Market Analysis Program (MAP)

Industry Sector Markets 1988-1993

Education Sector

INPUT®

1280 Villa Street, Mountain View, CA 94041 (415) 961-3300

DECEMBER 1988

INDUSTRY SECTOR MARKETS 1988-1993

EDUCATION SECTOR

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Industry Sector Markets, 1988-1993
Education Sector

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Industry Overview

A

Introduction

INPUT's annual coverage of the information services industry includes a series of reports that analyze the industry by seven principal delivery modes as well as by the industry-specific and cross-industry markets as defined by the first two digits of the Standard Industrial Classification (SIC) codes. The seven delivery modes include: application software, system software, professional services, processing services, turnkey systems/VAR, systems integration, and network/electronic services. These seven delivery modes are also used to analyze the industry-specific and cross-industry markets.

The education market for information services subdivides into two principal segments: academic education and education and training. Academic education, which is the subject of this report, includes K-12 public and private schools, secondary vocational programs, higher education institutions, vocational/technical programs that are part of community college programs, and academic libraries.

Coverage of the education and training markets is provided in a separate INPUT annual report.

B

Industry Overview

The academic education information services market includes three principal subsegments:

- Administrative applications
- Academic research/courseware applications
- Library applications

Administrative applications include:

- Education-specific administrative applications, such as student scheduling, instructor scheduling, classroom scheduling, attendance management, student evaluation, tuition, personnel administration, admissions,

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alumni information and registration, fixed asset inventory management, employee management, alumni and corporate development, financial aid administration, accounting, investments, covenants and appeals, reports for state and federal agencies, work/study program administration, fellowship/internship accounting, student records, immunization tracking, grade reporting, aggregate test score evaluation, redistricting analysis, vehicle maintenance, ticketing for athletic and art/music events, and guidance counselling

- Cross-industry administrative application tools, including word processing, electronic spreadsheet and data base management software (Cross-industry applications are sized as part of INPUT's annual office systems and planning and analysis cross-industry reports)

- Networking of intracampus and intercampus IS resources

Academic research/courseware applications include:

- Software for curriculum instruction and computer literacy at all academic levels including vocational/technical schools and professor or department-specific research projects

Library applications include:

- Catalog maintenance and information retrieval, circulation control, loans and reservations, acquisitions, periodical control, indexing, text search and retrieval, financial management, overdue and reserve book handling, interbranch and interlibrary loan, and tracking periodicals being bound

- On-line library computer services, including search services for bibliographic text, cataloging services, interlibrary loan services and document exchange programs (available from on-line data base services utilities through value-added, private, or dial-up networks)

As shown in Exhibit I-1, educational information services is a fragmented market.

C
Trends in K-12

1. Overview

Over the past two years, there appears to be an increasing rate of acceptance at the K-12 level of computer-assisted instruction (CAI) to enhance the learning process in individual curriculum areas. At the same time, there has been a reduced emphasis on the instructional use of computers primarily for computer literacy training. This also reflects a transition in the K-12 educational software markets from the specialized usage of

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EXHIBIT I-1

TYPES OF ACADEMIC EDUCATION MARKET VENDORS

- Administrative Software and Services Specialists
- Library Administrative Software and Services Specialists
- Textbook Publishers/Educational Curriculum Specialists
- Home Entertainment Software Specialists
- Small, Independent Software Developers, Usually with a Local Market Focus
- Turnkey Systems/VAR Vendors
- Network/Electronic Services Vendors
- Systems Integrators

computers primarily for advanced student instruction and drill and instruction applications for slower learners to more mass market utilization.

Factors that appear to be contributing to this transition include:

- The increased availability of computers for teachers, students, and administrators
- Friendlier computer interfaces, which make the computer less of an elitist tool
- Perceived improvement in the quality of programs, with more deliberate attempts to integrate software into the standard curriculum
- Challenging presentation modes that take advantage of the current generation of more powerful personal computers and related technologies—such as interactive simulation and videodisks
- Increasing familiarity with computers by administrators with the introduction of word processing and desktop publishing into the principal's office

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- A wider distribution of computer resources, which reflects administrative acknowledgement of the value of computers in curricula other than math and science

2. Academic Courseware Applications

The leading trends in K-12 courseware development include:

- Interactive simulation
- Group-oriented programs implemented with a single computer and liquid crystal overhead projector that encourage teacher-student problem-solving interaction
- Multimedia-based applications providing interactive linkages between videodisks and computers
- CD-ROM for storing commonly used reference material
- Simulation products with data base access in the social studies programs
- Graphics drawing and design packages in the art classroom
- Vocational programs for teaching the use of computers in a technical environment—Vocational teacher interest in computer applications reflects in part a congressional mandate for state technical committees under the Carl Perkins Vocational Educational Act of 1984, which encourages the development of curriculum models to make the vocational/technical programs more responsive to the needs of the business community.
- Drill and practice computer programs for special education needs
- Word processing programs to teach writing skills
- Programming tools such as LOGO

Exhibit I-2 shows the leading trends in K-12 courseware development.

Basically, two delivery modes are being used in the K-12 classroom.

