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AUTHOR Hunter, Beverly
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ABSTRACT

This case study is one of a series focusing on everyday learning and teaching applications of computers which is addressed to administrators, teachers, staff, and students who wish to plan or improve the uses of computers at their own institutions. Following a brief description of the purpose and selection of cases for the overall study, the report profiles academic computing at Mankato State University, a 12,000-student institution in South Central Minnesota and one of seven state universities. The organization and management of the academic and administrative computing in the state university system is explained and student access to three main computer facilities is described. Also addressed are costs and budgeting, student accomplishments, applications, computer literacy, computer science curricula, outreach, and plans and goals. Under the topic of lessons learned, comments focus on regional timesharing, computer science education, and dual computer usage by administrators and faculty. Contacts, nine references, and a list of the case study and exemplar institutions are provided. (LMM)

Academic Computing at Mankato University

A Case Study

Beverly Hunter

1978

Human Resources Research Organization (HumRRO)
300 North Washington Street
Alexandria, Virginia 22314

HumRRO

HUMAN RESOURCES RESEARCH ORGANIZATION

Foreword

This book was prepared by the Human Resources Research Organization and supported by the National Science Foundation Science Education Directorate, Grant Number SED-76-15399. Dr. Robert J. Seidel, Director of HumRRO's Eastern Division in Alexandria, Virginia, is Principal Investigator for the project, and Ms. Beverly Hunter is co-Principal Investigator. Any opinions, findings, and conclusions or recommendations expressed in this book are those of the authors and do not necessarily reflect the views of the National Science Foundation.

Dr. Donald Henderson, Chairman of the Computer Science Department of Mankato University, gathered the information that is presented in the book. Dr. Layne V. Hopkins, Director of Computer Services, also provided information for this case study.

Contents

Academic Computing at Mankato University

A Case Study

Purpose

This book is one in a series of twenty-one Case Studies of Academic Computing. The Case Studies focus on the ways in which computers have come to be an everyday tool and companion to students and teachers for the purpose of learning and teaching. The Case Studies are addressed to administrators, teachers, staff and students who wish to plan, extend, or improve the uses of computers at their own institutions.. You should find the Case Studies helpful in performing one or more of the following kinds of activities.

1. *Assessing the extent and nature of instructional computing at your own institution, by comparison with the Case Institutions.*

We selected a range of different sizes and kinds of institutions so that you could find one that most closely resembles your own. The Case Institutions include secondary schools, public school districts, community colleges, colleges, and universities in most regions of the continental United States.

2. *Organizing and staffing your computer center to provide improved support for instructional computing activities.*

The Case Studies highlight those aspects of organization and staffing that appear to be most significant in encouraging beneficial uses of computers for learning and teaching.

3. *Making computer resources more accessible to students.*

The Case Studies identify policies, procedures, documentation, hardware, software, and courses that facilitate student use of computing.

4. *Establishing realistic educational goals for instructional computing.*

The sections on Student Accomplishments provide ideas as to the kinds of achievements students attained with the aid of computers.

5. *Extending computer applications in particular courses and disciplines.*

Information is available in Case Books and from the contact persons listed at the back of the book concerning the kinds of computer applications used in the various academic disciplines and courses.

6. *Raising the general level of computer literacy on campus.*

The section on Computer Literacy describes goals and programs aimed at educating students and faculty regarding computer uses and the impact of computers on society.

7. *Establishing or improving a computer science curriculum.*

Most of the Case Institutions have a formal program designed to train students in computer science and/or data processing.

8. *Sharing your facilities, expertise, or curricular materials with your community or other institutions.*

The section on Outreach describes the ways the Case Institution makes an impact on the world around it with regard to instructional computing.

9. *Preparing a Five Year Plan for academic computing at your institution.*

The organization of the Case Books might be a useful framework for presenting your own Five Year Plan. Also, most of the Case Institutions have their own Plans from which you may draw ideas.

Selection of Cases

Case Institutions were selected through a four-stage procedure. First, we conducted a systematic search for institutions that are regarded as outstanding in their uses of computers for learning and teaching. Invitations were mailed to seven thousand educators and technologists who belong to professional organizations concerned with educational computing. These individuals were invited to nominate one or more educational institutions that they regard as outstanding. Nominators were asked to give specific reasons why the school should be considered, given the objectives of our study.

Over 500 individuals responded, nominating 370 institutions that met our criteria.[1] Eligible institutions included individual elementary and secondary schools, public school districts, community colleges, colleges, and universities, and public access institutions such as museums.

Second, we contacted, at each nominated institution, an individual who has a purview of instructional computing activities. In many cases, this individual is the Director of the Computing Center or a Coordinator of Instructional Computing. The nominated institutions were happy to participate, and provided information about their activities via a telephone interview with a member of our staff. The product of this stage is an Academic Computing Directory, published by HumRRO, that gives brief information on the reasons for nomination, enrollment, typical computer applications, make and model of main computer(s), number of terminals on campus, and persons to contact.

Third, the nominees were invited to respond to one or more of a series of open-ended questionnaires corresponding to the following Categories of Excellence:

1. Institutional Commitment to Instructional Computing
2. Student Accomplishments
3. Institution Productivity
4. Spectrum of Applications
5. Computer Literacy
6. Computer Science and/or Data Processing Programs
7. Outreach
8. Model

[1] Projects, consortia, timesharing companies were not eligible.

These questionnaires were quite lengthy and required considerable work on the part of the respondents. By completing one or more of the questionnaires, the respondents demonstrated their willingness and ability to share information. Over one hundred of the nominees responded in one or more categories of excellence. HumRRO staff then reviewed all candidate institutions within each Category of Excellence. We selected as Exemplars in each Category those institutions that had provided complete answers and had demonstrated a high commitment to instructional computing. Consulting experts were called upon to review candidates in specific Categories. The product of this third stage is a list of Exemplary Institutions distributed by HumRRO.[1]

Fourth, the Case Institutions were selected from among the Exemplars. The following criterion dimensions were used in selection:

1. High institution commitment to academic computing as demonstrated by the survival of instructional computing over several budget cycles; staff support for instructional computing; reform of curriculum to incorporate computer uses; increases in appropriate computing equipment; incentives to faculty for instructional innovation.
2. High degree of computer literacy among students, faculty and administration, as reflected in student accomplishments, spectrum of applications, and number of computer users on campus.
3. Appropriate response to the Model questionnaire, and usefulness of all questionnaire responses.

[1] A list of the exemplars and twenty-one Case Institutions is provided as Appendix A.

Profile

Mankato State University, established in 1867, is one of seven State Universities in Minnesota.

