

computers. This weakens the quasi-monopoly of higher learning institutions (Keller, 1986).

## SUMMARY

Administrators in colleges and universities must make decisions regarding the institutional uses of new technologies. Factors impacting these plans include: a challenging economic environment, increasing difficulty attracting computer professionals, and technological obsolescence. These factors must be planned for and must be weighed against increasing student expectations for technologically enhanced services in areas such as enrollment, registration, and recordkeeping.

An institution needs to define an aspiration level to match its mission and resources. For a two-year community college, that may be to simply treat computing as an ordinary resource, not of particular concern to any of the student affairs offices. A large four-year university may want to be a leader in the field, offering state-of-the-art capabilities in all offices. In any event, it must be realized that the aspirations for sophistication in computing services may differ among academic and student services administrators.

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