- Standalone programs delivered on individual floppy disks—This involves more teacher planning in the implementation of the application and is oftentimes used in concert with group instructional methodology.

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EXHIBIT I-2

LEADING TRENDS IN K-12 COURSEWARE DEVELOPMENT

- Interactive Simulation
- Group-Oriented Programs
- Multimedia-Based Applications
- CD-ROM Storage
- Simulation Programs Integrated with Data Base Access
- Graphics Design Packages
- Vocational/Technical Programs
- Drill and Practice Programs
- LOGO

- Integrated (turnkey) learning systems, where one supplier provides the total hardware and software solution, usually in a networked configuration for a computer laboratory environment

  - Turnkey solutions were originally provided primarily on a proprietary minicomputer-based system basis. The more recent use of lower cost, standard workstation/PC platforms and CD-ROM storage has helped to minimize the cost deterrent to the usage of such systems.

  - Such integrated systems have traditionally tied the curriculum to a proprietary vendor approach. More recently, certain vendors of integrated systems have also begun offering an unbundled software/hardware product.

  - The integrated learning systems have particular merit as an instructional approach for the slower learner. These systems help provide an emphasis on individualized instruction with individually tailored instructional programs. They also help diagnose further instructional needs.

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- Surveys indicate that at least one-third of students in today's K-12 classrooms can be classified as disadvantaged learners. As such, instructional approaches that can provide practice of skills on an individualized basis are establishing their merit as measured by standardized test scores. Along with this, they also tend to motivate the learning process with such children.

- However, such "teaching machines" should also address higher orders of thinking, such as conceptual and critical thinking.

3. Administrative Applications

Leading trends in K-12 administrative applications include:

- Teacher/classroom management applications. In addition to automating the teacher's grading and other recordkeeping functions, these applications could be linked to the local principal's office as well as to district level computer systems. Teacher management is also being integrated into CAI programs to enhance the individualized instructional approach. This includes teacher editing intervention in the CAI instructional learning systems.

- Automation of the district-level recordkeeping process

  - Many states have required school districts to work with Service Bureaus that are tied directly into state data processing programs in order to comply with state recordkeeping procedures. This has led to the development of regional data processing consortiums in various states that perform the data processing functions for individual school districts. These are funded by the individual districts.

  - Larger districts, in particular, are buying their own minicomputers to provide for services not provided by the Service Bureaus and to bring in-house the type of total data processing functionality provided by the Service Bureaus. This reflects complaints about the overhead costs of Service Bureaus and suggests that data processing functions can be performed locally on minis and microcomputers at lower cost. In some cases, this has lead to the development of dual systems, with continued use of Service Bureaus for certain mandated state requirements.

- Microcomputer-based computer solutions for local school administrative tasks, including:

  - Scheduling
  - Attendance tracking
  - Grade reporting

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- Budgeting
- Word processing and desktop publishing
- Test scoring

D

Trends in Post-Secondary Institutions

1. Overview

Information services markets within higher education include:

- General administrative, including student recordkeeping, financial, and business applications
- Classroom management, including faculty use of basic software utilities, such as word processing, spreadsheets, and data base management systems
- Computer-assisted instruction (CAI)
- Library administration
- Computer literacy instruction
- Research support

2. Administrative Applications

At the university level to date, most of the major information services applications have been administrative- and research-oriented, increasingly involving network solutions. The most prevalent use of computer systems at the faculty and student levels is for word processing.

Much of the initial administrative application development was for student record-keeping services. More recent programs to be automated include:

- Payroll
- Personnel
- Planning and budgeting at the departmental level

Overall trends in information services at the administrative level in higher education include:

- Intracampus networking of computer resources. University networks are tying together administrative computing environments, individual departments, instructional activity, research programs, and library automation programs.

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- A typical university data network includes a backbone network tied into several smaller departmental local-area networks.

- Ethernet and TCP/IP tend to dominate network types at U.S. higher educational institutions. This is due in part to the fact that many researchers want to be able to use the National Science Foundation Network or other supercomputer centers, which requires TCP/IP network access.

- Multivendor connectivity solutions are in demand, as well as higher bandwidth networks to interconnect technical workstations to supercomputers.

- Network applications can also include interactive instruction, electronic mail, and support for professors in research activities and proposal development. The University of Michigan is developing a multimedia E-mail system called Express which can be used to create and edit text, spreadsheets, graphs and images, as well as to carry data, graphics, video and voice.

• Intercampus networking among universities and other research facilities, such as the supercomputing network called NSFnet, sponsored by the National Science Foundation.

  This connects researchers and scientists around the country with computing resources at the foundation's 13 Supercomputing Centers.

  - IBM and MCI Communications are implementing a new advanced network management and routing capability for NSFnet. The first part of the project replaces the old 56K b/sec. NSFnet with a 1.5M bit/sec. backbone of T1 lines and packet switches. The next phase will tie all of the network components into the centralized Network Operations Center in Ann Arbor, Michigan. Eventually the NSFnet network will be migrated from TCP/IP to the IOS' Open Systems Interconnect protocol structure.