Size: Approximately 12,000 students; 1,000 faculty and staff.

Location: South Central Minnesota, in the city of Mankato. The 400-acre campus overlooks the city. Adjacent counties are rural. Minneapolis/St. Paul (Twin Cities) is 90 miles to the north.

Programs: Degree programs range from two-year associate degrees to sixth-year specialist degrees. Programs include education, accounting and business administration, liberal arts, nursing, urban studies, computer science, and others. About one-third of the 2,000 graduates in 1976-77 received degrees in teaching and education.

Students: Thirty-six percent of the student body comes from the eight rural counties nearby Mankato. Twenty percent come from the Twin Cities. A small but growing number of American minority students and foreign student population adds to the heterogeneity of the student mix.

Budget: The University's yearly operational budget is approximately $30 million.

The Past Sixteen Years

Mankato State University has provided leadership in educational computing in Minnesota since the 1960's. Donald Henderson, presently the Chairman of the Computer Science Department, has been involved in these activities since 1962. He provides the following list of significant events in the history of academic computing:

1962: Mankato State's Computer Services formed and first computer installed—IBM 1620—Don Henderson, Director.
Data Processing short courses offered for faculty and staff.
Computer Science courses offered in Mathematics Department.

1964: Second computer system installed—IBM 1401.

1968: Computer Science Curriculum designed and approved.[1]
Southern Minnesota School Computer Project developed.
Timesharing on a Honeywell computer located in Minneapolis began.

1969: NSF Summer Institute—John Odom, Director.

1970: Univac 1106 system installed replacing IBM 1620 and 1401 computers, and the Honeywell timesharing access.

1971: Dual Hub computer concept[1] implemented at Mankato and St. Cloud.
Student computer centers formed on upper and lower campuses.
Academic Regional Computer Coordinator hired for State University System.

1972: Report prepared for Governor's Joint Committee on Computers in Education by planning task force—Don Henderson a member.

1973: Minnesota Educational Computing Consortium formed—Don Henderson, Executive Director.
NSF Summer Institute—Layne Hopkins, Director.

[1] See section on Organization.

1974: Computer Science teaching degree approved.

1975: Computer Services and Computer Science Departments separated with Dr. Layne Hopkins assigned as Director of Computer Services, and Dr. Donald L. Henderson appointed Chairman of the Computer Science Department.

1976: Univac 100 system for instructional use installed. (Partial matching funds grant from National Science Foundation.)

1976-77: Thirteen new terminals (DECwriters) acquired.

1977: PDP-8 timesharing computer system acquired.
Data 100 batch terminal system acquired.

1977-78: Computer Science Department reached an all-time high of 275-300 majors; 25-30 graduate students, and 75-100 minors in the department.

Organization and Management

Academic and administrative computing in the State University System is managed and coordinated at the State level. Four major organizations provide computing for Mankato: St. Cloud administrative computing center; Mankato academic computing center; Minnesota Educational Computing Consortium (MECC); and Minnesota Educational Regional Instructional Timesharing System (MERITSS).

During the 1969-71 biennium, the Governor's Committee on Statewide Computing formulated a dual hub concept for the State University system. St. Cloud was designated as the administrative computing site and Mankato was selected as the academic computing center. Each of the remaining four colleges were provided access through remote job entry terminals to these sites. Under this plan, the Chancellor of the State College System was given direct control of the funds appropriated for this purpose. In addition to providing the funding for the hardware, a core allocation for staffing was also developed, implemented, and financed through the Chancellor's Office. Full implementation of this plan began in 1971.

Due to the rapid growth of data processing at all levels of education, the 1973 Legislature authorized the creation of the Minnesota Educational Computing Consortium (MECC). The direct impact of MECC on the State College System has been that all academic timesharing computing is obtained via this organization and that all computing plans are reviewed and approved by them before they are submitted to the Legislature for funding. Thus, the State College System determines their academic and administrative needs at meetings of the six Computer Center Directors and receives funding for their computing activities from the Legislature after review and approval of MECC. Funding for the hardware to provide timesharing services to MECC users follow similar procedures, i.e., input is gathered from user organizations, then reviewed by MECC personnel, with final approval by the Legislature. The organization, Minnesota Educational Regional Instructional Time Sharing System (MERITSS), receives funding for their timesharing hardware from the Legislature via request from the University of Minnesota through MECC. Since MECC coordinates all academic timesharing services, the MERITSS ports are obtained from the University of Minnesota only after MECC approval.

All of the budgets referred to above originate at the institutional level. At this level, the Computer Center Director formulates the academic and administrative needs in consultation with users and administrative