  - The National Science Network will also be deploying a nationwide computer file system on the NSFnet, called the Andrew File System (AFS), which has been used at Carnegie Mellon University since 1985. This will run initially on IBM RT systems, and eventually will run on systems that use Sun Microsystem Inc.'s VNode UNIX interface. Initially, the AFS prototype network will be used to exchange programs and experimental data among scientists and will be used to exchange spreadsheet data, manuscripts, and other information resources.

• Centralized control over higher education information services, including campuswide data base resources. There is also a countervailing trend to departmental budgeting and control over local data bases and

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research projects at the departmental level. In some cases, the trend has been to extreme decentralization, where data processing personnel are used entirely at the departmental level.

- A move to standards for intercampus networking.
- Increased use of customized application software development—involving partnerships with outside vendors.
- The connection of campuswide micros to mainframe facilities—providing a combination of local processing and access to information in central data bases.
- Backbone networking for connecting multiplatform hardware and software resources.
- User involvement in software development
- More end-user training services provided by information services centers
- The creation of the post of centralized information officer, with responsibility for academic, administrative, and multimedia resources—often in combination with libraries.

3. Computer-Assisted Instruction (CAI) Software

To date, little commercial CAI software for the higher-education market has been developed by the commercial educational software publishers. The higher-education market today for courseware applications consists mainly of computer literacy learning tools and research applications. However, there has been a considerable amount of courseware developed at many universities for internal use. In a few cases, such as with the Minnesota Educational Computer Consortium, these programs have been commercialized through licensing by independent software vendors.

Factors influencing the limited size of the higher-education commercial courseware market include:

- The expensive development costs to produce programs for the higher academic levels, due to the sophisticated curriculum knowledge base
- A lack of interest on the part of many members of the college teaching community in using such curriculum tools
- A lack of sophisticated computer programming skills by many in the college faculty community

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It has been the computer hardware manufacturers, such as IBM, DEC, and Apple, that have shown the most interest in CAI software development for the higher education markets. Along with deep discounts on computer hardware, they are providing grants to professors to write programs.

- DEC recently announced a new three-prong program for accredited nonprofit primary and secondary schools and colleges and universities in the U.S. that includes royalty-free software licenses and product support discounts. The initial program provides educational institutions with royalty-free licenses for more than 160 software products, including a variety of language, computer-aided software engineering, data base and communication products.

- IBM recently started a Higher Education Software Consortium to market various packages of its software applications and tools to colleges and universities at a low fee scale of $2,000 to $10,000, depending on enrollment size. Schools will also pay annual fees ranging from $4,000 to $25,000 depending on which of four product categories is chosen: Selected System Platform Programs; Engineering/CIM Programs; Business Applications; and Selected Business Systems Programs.

Universities with a major scientific/technical emphasis have shown the greatest interest to date in computer courseware.

Some of the strongest encouragement for courseware development at the post-secondary level has come from educational consortiums founded for such purposes. Probably the largest effort is that of EDUCOM, based in Princeton, New Jersey, which is actively encouraging faculty members at various universities to write courseware. In addition, EDUCOM has a major program initiative to promote the development of intercampus computer networking.

As indicated in Exhibit I-3, EDUCOM has suggested a basic set of application software programs for all university students and scholars.

In addition, applications should be networked and should incorporate standard application software interfaces.

E

Trends in Computerization of Academic Libraries

Interlibrary linkage is a major overall trend in the use of computers in academic libraries.

Basic trends in library administration software and services include:

- Automation of internal administrative processes.

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EXHIBIT I-3

EDUCOM'S SUGGESTED SOFTWARE APPLICATIONS FOR UNIVERSITY STUDENTS

- Word Processing
- Composition
- Bibliographic Search
- Electronic Mail
- Terminal Emulation
- Electronic Spreadsheets
- Graphics
- Data Base Creation and Access
- Statistics
- Numerical Analysis
- Computer-Aided Design

- On-line or CD-ROM access to bibliographic material in other major academic libraries.

- Electronic mail systems for libraries, such as the CLASS OnTyme network from McDonnell Douglas Corp. It allows subscribers to communicate with each other, for interlibrary loans and also with their associations and their vendors, for discounted purchasing access.

- The Linked Systems Project (LSP), which is a collaborative project to develop computer-to-computer networking among the Library of Congress, the Research Libraries Group (Research Library Information Network), the Western Library Network, and OCLC. LSP will provide academic libraries on-line access to bibliographic materials from all these sources by accessing major on-line cataloging utilities such as OCLC.

  A related purpose of LSP is to provide for an on-line communications interface standard among libraries using remote access facilities for bibliographic material. LSP will implement the Standard Network Interconnection (SNI) communication protocol based on the International Standards Organization's Open System Interconnection Reference Model.

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F

Inhibiting Forces in the Education Software and Services Markets

Factors that are constraining the use of information services within the educational markets include:

- Price sensitivity of the educational market. At the K-12 level, $50 per user (for courseware) appears to be a price cap. Educational software is frequently sold with rights to duplication, with pricing structures that can vary by size of district, among other factors. Perceived improvement in quality of educational software could create a greater incentive to use additional software, as well as to pay more for the perceived added value.

- Inconsistent quality of academic computer software. The increasing awareness by software publishers that the software application should enhance the learning process in ways that paper, pencil, text, and other traditional learning tools cannot should lead to better cost justification models for software utilization.

- Constrained funding sources in the educational community. Educational budgets at all levels have been restricted in recent years by state budget and spending limits, such as Proposition 13 in California. States are the primary source of curriculum funds at the K-12 level. Local taxes provide more of the funding for capital spending related to computer hardware purchases.

  - Much of the incremental funding for software purchases at K-12 levels has come from federal sources. However, many federal education programs have been truncated in recent years. A major federal funding for K-12 academic computer software purchases today is the Chapter I program for disadvantaged and limited English proficient (LEP) children.

  - In addition, Congress and state legislators are beginning to ask for evidence of learning outcome benefits from the curriculum money that has been spent on software. One recent major study on this topic was recently completed by the Office of Technology Assessment of the U.S. Congress.

- The flattening enrollment pattern in recent years in both secondary and higher education. This reflects the pattern of declining family size in the last two decades. Recent budget shortfalls in many public schools districts reflect the impact from this demographic trend, since state support of public schools is based in large part on enrollment figures.

  Enrollment rates, however, are beginning to pick up for the early junior high years. In addition, there are some recent indications that a higher percentage of high school graduates are choosing to go on to college.

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- The relative profitability of educational software compared to that of software sales to the corporate market.
  - Margins for curriculum software publishers are estimated to be generally below those achieved by companies marketing software to the corporate markets or by companies with textbook programs. A pretax margin of 10% is estimated to be the norm for educational software companies, compared to 20%+ levels achieved by companies in many other software markets.
  - At the college level, the fact that very little academic (courseware) material has been developed by software publishers is due in part to the high software development costs at this level.
- The "hodge podge" of computer types in many school districts and in the college and university environment that has been purchased for a variety of specialized needs
  - Related to this is that much of this equipment became obsolete as newer generations of more sophisticated software required more advanced hardware.
  - This could also provide a significant opportunity for systems integrators.

Exhibit I-4 summarizes these inhibiting forces in the educational software and services market.

EXHIBIT I-4

INHIBITING FORCES IN THE K-12 EDUCATION SOFTWARE AND SERVICES MARKET

- Price Sensitivity, Particularly at the K-12 Level
- Inconsistent Quality of Computer Courseware
- Constricted Funding Sources
- Flat Enrollment Patterns in Secondary and Higher Education
- Relatively Lower Profitability of the K-12 Educational Courseware Market Compared with Other Software Markets

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User Issues and Demands

A Major Issues

Key issues impacting the level and type of use of computer systems in the academic education markets include the following considerations for end users and IS departments.

1. End User

a. Academic Courseware Applications

At both the K-12 and the higher education levels, important issues are training teachers on computer use and positioning the use of computers for the general student body or the "mass market."

- Colleges of Education are now beginning to require courses on the use of the computer as a graduation requirement.

- Much of the current use of the microcomputer in the classroom, however, is still related more to the gifted student who represents the early user of CAI.

Exhibit II-1 suggests particular courseware program features that encourage computer use, especially in the K-12 markets. These features include:

- Interactive capabilities

- Individualized instruction

- Close interweaving of curriculum content with the software

- Imaginative, stimulating formats

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- Interfacing with interactive video disc players to maximize video graphics portion of the program.
- Ease of use

EXHIBIT II-1

PROGRAM FEATURES THAT ENCOURAGE COMPUTER USE

- Interactive Capabilities
- Individualized Instruction
- Close Interweaving of Curriculum Content with the Software
- Imaginative, Stimulating Formats
- Interfacing with Interactive Video Disc Players to Maximize Video Graphics Portion of the Program
- Ease of Use

Shifts in the decision-making centers in the K-12 environment is another key issue. A current trend is to move teacher/principal-based curriculum decision making away from the more traditional centralized sources, such as district curriculum consultants. This is part of new educational theory known as site-based management. Under this approach principals and teachers make most of the decisions on curriculum at particular local sites.

Software pricing is important, particularly in school districts where much of the curriculum material is shared. (In many districts only one package is initially purchased when there is a central checkout program.) Some alternatives include:

- Site licensing
- School district membership fees based on enrollment size

b. Administrative Applications

Factors limiting increased implementation of local administrative computerized solutions include the following.

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- As local schools districts increasingly utilize their own computer facilities for administrative applications (as opposed to relying primarily on outside Service Bureau Solutions), administrators are finding that significant additional support costs (staffing and maintenance) must be factored in when comparing costs of such systems versus the use of Service Bureaus.

- In some of the smaller school districts, without specialized IS staff, the lack of knowledge about computers and computer applications by administrators contributes to a lack of knowledge on how recordkeeping processes can be automated locally and can create fear of use.

- Administrative reporting practices can also differ substantially from county to county and state to state. There are efforts among states to standardize school administrative reporting, but certain states still require that local districts use regional Service Bureau facilities.

c. Library Applications

In the area of library automation, an important, newer user issue is security of information related to electronic delivery modes, which is further complicated by the Freedom of Information Act.

2. IS Departments/Post-Secondary Education

The overriding issue facing higher education IS programs continues to be budgetary concern. This reflects concern over the costs of keeping up with increasing hardware/software intracampus demands along with the competitive pressure from peer institutions implementing sophisticated computerized solutions. Certain colleges, for example, have major programs underway to network thousands of workstations.