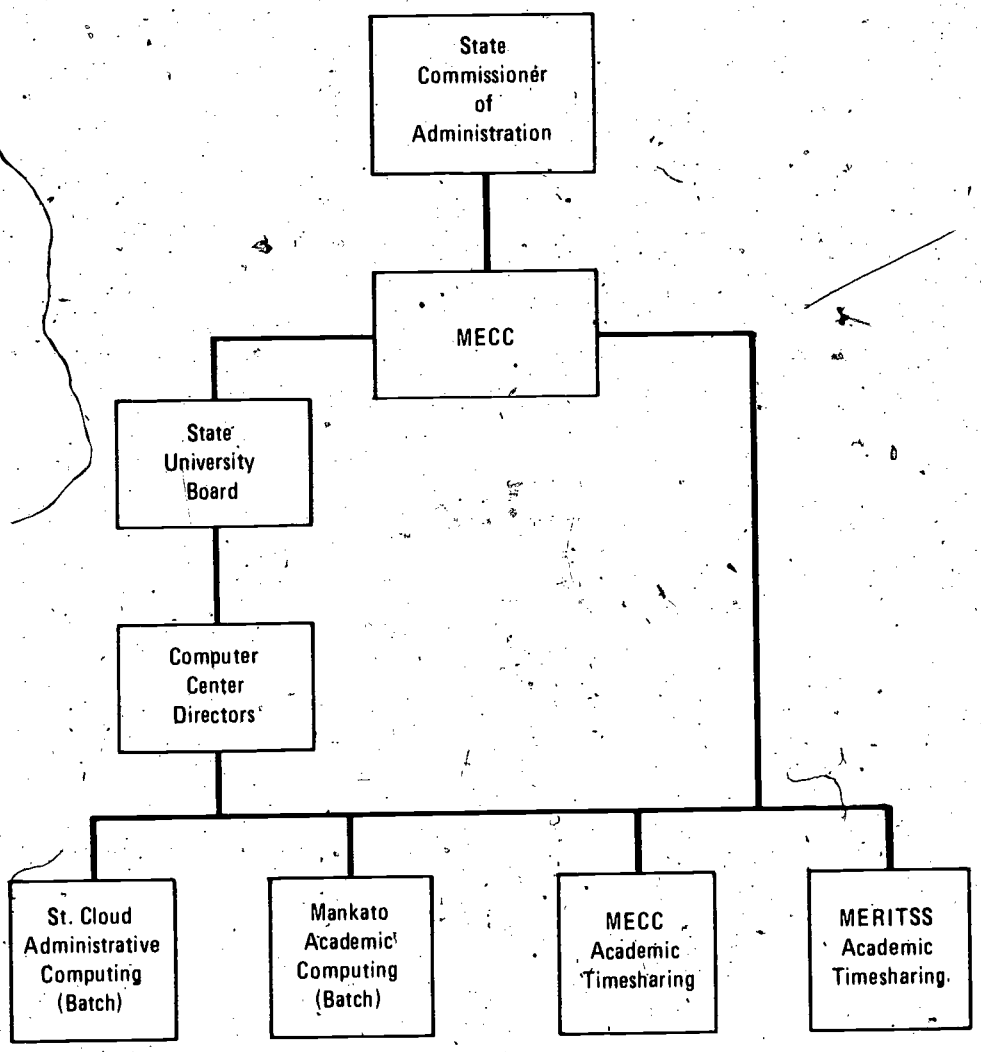

Figure 1. **Organization of Computing for Minnesota State University System**

officials. Once finalized they are presented to the respective academic and administrative state university computing committees for final review and approval. This then serves as the final assembly point prior to their submission to MECC.

COMPUTER SERVICES ORGANIZATION

The Academic Regional Computer Center is managed by the Director of Computer Services at Mankato State University. A staff of 22 full-time and 40 part-time personnel are employed to meet the needs of the users of the center. Organization of the staff is shown as Figure 2.

Usage statistics are reported monthly to major administrative units on their usage of the Mankato, St. Cloud, MECC, and MERITSS systems. A total system budget summary is distributed by the State University Board Office. Accounting reports mentioned above are used by the Director of Computer Services as planning documents for budget requests. For instance, if timesharing ports are being used at a consistently high level, this becomes a major factor in planning additional port accesses for the next fiscal year. At the Regional Center, monitoring of hardware and software failures are analyzed daily and whenever it becomes apparent that users are not receiving excellent service, immediate steps are taken to correct the situation.

FACULTY SUPPORT

The Computer Services Center provides academic assistance to all interested faculty members on a low-cost basis. All faculty members have access to a staff member of the service center for designing special projects. If the projects have approval of their academic department, the only expense associated with the project is the actual cost of materials utilized. In the event it is not approved by the related department, reduced rates for personnel and computer time are assessed in addition to material costs. In any case, the resulting computer expenses are very low.

In addition to the individual interest projects, every faculty member has the opportunity to apply for a faculty research grant. These grants are issued from the academic vice president's office and approximately 110 are

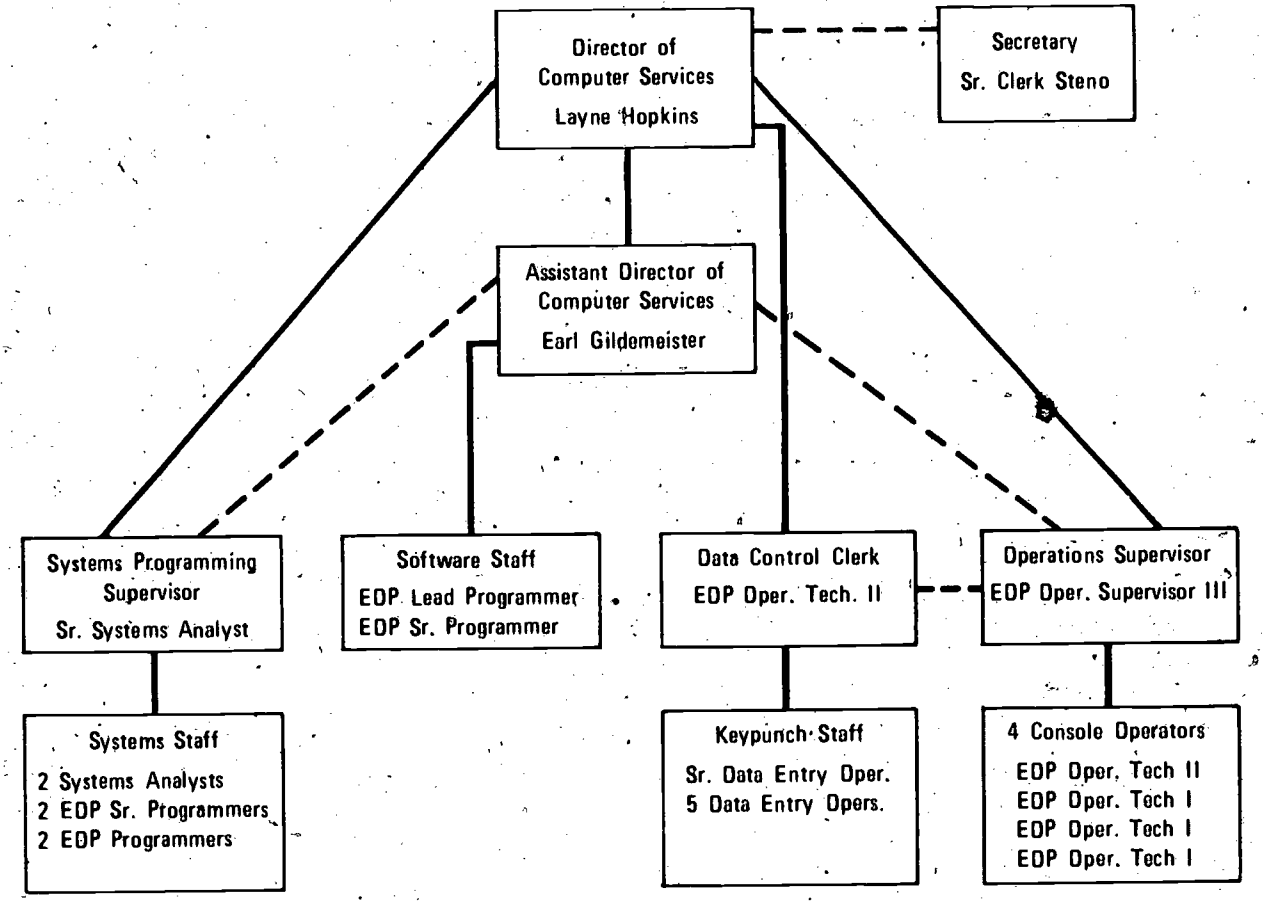

Figure 2. **Computer Services Organizational Chart**

approved annually. Generally, computer material costs and additional pay are provided to recipients.