For publicly financed colleges and universities, key state and federal funding sources have remained relatively flat in recent years, due to budget balancing concerns at both levels of government.

For privately funded institutions, boosts in tuition have helped to counteract the trend to flattening enrollment growth. This has required greater support by the IS department for such administrative marketing activities as student recruitment and solicitation of alumni financial support.

Other critical strategic issues facing college organizations include:

- Implementation problems associated with the migration to new CASE application development tools

- Increasingly more sophisticated technical demands and higher training costs associated with new programs

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- The need to keep programmers' salaries competitive with other industries while budget allocations remain relatively flat
- Increasing demand for harnessing workstation computer power into the general campus computer infrastructure
- Conflicting demands within the campus community over centralized versus decentralized delivery of computer services
- Increasing resource requirements for implementation of end-user computer applications

B

Demands on IS Departments

1. K-12

At the K-12 administrative level, there is an increasing demand for microcomputer-based solutions at the local school level for both principals and teachers.

Among principals at local school sites, applications in demand include:

- Desktop publishing
- Integrated applications, including word processing, file management, and spreadsheets
- Student record management programs
- Computerized budgeting and purchasing solutions
- Integration of local school administrative applications with the central district office, such as:
  - Student record keeping
  - Budgeting
  - Purchasing

A principal benefit of an administrative network for such applications is cost reductions achieved through improved turnaround time, increased local office productivity, and more efficient use of centralized purchasing discounts.

At the individual teacher level, demand is strong for classroom management software for attendance/grade storage and reporting. Networking of such applications within the school as well as with the central office is also in demand.

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At the K-12 district level, there is a demand shift to in-house minicomputer administrative applications, particularly to supplement record keeping services provided by regional Service Bureau Consortiums.

2. Post-Secondary Education

At the college and university levels, a principal driving force is the shifting demand to provide information-based delivery services to an ever-broadening computer user base.

Related to this is the increasing demand for the IS department to provide application development tools, CAI applications, and training in computer use to professors, students, and other members of the campus end-user community.

In recognition of such needs, IBM recently introduced a new software tool called LinkWay to enable nonprogramming educators to develop their own applications for teaching and administration. LinkWay includes sample programs as well as a sample lesson planner, grade book, classroom resource manager, to-do list, and a calendar. It is also targeted at professional programmers to enable them to develop more-complex programs incorporating different media, such as video-disc players and CD-ROMs. LinkWay is also available in a LAN Package configuration.

Among college and university library administrators, a principal demand is for increased networking facilities with library resources on other campuses as well as for connecting the library files to the other principal campus data base programs. This includes providing students and professors with on-line access to library search services through distributed personal computers and workstations.

C
Application Development Trends

1. K-12

a. Academic Courseware Applications

CAI software for the K-12 level has been grouped into three generic categories by Phi Delta Kappa (*The PDK Guide: An Introduction to Microcomputer Literacy for Educators, Revised 1987*), a leading professional education organization.

- Drill and practice
- Tutorials: Unlike drill and practice programs, tutorials introduce new information. Like drill and practice applications, reinforcement is often built into the program and students progress at their own pace.

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- Simulations: Simulation programs place students in realistic settings where they are required to solve problems, either individually or in groups.

CAI software comes from a variety of sources, including textbook publishers and educational software companies.

- At the K-12 level, software development consortiums among universities and state departments of education have also developed and promoted CAI software. Such efforts have tended to reduce the risk associated with software development and improve the quality of the product. An example is the Minnesota Educational Computer Consortium (MECC).

b. Administrative Applications

Administrative applications development trends at the K-12 level include:

- The use of computer authoring systems. With the recent introduction of personalized software development and data base management tools, such as HyperCard™, authoring systems are increasingly being structured to interact with CAI software for student diagnosis and performance measurement.

- Microcomputer-based administrative software programs that provide integrated word processing, data base management, and spreadsheet capability for local administrative needs such as budgeting, forecasting, record keeping, report generation, and mail lists.

- Administrative software for the classroom, including filing (recordkeeping) systems and educational utilities (such as programs for test development).

- Networking of word processing and desktop publishing facilities.

- Networking of local schools into central computer centers at the district or regional level. One particular area of current interest is in automating the budgeting and purchasing processes at the local school level and tying in to the central district budgeting processes. Eventually, classroom management programs will also be integrated into such networks.

At the local school level, future demand will likely increase for the following administrative applications:

- Graphics materials for presentations

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- Bar-coding technology for assisting in the automation of fixed asset management.
- Desktop publishing for the principal's office.
- Project management software
- Departmental data base management programs
- Micro-to-mainframe networking to central offices for outside purchasing of supplies

2. Post-Secondary Education

a. Administrative Applications

At the post-secondary level, future application development trends recently cited by CAUSE, an organization for data processing managers at the post-secondary level, include:

- The use of fourth-generation languages, prototyping tools, authoring systems, report generation, and query languages.
- CASE (computer-aided software engineering) tools to speed application development and decrease difficulty of development
- CD-ROM (compact disk-read-only memory), particularly for library reference storage, such as doctoral dissertations
- External networking

b. Library Applications

A basic automation trend at academic libraries of all sizes is the implementation of on-line administrative solutions. This involves automation of the card cataloging process in conjunction with an on-line data base search facility.

- The more prevalent method for accessing bibliographic text has been through major on-line bibliographic text facilities, such as: On-Line Computer Library Center, Inc. (OCLC); The Wilson Company's WILSONLINE, which provides access to numerous literature indexes such as the Readers' Guide; RLIN (Research Libraries Information Network), owned by the Research Libraries Group; BRS Information Technology, a provider of industry-specific data bases; and DIALOG Information Services

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- A more recent trend has been the adoption of CD-ROMs to provide access to bibliographic text from other library facilities without the need to use on-line telecommunication resources.

- On-line text retrieval systems are also becoming increasingly sophisticated. Some include conceptual search capabilities.

Application development trends in library automation being researched by OCLC, which is also a major center for library information science research, include:

- Natural language processing

- Automatic indexing

- Automatic question answering, incorporating artificial intelligence or expert systems technology

Other areas of new application development for automated library products include:

- Serials (general-purpose magazines)
- Electronic document delivery to homes

With more computer networking and through development of elaborate search utilities to index data base resources, the library could eventually become the major intermediary for providing access to general data bases.

One "dream" configuration has microcomputers on the desks of faculty members and students with networked access to the library's bibliographic and textual material.

The Library of Congress is developing a national networking project among major academic libraries and bibliographic utilities known as the Linked Systems Project (LSP). This involves computer-to-computer links among the Library of Congress, the Research Libraries Group (Research Library Information Network), the Western Library Network, and OCLC.

- LSP will provide for the linkage of computers to produce a master file of bibliographic data at the Library of Congress.

- The master network will use the Standard Network Interconnection (SNI) LSP's implementation of the International Standards Organization's Open System Interconnection Reference Model. The major project participants are internally developing the software to link their computer facilities. However, they are actively soliciting software and

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systems vendors serving the library market to develop communications software packages that will provide off-the-shelf network interconnection solutions for libraries of all sizes. Much of the communication between vendors and the LSP project is being done through the Advisory Committee on Vendors of the American Library Association (ALA).

c. Academic Courseware

At the college and university levels, the majority of CAI software is being developed internally by college teachers, either for their own purposes or as part of an educational consortium, and increasingly under grants or contracts from computer hardware vendors.

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III

Market Forecast

A Introduction

The academic education information services market is diverse. It includes software and services for K-12, colleges (including two-year vocational/technical schools), universities, and academic libraries. There are also the separate administrative and curriculum courseware markets.

Information services requirements are unique for each of the segments. As a result, most of the companies that provide information services to academic education markets specifically address one of the three submodes (K-12, higher education, or libraries). In addition, companies that produce academic courseware and administrative software usually represent different vendor types.

The academic education market (distinct from education and training market) in 1987 was approximately $1.1 billion (1%) of a total information services market in 1987 of $67 billion.

INPUT is projecting a 17% CAGR in the total information services market between 1988 and 1993. The academic education market during the same time period is expected to increase at a CAGR of 11%, from $1.2 billion in 1988 to $1.9 billion in 1993, as shown in Exhibit II-1.

The slower growth projected in the academic education market reflects basically two factors that could negatively impact institutional educational expenditures over the next five years:

- The current demographic trend of relatively flat enrollment growth in the secondary school environment. As such, enrollment growth rates in the higher education markets are also likely to remain relatively flat over the next three to five years, reflecting the impact of the current demographic trends in the secondary schools. However, there are signs that the percentage of high school students pursuing higher education is increasing, which could represent the beginnings of a change from recent enrollment trends in higher education.

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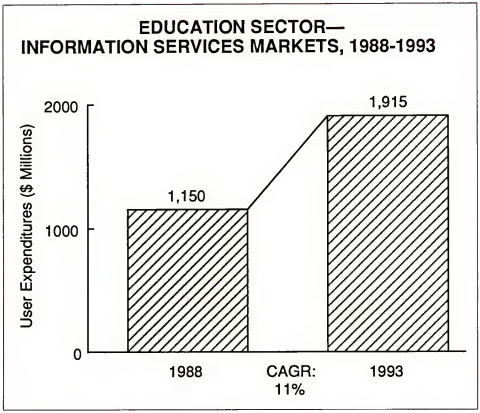
EXHIBIT III-1



- Budget constraints in all the academic education markets. These constraints reflect reductions in state aid to education, which are based in large part on changing patterns in secondary student enrollments, cutbacks in federal grants for education, and reductions in the corporate tax base in many inner city and rural environments. Increases in funding has been largely for intervention programs involving "children-at-risk."

A counterbalancing budgetary factor in the higher education markets are the federally sponsored Sallie Mae and the Guaranteed Student Loan (GSL) programs, which in recent years has been providing much more liquidity into the student credit markets. The resultant increased lending capacity for student loans has probably been a factor in allowing universities to increase tuititon rates in recent years to help counterbalance fixed-expenditure outlays in a flattening student enrollment environment.