The State University Board has recently introduced a new concept in teaching/learning projects for faculty. Guidelines for two of the six categories of projects faculty wish to propose for funding include workshops for faculty on use of computers in instruction and computer software development. Specifically, the workshops are intended to acquaint and equip faculty with knowledge and skills whereby they may improve instruction through computer technology while the software development projects are for the design and implementation of one or more computer-assisted courses. Each proposal may request funds up to $20,000 each of the next two fiscal years. In each case, staff members will be provided additional salary and/or release time for the duration of the projects. Currently, a few faculty members have taken the initiative to begin computer-assisted instruction projects on their own. Included in this list are units for computer science, physics, college mathematics, urban studies, political science, and elementary mathematics. In each of these cases, faculty are receiving computer time at no expense and materials are being supported by end users of the developed units.

Student Access to Computing

Students and faculty at Mankato have access to three main computer facilities: the academic batch facility at Mankato; MECC academic timesharing; and MERITSS instructional computing network located at the University of Minnesota.

COMPUTERS

Univac 1106—Batch system at Mankato
CDC-Cyber 73—MECC Timesharing System
CDC-Cyber 73—University of Minneosta MERITSS Timesharing System
System Donner analog computer
DEC PDP-8—Computer Science Department

The three computer systems available to the academic users of the University have special individual capabilities. The Univac 1106 system is dedicated to academic batch processing with the program library containing programs of interest to college level users. This system provides the user with large data files, programs, etc. on a batch service which is not available on the other systems.

The MECC CDC 73 system is dedicated to low speed instructional timesharing for all educational users in the State of Minnesota. This system has a large number of elementary/secondary school users and thus the program library is heavily oriented toward programs for these users. This is advantageous to the University departments preparing teachers and school administrators since they can teach with and about programs on this common computer system.

The MERITSS CDC 73 system is dedicated to higher education users. This gives all colleges and universities in the State a common computer system and thus permits the sharing of programs and other materials which would not be possible otherwise.

The main disadvantage of the above capabilities is not being able to use material developed on one system on one of the other systems without additional programming work. This is especially true when using the Uniscope 100 system to develop software which at completion the user would like to use on one of the other systems.

TERMINALS

Thirty interactive terminals are available for student use, including:

- Teletypewriters
- DECwriters
- Uniscope 100 system
- Teleray

LOCATIONS

Two student centers are located in the library and on the lower campus. The centers are equipped with interactive and batch terminals for communication with the three main computer systems, as well as keypunch and other unit record equipment.

CONSULTING

The student centers have full-time advisors on duty to assist users with equipment and answer questions in regards to computer use. The advisors are part of the Computer Services Staff. The Centers also have tutors available during the hours of 6-10 pm Sunday through Thursday evenings to assist users with programming questions. The tutors are computer science majors with a background in BASIC, FORTRAN, ASSEMBLER, and COBOL programming languages. They are supervised and supported by the Computer Science Department.

ACCESS

Account numbers are issued by the Computer Services Department to any faculty member or student who requests it. Users doing work outside of a class regular are charged only for materials (forms and cards) and not for computer time.

USAGE

About 2000 students use the computers annually. Usage reports show breakdowns by connect hours for timesharing and by number of batch runs. One month's report (December 1977) shows the following usage:

	December	Annual, 1977-78
Mankato Univac 1106 Demand	507 hours	6,892—10 months
MERITSS Network	268 hours	3,178
MECC Network	615 hours	9,605—9 months
Batch runs	6,700*	119,983

*One computer science course used 1,457 of these 6,700 runs.

AVAILABILITY

Student Centers are open 22 hours a day, seven days a week. The system is normally available at least 99% of the scheduled time. Changes to the hardware configuration are examined on an annual basis according to past usage, current performance, and anticipated user needs. Software modifications are considered at monthly meetings of the six computer center directors with changes being implemented when approved by the group.

Costs and Budgeting

Fifty percent of the total computing budget at Mankato is used for instructional, as opposed to administrative and research applications. Overall computing budgets for the University for sample years include the following:

1967-68:	$ 50,000
1969-70:	$314,740
1973-74:	$483,501
1976-77:	$564,766
1977-78:	$580,553

This budget includes computer services personnel, hardware, and charges for MECC and MERITSS usage. It does not include computer hardware at the Mankato Regional Batch Center, since that center is supported by the State University System office.

In 1976-77, ninety-six percent of these funds were provided by the State and four percent by Federal sources.

Student Accomplishments

Information on student accomplishments is available in the area of student projects and community service. At Mankato, the Computer Science Department emphasizes an applications-oriented program. A significant part of a student's program involves application of theory to actual systems problems. Students in applied systems courses have developed systems and computer programs for many community organizations, and have received many letters of commendation from those organizations. Students have developed, for example:

- Planning and budgeting systems for the United Way. Twenty students were involved in this two-year project.
- Donor reporting system for the Boy Scouts.
- Cost accounting system for the YWCA.
- Social indicators system for Blue Earth County.
- Personnel benefits system for a local manufacturer.
- Building maintenance system for the University.
- Specifications for a state-wide educational goals inquiry system.
- Systems flow documentation for the registrar's office, used as an aid in training personnel in the registrar's office.
- Religious talent data bank for United Methodist Church District.

Spectrum of Applications

Twenty-one of the twenty-eight academic departments use computing in at least one of their courses. About a third of the faculty (125 out of 405) use computers for learning and teaching. About 11% of the courses at the University use computers in some way in the instructional process. (This excludes test scoring applications.)

The following describes some of the computer applications used for learning and teaching in Mankato academic departments.

ART

The Art Department uses test scoring and analysis services in 20 of their courses. In one course, computer programs are used to generate frequencies of word usage to study the "Hierarchy of Concreteness Values of Nouns and Their Pictorial Equivalents."

BIOLOGY

Computing is used only for research courses and thesis work.

BUSINESS ADMINISTRATION

Computing is used for interactive business games; for forecasting using statistical programs; for data analysis; and for learning data processing. The following courses are involved:

Introduction to Business Data Processing
Business Computer Programming
Marketing Management
Marketing Research and Analysis
Sales Management
Investments
Elements of Statistics
Marketing Analysis
Retailing Management

BUSINESS EDUCATION

Computing is used in the following courses:

Vocational Data Processing
Management of Interpersonal Relations
Methods of Teaching Basic Business
Filing and Records Management

CHEMISTRY AND GEOLOGY

Computers assist in determinations of chemical reaction rates and simulation of chemical reactions in a chain process.