Forecasts for user expenditures in the education sector by delivery mode are shown in Exhibit III-2. In its 1987 market survey, INPUT subdivided the educational information services market into six delivery modes compared to four (with applications and systems software as separate submodes) in its 1986 market survey. The two new submodes are systems integration and network services. In the 1987 market survey, systems integration was separated from the professional services delivery mode, and network services was distinguished from the combined processing services/network services delivery mode classification.

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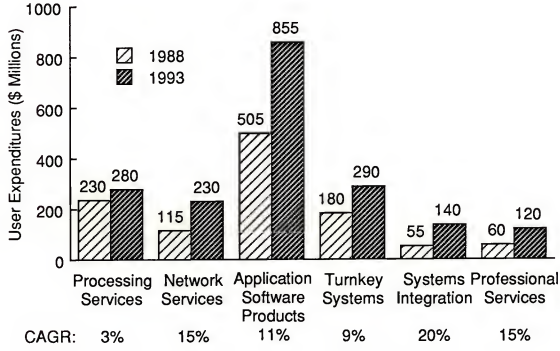
The educational market for systems integration is projected to grow the most rapidly at 20%, which reflects INPUT's assessment that in the overall information services market, systems integration is the fastest growing. It also reflects the trend to network integration in the higher education environment.

EXHIBIT III-2

EDUCATION SECTOR—INFORMATION SERVICES MARKETS BY DELIVERY MODE, 1988-1993



B

Processing Services

INPUT defines processing services for the educational market as transaction services, which may be interactive or remote-batch-oriented, and systems operations (facilities management).

User expenditures for processing services will grow at a 3% annual rate, increasing from $230 million in 1987 to $280 million in 1993. Negatively impacting growth in processing services is the trend in the larger school districts to bring administrative computer processing activities in-house. These functions are being transferred to minicomputer-based solutions.

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At the college level, there appears to be some expansion in the use of facilities management support services from third-party administrative software suppliers.

In addition, the federal government, through the National Science Foundation (NSF), has funded several university computer centers for advanced research projects in scientific and technical disciplines. These computers can be accessed through existing campus telecommunication links.

C

Network/Electronic Information Services

INPUT defines the network information services market as consisting of three sub-segments: value-added networks (VANs), electronic data interchange (EDI, and E-mail. Electronic information services are defined as data base, news, and videotex services.

The educational markets for network/electronic information services is projected to grow at a 15% annual rate, from $115 million in 1988 to $230 million in 1993, with the expected continued strong demand for online data base delivery and E-mail facilities. INPUT projects that in the total information services market over the next five years, the network services markets will be the second-fastest-growing segment, at 23%. The slower growth rate in the education market reflects budgetary constraints on such expenditures.

D

Application Software Products

The academic educational market for application software products includes courseware and administrative software at both the K-12 and higher education levels and academic library administrative software. The educational application software markets are expected to increase from $505 million in 1988 to $855 million in 1993, for a CAGR of 11%.

The current market for K-12 academic courseware is estimated at $200 million. It consists of a large number of companies including: independent academic courseware developers that specialize primarily in the K-12 markets, textbook, and turnkey systems suppliers and smaller VARs (whose software revenues are counted under the turnkey systems delivery mode).

Although there is a major interest in increasing the amount of computer-assisted instruction in the K-12 classrooms on the part of both user and vendor, there are a number of factors negatively impacting faster growth in this market:

- Budget constraints for both hardware and software
- The need to upgrade classroom computer hardware from older generations to the more user-friendly newer generations

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- Need for more intensive teacher training in computer usage
- High delivery costs associated with providing courseware to the K-12 market, particularly with its need for extensive support services.

The commercial courseware market for higher education is very small at this point, due to such factors as the complexity of the courseware required, the expense of developing such programs, and limited budgets. The NeXT workstation, which is targeted at the higher education market, could be a catalyst for change. Its ease-of-programming thrust might stimulate college faculty and students to write courseware products. However, software vendors will also have to evaluate the financial incentives, such as royalties, that would encourage professors to develop programs for the commercial market.

The administrative education software markets includes different sets of vendors for higher education, K-12, and library administration. These markets are currently estimated at $225 million. The strongest growth potential for these markets is projected to be for minicomputer and workstation-based departmental computing at the higher-education level; PC/workstation-based administrative/classroom management applications in the K-12 market; and PC/workstation-based library administrative applications.

E

Turnkey Systems

Turnkey systems provide the integration of systems software, packaged or customized applications software, a CPU, and related equipment and peripherals. For vendors, it involves the concept of total solutions selling.

User expenditures for turnkey systems was expected to show the second-slowest growth, at 9%, in the educational information services market over the next five years. From $170 million in 1987, the turnkey systems education market is expected to increase to $180 million in 1988 and to $290 million in 1993.

In recent years, there has been a decline in enthusiasm for delivery of computer-assisted instruction on an integrated turnkey delivery platform combining curriculum software and hardware from the same vendors. Factors contributing to this have been the higher cost of implementation (versus the use of general-purpose computers) and the lack of flexibility in curriculum implementation.