COMPUTER SCIENCE

See "Computer Science" Section.

CURRICULUM AND INSTRUCTION

Understanding the educational uses of computers, and the impacts of computing on society are considered to be essential to teacher education at Mankato. [5] Computer applications are used in the following courses:

Teach Culturally Disadvantaged
Middle School
Elementary School Curriculum
Secondary Curriculum
In-Service Training
Improvement of Instruction
Field Study in Curriculum
Diagnosis and Corrective Study in Elementary Math
Seminar in Elementary Education
Seminar in Early Childhood

- Practicum
- Curriculum Development
- Advanced Seminar Elementary Education

ECONOMICS

Computing is used in the following courses:

- Elements of Statistics
- Quantitative Accounting Applications
- Linear Models in Economics
- Economic Analysis
- Statistical Analysis for Business

EDUCATIONAL ADMINISTRATION

Students learn how to use computer applications to school administration, such as scheduling and linear programming applications.

ENGLISH

Little computing is used except for test scoring and analysis.

HEALTH SCIENCE

Computing is used in the following courses:

- Community Health Education
- Community Health Research
- Health Seminar
- Community Health Development

INDUSTRIAL AND TECHNICAL STUDIES

Computing support is used in individual study projects.

MATHEMATICS ASTRONOMY AND STATISTICS

Packaged statistical programs are used to teach elements of statistics. Computing is the focus of several courses, including:

Computers in the Secondary Mathematics Curriculum
Mathematics of Computer I and II
Numerical Analysis
Numerical Computer Methods I and II

Computer methods are also used in courses in Probability, Design of Experiments, and Calculus [7].

NURSING

Computer applications are used in the following courses:

Pre-professional Seminar
Nursing 1 through 10
Introduction to Nursing Research
Advanced Clinical Techniques

PHYSICS AND ELECTRONICS ENGINEERING TECHNOLOGY

Students construct microcomputers and have hands-on work with minicomputers. Computing applications are used in the following courses:

Cultural Physics
Principles of Physics
General Physics
Atomic Physics
Nuclear Physics
Solid State Physics

Semi-Conductor Circuits 1 and 2
Computer Applications in Physics
Quantum Mechanics
Research
Mathematical Physics 1, 2 and 3

POLITICAL SCIENCE

Students use computer tools to analyze actual election data and voting records of Congressmen. Computing is also used in:

Research Design
Advanced Political Analysis
Public Policy Analysis
Political Dynamics
Political Participation

SOCIOLOGY

Students use computing in the following courses:

Social Statistics
Sociological Research I and II
Population
Applied Social Research
Introduction to Archaeology
Methods in Anthropology
Fieldwork in New World Archaeology
Seminar in Sociological Research
Sociological Statistics
Correctional Research

URBAN STUDIES

There is intense student involvement in building a computerized Model City, that includes functions from garbage to government. [9] Computing is used in:

Urban Simulations I and II
Computer Applications in Urban Studies
Urban Graphics

Computer Literacy

Mankato State University began a series of events to improve computer literacy on and off campus when the first university computer was installed in 1962. Three major programs that address computer literacy include:

- Short courses offered by the Computer Service Department
- Computer Science service courses
- Computer literacy for elementary and secondary school teachers

SHORT COURSES

Since 1962, short courses have been offered to faculty and staff of the University as well as to the townspeople of Mankato. Course content has changed over the years from data processing to programming and more recently to on-line data inquiry and update. Content is usually tailored to the interests of the participant group.

Participants generally are from the sciences, business, and social science departments. About 25% of the faculty have participated over the years. Participants are not charged fees except if college credit is desired. Staff of the Computer Services and Computer Science Departments have volunteered their time to provide these courses.

SERVICE COURSES

The Computer Science Department provides an Introduction to Computer Science course which serves students from a variety of disciplines. This course has an annual enrollment of 800 to 900 students.

Introductory courses in subjects such as data processing and COBOL programming were previously provided by the College of Business and the Business Administration Department. These have now been consolidated into the Computer Science Department, thus reducing costs due to duplication of offerings.

TEACHER LITERACY

Over the past ten years, Mankato has provided training in computing for elementary and secondary school teachers, through several different projects and programs. In 1968, a secondary school project (Southern Minnesota School Computer Project) was initiated by the Computer Services and Computer Science Departments. The main objective of that project was to improve the computer literacy of the elementary and secondary school faculty, as well as of the students attending those schools. The project grew to include 30 school districts in 1972, when MECC took over the responsibilities for instructional computing in Minnesota. [8]

Another program for teachers is the Computer Science Education degree program offered by the Computer Science Department (see Computer Science section of this book).

The Outreach section of this book describes other activities aimed at increasing computer literacy on the part of educators.

Computer Science Curricula

The first computer science curriculum at Mankato was approved in 1968. Since then, the number of undergraduates annually has increased from 20 to 300 majors and 80 minors.

PROGRAMS

Four programs are offered:

Bachelor of Science in Computer Science
Interdisciplinary Majors in Business
Interdisciplinary Majors in Mathematics
Computer Science Education—Teaching Degree

Also, a Master's Program has been designed and proposed.

CURRICULUM

The Computer Science curriculum was designed originally following the "Recommendations for Academic Programs in Computer Science" produced by the ACM Curriculum Committee on Computer Science. The curriculum now includes 50 courses, listed as Figure 3.

The primary purpose of the BS program is to train systems analysts and programming analysts; graduate school preparation is a secondary purpose.

FACULTY

Ten faculty members teach in the computer science program. Seven are in the Computer Science Department and three in the Computer Services Department.

WORK-STUDY

Students are employed as teaching assistants and as tutors for the student computer centers. In addition, each student major must complete

Introduction to Computer Science
FORTRAN for the Non-Major
Digital Computer Programming I (FORTRAN)
Digital Computer Programming II (Assembler)
Digital Computer Programming III (COBOL)
Job Control Language
Report Program Generator (RPG)
Introduction to Software Systems
Elements of Systems Analysis
Case Studies in Systems Design
Applied Systems Analysis
Telecommunications
Linear Programming
Information Structures
Concepts of Programming Language
Operating Systems
Simulation Process
Data Management Systems
Management Information Systems
Analog Computation
Computer Organization
Systems Programming
Theory of Automata
Computers in Society
Seminar in Computer Science
Selected Topics in Computer Science
Computer Science Workshop
In-Service in Computer Science
Computers in the Classroom
Elements and Methods of Computer Assisted Instruction
Applied Computer Assisted Instruction
Descriptive Statistical Packages
Statistical Inference Packages
Internship
Individual Study in Computer Science
Administrative Uses of the Computer in Education
Seminar in Computer Assisted Instruction
Compilers
Artificial Intelligence
Numerical Solution of Differential Equations
Computations in Linear Algebra
Advanced Science Computation

Figure 3: **Computer Science Course Titles**

an internship as part of the program requirements. Over the past five years, over 250 students have participated, working in industry and government organizations such as IBM, Honeywell, Marquette Computers, Univac, State of Minnesota, public schools, and others. The majority of the students receive offers for permanent employment upon completion of their internship experience.

EVALUATION

The Computer Science program, being oriented towards employment in applied work, is evaluated by potential employers. The most recent evaluation was a survey in 1978 of employers, requesting comment on course content and specialization requirements. [1]

COMPUTER SCIENCE EDUCATION

The Computer Science teaching degree program is designed for individuals who desire to use, teach, or coordinate the computer science curriculum of a junior or senior high school. The program is approved for teacher certification in the State of Minnesota. Each major must complete a related academic core in mathematics or business education in conjunction with this major.

In addition to traditional computer science courses in such subjects as systems analysis, languages, and telecommunications, computer science education majors also take courses in "Computers in the Classroom," "Elements and Methods of Computer Assisted Instruction," and "Applied Computer Assisted Instruction."

For further information on preparation and certification of teachers and administrators for educational uses of computers, see Henderson [5], and the brochure "Computer Science Education," [3].

Outreach

Mankato State University has had several successful computing experiences with other educational institutions. Specific instances include the development of a secondary school computer consortium, a regional academic computer center for the State University System, and the establishment of workshops, evening classes, and institutes for area personnel.

SCHOOL PROJECT

The Southern Minnesota Secondary School Project (SMSCP) was established in 1968 with six (6) Southern Minnesota schools participating. The project increased in size to 31 schools participating in 1974. Each school supported the costs of the project while the university coordinated all activities, provided computer access, and provided extensive training sessions for secondary school personnel throughout this period. Since that time, computer access and coordination has been by the Minnesota Educational Computing Consortium (MECC) while the University has continued the support of this group by continuing training sessions. The MECC concept was developed for all state elementary, secondary, and institutions of higher education in Minnesota by utilizing the SMSCP concept as an example. [8]

NSF INSTITUTES

Training of college faculty, secondary and elementary teachers, and students at all levels has and continues to be provided by the University. Two National Science Foundation (NSF) institutes have been held which provided concentrated training for selected individuals while individual courses, workshops, seminars, and conferences numbering well over one hundred have been conducted for interested individuals. These sessions have been held throughout Southern Minnesota and in the Twin Cities area since 1968.

REGIONAL COMPUTING CENTER

Since 1971, Mankato State University has served as the host for the Regional Academic Batch Computer Center for the entire Minnesota State

University System. The Minnesota State University System consists of six state universities located in St. Cloud, Winona, Moorhead, Bemidji, Marshall, and Mankato. Each of these centers have high speed computer terminals connected to Mankato's Univac 1106 computer system which are utilized for processing all student and faculty academic batch runs. This consists of approximately 24,000 runs per month. The Computer Services staff is responsible for assuring equal access to all users to maintain all hardware and software, and to monitor all usage of the system. This also involves considerable direct contact with users at each of the other institutions. Monthly meetings are held with computer center directors from each of the institutions to discuss services provided as well as any other related items concerning the operation of the center.

MATERIALS

Materials which have been developed in the NSF institutes have been distributed throughout the United States. One of these programs was tailored specifically for curriculum development while the second included training and individually developed materials, i.e., designed for an individual teacher's course. Newsletters, locally developed user manuals, and computer news releases have been shared with all users and with other institutions nationally. The sharing and exchanging of software with other colledges and universities continues to provide an excellent resource for the center.

In conclusion, the computer resources available at Mankato State University have been shared on numerous occasions with interested agencies. The impact of this service has resulted in substantial increase in the utilization and literacy of educators about computers in the Southstate area.

Plans and Goals

COMPUTER SCIENCE

A plan and proposal have been drawn up to establish a Master's degree program in Computer Science. Areas of specialization will include Information systems, Applied Software, Numerical Mathematics, and Theoretical Computer Science. The Department Chairman, Donald Henderson, believes that the existence of such a program will not only provide opportunities for specialization for graduate students, but will also enhance the undergraduate program.

FACILITIES

Plans to improve the facilities for student centers and computer center are now past the blueprint stage, with construction underway this summer to complete a new computer center and central student data center. The Computer Science and Computer Service departments will also be housed in the new facilities.

Lessons Learned

Other institutions and states have looked to Mankato's experience for guidance in at least three areas: regional timesharing; computer science education programs; and dual computer usage.

REGIONAL TIMESHARING

The regional timesharing plan developed at Mankato State has been copied by other institutions who have visited the campus and learned from Mankato's experiences. This same concept was used as a part of the basis for forming the Minnesota Educational Computing Consortium (MECC) for statewide computing in education. The cooperative sharing arrangements designed for the Southern Minnesota Secondary School Computer Project by Mankato State personnel were used as guidelines in extending this type of service throughout Minnesota.

COMPUTER SCIENCE EDUCATION

The Computer Science Education major program established at Mankato is a major area of interest by other states as they explore the computer science field in regards to teacher certification at the secondary school level. Minnesota is at this time one of four states with such a program.

DUAL COMPUTER USAGE

The joint usage of a computer system by both school administrators and instructional faculty was not looked upon very favorably by either of the two groups at the time this approach was adopted in Minnesota in 1971. However, it was very successful and as a result several other colleges reviewed Mankato's operation and patterned their developments after Mankato State. This joint usage has changed at Mankato now, with most of the administrative work processed on the central State University System computer in St. Cloud and with Mankato's system devoted to instructional batch processing for the seven universities in the State University System.

Contacts

Individuals recommended as contacts in the academic and administrative areas are:

ACADEMIC:

Name	Department
Henderson, Donald	Chairman, Computer Science
Hopkins, Layne	Director, Computer Services
Kelley, Philip	Geography
Morley, Gayle	Physics
Odom, John	Computer Science
Prouse, Howard	Mathematics
Symons, Joseph	Urban Studies

ADMINISTRATIVE:

Gildemeister, Earl	Associate Director, Computer Services
Hopkins, Layne	Director, Computer Services
McMahon, Edward	Vice President for Resource Management
Trauger, Dean	Director of Business Affairs

ADDRESS:

Mankato State University
Mankato, MN 56001
(507) 389-2618

References

1. Christensen, Richard and Odom, John. "Curriculum Planning Survey." Computer Science Department, Mankato State University, December 15, 1977.

2. *Computer Science Curriculum.* Mankato State University, May 1971.

3. *Computer Science Education: Bachelor of Science Degree in Computer Science Teaching.* Mankato State University, September 1974.

4. *Computer Usage Information Manual.* Computer Science Department, Mankato State University, September 1977.

5. Henderson, D.L. *Educational Uses of the Computer, Teacher/Administrator Preparation and Certification.* Mankato State University, June 1976.

6. Henderson, D.L. *Management Information Systems for Admission and Registration.* Paper presented at the Upper Midwest Association of College Registrars and Admission Officers, Minneapolis, Minn.: June 21, 1976.

7. Prouse, H. *Using the Computer in the Mathematics Classroom.* Mankato State University, undated.

8. *Secondary School Computer Project.* Paper outlining outreach program established by Computer Services of Mankato State University which developed a secondary schools computer consortium, Mankato State University, 1971.

9. Symmons, John and Schneider, J.B. *Locating Ambulance Dispatch Centers in an Urban Region: A Man-Computer Interactive Problem-Solving Approach*, Seattle: Regional Science Research Institute, 1971 (Discussion Paper Series No. 49).

APPENDIX:

CASE STUDY AND EXEMPLAR INSTITUTIONS

Case Study

The following educational institutions have been selected to participate as Case Studies in Academic Computing.

The persons to contact regarding academic computing at the Case Study institutions are identified in the *Academic Computing Directory* published by HumRRO.

North Salem High School, Salem, Oregon
George Washington High School, Denver, Colorado
Lincoln High School, Bloomington, Minnesota
Ridgewood High School, Ridgewood, New Jersey
Riverdale Country School, Bronx, New York
Huntington Beach Union High School District, Huntington Beach, California
Alexis I. DuPont School District, Greenville, Delaware
Chicago Public Schools, Chicago, Illinois
Dallas Independent School District, Dallas, Texas
Lawrence Hall of Science, Berkeley, California
William Rainey Harper Community College, Palatine, Illinois
Golden West Community College, Huntington Beach, California
United States Naval Academy, Annapolis, Maryland
Worcester Polytechnic Institute, Worcester, Massachusetts
Denison University, Granville, Ohio
Evergreen State College, Olympia, Washington
Jackson State University, Jackson, Mississippi
Mankato State University, Mankato, Minnesota
Rutgers, The State University, Piscataway, New Jersey
University of Delaware, Newark, Delaware
University of Texas, Austin, Texas

Exemplar Institutions

Educational institutions identified here are participating in the study, "Exemplary Institutions in Academic Computing." These institutions have been selected as Exemplars in one or more Categories of Excellence, on the basis of written responses to a series of questionnaires prepared by the Human Resources Research Organization.

Individuals to contact regarding academic computing at the Exemplar institutions, may be found in the *Academic Computing Directory* published by HumRRO.

CATEGORY 1: STUDENT ACCOMPLISHMENTS

Colleges and Universities With Student Enrollment Over 6,000 FTE

University of California, Irvine (CA)
University of Akron (OH)
University of Pittsburgh (PA)
University of Texas, Austin (TX)

Colleges and Universities With Student Enrollment Under 6,000 FTE

University of D.C., Van Ness
Grinnell College (IO)
Transylvania University (KY)
U.S. Naval Academy (MD)
Worcester Polytechnic Institute (MA)
Bennett College (NC)
Denison University (OH)
Evergreen State College (WA)

Community Colleges

Gavilan College (CA)
Golden West College (CA)
William Rainey Harper College (IL)
Burlington County College (NJ)

Elementary and Secondary Schools

George Washington HS (CO)
Ballou HS (DC)
Hull HS (MA)
Joyner Elementary School (NC)
Amherst Central Senior HS (NY)
Riverdale Country School (NY)
Belmont HS (OH)
North Salem HS (OR)
Sehome HS (WA)

Public School Districts

Huntington Beach USD (CA)
Los Nietos ESD (CA)
Montgomery County PS (MD)
School District of Kansas City (MO)
Syosset Central SD (NY)
Woodridge PS (OH)
Memphis City Schools (TN)
Dallas ISD (TX)
Richardson ISD (TX)
Jordan SD (UT)
Fairfax PS (VA)
Highlina SD (WA)

Public Access

Capital Area Career Center (MI)

CATEGORY 2: INSTITUTION ACCOMPLISHMENTS

Colleges and Universities With Student Enrollment Over 6,000 FTE

New York Institute of Technology (NY)
University of Pittsburgh (PA)
University of Texas, Austin (TX)

Colleges and Universities With Student Enrollment Under 6,000 FTE

Trinity College (CT)
University of Tennessee, Chattanooga (TN)
Trinity University (TX)
Carnegie-Mellon (PA)

Community Colleges

Golden West College (CA)

Elementary and Secondary Schools

Ballou HS (DC)
Garden City HS (KS)
Lincoln HS (MN)

Public School Districts

Huntington Beach USD (CA)
Atlanta PS (GA)
Chicago PS (IL)
Albuquerque PS (NM)
Jamesville-DeWitt CSD (NY)

CATEGORY 3: SPECTRUM OF COMPUTER APPLICATIONS TO LEARNING AND TEACHING

Colleges and Universities with Student Enrollment Over 6,000 FTE

Auburn University (AL)
California State at Fresno (CA)
Stanford University (CA)
University of Colorado, Boulder (CO)
University of Delaware (DE)
Southern University and A&M College (LA)
Mankato State University (MN)
Rutgers University (NJ)
Ohio State University (OH)
University of Pittsburgh (PA)
University of Texas, Austin (TX)
University of Texas, El Paso (TX)
Western Washington University (WA)
University of Wisconsin, LaCrosse (WI)

Colleges and Universities With Student Enrollment Under 6,000 FTE

Colorado School of Mines (CO)
Fairfield University (CT)
Trinity College (CT)
Anderson College (IN)
Grinnell College (IO)
Emporia State University (KS)
U.S. Naval Academy (MD)
Carleton College (MN)
Northern Montana College (MT)
Worcester Polytechnic Institute (MA)
Dartmouth College (NH)
Hamilton/Kirkland College (NY)
Bennett College (NC)
University of North Carolina, Asheville (NC)
Denison University (OH)
Bucknell University (PA)
University of Tennessee, Chattanooga (TN)
University of Tennessee, Martin (TN)
Trinity University (TX)
Evergreen State College (WA)
University Wisconsin, Superior (WI)

Community Colleges

Golden West College (CA)
William Rainey Harper College (IL)
St. Louis CC, Florissant Valley (MO)
Broome County CC (NY)
Roane State CC (TN)

Elementary and Secondary Schools

George Washington HS (CO)
Garden City HS (KS)
Lincoln HS (MN)
Maple Lake HS (MN)
Ridgewood HS (NJ)
Teaneck HS (NJ)
Commack HS South (NY)
Jericho HS (NY)
Joyner Elementary School (NC)
West Cary Jr. HS (NC)
Belmont HS (OH)
Catlin Gabel School (OR)

Public School Districts

Huntington Beach USD (CA)
Palo Alto SD (CA)
San Francisco Unified SD (CA)
Chicago Public Schools (IL)
Wichita PS (KS)
Jamesville-DeWitt CSD (NY)
Dallas ISD (TX)

CATEGORY 4: COMPUTER LITERACY PROGRAMS FOR STUDENTS, FACULTY OR COMMUNITY

Colleges and Universities With Student Enrollment Over 6,000 FTE

Auburn University (AL)
University of California, San Diego (CA)
Mankato State University (MN)
Rutgers University (NJ)
University of Illinois, Urbana (IL)
New York Institute of Technology (NY)
University of Texas, Austin (TX)
University of Texas, El Paso (TX)
University of Wisconsin, LaCrosse (WI)

Colleges and Universities With Student Enrollment Under 6,000 FTE

Colorado School of Mines (CO)
Fairfield University (CT)
Grinnell College (IO)
U.S. Naval Academy (MD)
Carleton College (MN)
Northern Montana College (MT)
Dartmouth College (NH)
Bennett College (NC)
Denison University (OH)
Cameron University (OK)
Bucknell University (PA)
Moravian College (PA)
University of Tennessee, Chattanooga (TN)
Trinity University (TX)
Evergreen State College (WA)

Community Colleges

Gavilan College (CA)
Mercer County CC (NJ)

Elementary and Secondary Schools

George Washington HS (CO)
St. Patrick HS (IL)
Lincoln HS (MN)
Maple Lake HS (MN)
North Salem HS (OR)
Teaneck HS (NJ)
Amherst Central Senior HS (NY)
Riverdale Country School (NY)

Public School Districts

Huntington Beach USD (CA)
Palo Alto USD (CA)
San Jose USD (CA)
Alexis I. DuPont (DE)
Montgomery County PS (MD)
Albuquerque PS (NM)
N. Syracuse Central SD (NY)
Dallas ISD (TX)
Richardson ISD (TX)
Fairfax County PS (VA)
Highline SD (WA)

Public Access

Lawrence Hall of Science (CA)

CATEGORY 5: COMPUTER SCIENCE OR DATA PROCESSING CURRICULA

Colleges and Universities With Student Enrollment Over 6,000 FTE

California Polytechnic State University, San Luis Obispo (CA)
Mankato State University (MN)
Western Washington University (WA)
University of Colorado, Boulder (CO)
Rutgers University (NJ)
Ohio State University (OH)
University of Texas, Austin (TX)
University of Wisconsin, LaCrosse (WI)

Colleges and Universities With Student Enrollment Under 6,000 FTE

Anderson College (IN)
U.S. Naval Academy (MD)
Worcester Polytechnic Institute (MA)
University of North Carolina, Wilmington (NC)
State University of New York, Plattsburgh (NY)
Bucknell University (PA)
Carnegie-Mellon (PA)

Community Colleges

William Rainey Harper College (IL)
St. Louis Community College, Florissant Valley (MO)
Burlington County College (NJ)
Mercer County College (NJ)
Roane State Community College (TN)

Elementary and Secondary Schools

George Washington HS (CO)
Ballou HS (DC)
Hull HS (MA)
Belmont HS (OH)
N. Salem HS (OR)
Ridgewood HS (NJ)
Teaneck HS (NJ)
Amsterdam HS (NY)
Commack HS South (NY)
Riverdale Country School (NY)
Sehome HS (WA)

Public School Districts

Jefferson County PS (CO)
Alexis I. DuPont SD (DE)
Atlanta PS (GA)
Chicago PS (IL)
Albuquerque PS (NM)
Churchill Area SD (PA)
Dallas ISD (TX)
Fairfax County PS (VA)

CATEGORY 6: OUTREACH TO COMMUNITY AND OTHER INSTITUTIONS

Colleges and Universities With Student Enrollment Over 6,000 FTE

California State, Fresno (CA)
University of California, Irvine (CA)
University of Illinois, Urbana (IL)
Mankato State University (MN)
Jackson State University (MS)
University of North Dakota (ND)
University of Akron (OH)
Ohio State University (OH)
University of Pittsburgh (PA)
University of Texas, Austin (TX)
Western Washington University (WA)
University of Wisconsin, LaCrosse (WI)

Colleges and Universities With Student Enrollment Under 6,000 FTE

Fairfield University (CT)
Lewis University (IL)
Grinnell College (IO)
U.S. Naval Academy (MD)
Worcester Polytechnic Institute (MA)
Northern Montana College (MT)
Dartmouth College (NH)
University of North Carolina, Asheville (NC)
Denison University (OH)
Bucknell University (PA)
University of Tennessee, Chattanooga (TN)
Rice University (TX)
Evergreen State College (WA)

Community Colleges

Maricopa Community College District (AZ)
Gavilan College (CA)
Golden West College (CA)
Burlington County College (NJ)
Mercer County Community College (NJ)
Roane State Community College (TN)

Elementary and Secondary Schools

George Washington HS (CO)
Canterbury School (CT)
Ballou HS (DC)
St. Patrick HS (IL)
Hull HS (MA)
Ridgewood HS (NJ)
Riverdale Country School (NY)
Belmont HS (DH)
Catlin Gabel (DR)
Upper St. Clair HS (PA)
Sehome HS (WA)

Public School Districts

Huntington Beach USD (CA)
Los Nietos ESD (CA)
San Francisco Unified SD (CA)
Jefferson County PS (CO)
Alexia I. DuPont SD (DE)
School District of Kansas City (MO)
Wayne Township PSD (NJ)
Jamesville DeWitt CSD (NY)
Churchill Area SD (PA)
Dallas ISD (TX)
Fairfax County PS (VA)

Public Access

Lawrence Hall of Science (CA)
Capital Area Career Center (MI)