However, there could be an increasing role for turnkey systems at the K-12 level in helping provide individualized instructional models—for example, in multilingual classrooms. In addition, some turnkey courseware providers are now unbundling hardware and software product offerings to provide support for standard hardware solutions. This has generally been well-received because it increases product flexibility.

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Turnkey systems represent a substantial share of the K-12 administrative systems market. This should continue to be one of the stronger growth opportunities for turnkey systems vendors in the total educational market. However, unbundling of hardware and software and related services should also be considered.

The CD-ROM market also provides a strong growth opportunity for turnkey systems vendors, particularly in the academic library environment.

F

Systems Integration

Systems integration involves the delivery of large, multidisciplinary, multivendor systems, incorporating some or all of these functions: systems design, programming, integration, equipment, networks, installation, and acceptance. Systems can also encompass multiple product delivery modes.

The 1987 educational market for systems integration totaled $50 million. This is expected to increase at a CAGR of 20% over the next five years, from $55 million in 1988 to $140 million in 1993. INPUT estimates that the total systems integration market (involving all industries) will expand at a CAGR of 25% of the same time period.

The major reason for the much higher growth expectation for systems integration in the educational markets compared to other delivery modes is the great demand for intra- and intercampus network capabilities. These capabilities require integration of diverse computers, operating systems, and network architectures. At the K-12 level, there is growing interest in interconnecting local schools with district headquarters, as well as in providing interactive courseware to improve curriculum quality and cost efficiencies.

G

Professional Services

The professional services delivery mode is defined as management consulting activity related to information systems consulting, custom software production, education and training, and systems operations of client-owned computers (formerly identified as facilities management) where the vendor provides human resources to operate and manage the client facility.

In 1987, the educational market for professional services was $50 million. It is expected to grow at a CAGR of 15% from $60 million in 1988 to $120 million in 1988. INPUT is projecting that the overall professional services market will expand at a CAGR of 17% over the next five years.

The educational professional services market largely consists of services provided at the higher-education level related to sales of administrative

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software. As the software solutions become more complex, there is an increasing need for consulting and education and training support services and the ability to customize standard solutions. This need is increasing the acceptance of third-party-developed administrative software solutions in the higher-education markets. Demand for the combination of software and support services in the higher-education markets is expected to cause higher growth for the professional services market than for the standalone application software market.

H

Educational Expenditures

The information in the next four paragraphs is based on statistics obtained from the U.S. Department of Commerce publication, *1988 U.S. Industrial Outlook*.

Expenditures for educational services, at $307.6 billion in the 1987-1988 school year for kindergarten through graduate school, rose 6.7% (in current dollars) from the 1986-1987 school year. Elementary and secondary schools' expenditures in 1987-1988 were estimated at $183.7 billion, 6.5% more than in 1986-1987. Expenditures per pupil (based on average daily attendance) in public elementary and secondary schools rose from an estimated $3,755 in 1986 to $3,970 in 1987, a 5.7% increase.

College tuition charges have risen very steeply in recent years—at an annual rate of nearly 10% for both public and private institutions. During that time, the consumer price index and disposable personal income rose only 4.9% and 6.5%, respectively. The government provided 44.1% of all higher-education revenues for 1985, tuition and fees supplied 22.5%, and 33.4% came from other sources. Expenditures for higher education also increased about 10% between 1985 and 1986 in all institutions of higher education in the United States, despite declining full-time enrollment.

The U.S. Department of Education and the U.S. Department of Commerce estimate that expenditures for educational services will increase to $328.5 billion in 1988-1989, a 6.85% rise from 1987-1988. For public elementary and secondary schools, expenditures are estimated to increase 6.5%; for nonpublic elementary and secondary schools, 7.3%; for public higher-education institutions, 7.9%; and for nonpublic higher-education institutions, 5.6%.

The U.S. Department of Commerce also indicates that enrollment in elementary schools rose slightly in the fall of 1987, to 32.2 million from 31.7 million in 1986, as gains in the lower grades exceeded decreases in the upper elementary grades. At the high school level, enrollment decreased by about 272,000 during the same period, standing at 13.5 million in the fall of 1987. Preschool enrollment for 3-to-5 year olds has risen dramatically during the early 1980s. By 1985, preschool enrollment had jumped to 5.9 million, a 20% increase from 1980.

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The number of college students was down 1% in 1987 from the fall of 1986, when an estimated 12.3 million students were enrolled.

Microcomputer unit installations in the K-12 grades, are variously estimated to range from 1.5 to 2 million. This represents approximately one computer for every 20 to 25 students. A more optimal student/computer ratio, suggested by educators to encourage more active use of computers in the classroom, is one computer for every 10 students.

The home education/entertainment market overlaps to some extent with the academic K-12 market—in districts with more decentralized curriculum implementation, some teachers supplement their curriculums with purchases from retail vendors specializing more in home educational software. The size of the home educational software market is larger than the academic K-12 market due in large part to the fact that the number of computers in homes is several times that of the K-12 installed base.

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Information Systems Department Outlook

A

Driving Forces

Key factors shaping the delivery of information services in the academic education market include the following:

- Strategic planning is becoming increasingly important at both K-12 and higher education institutions. This relates to tight budgets, declining birth rates, and competitive recruiting environments.

- Intracampus as well as intercampus networking at higher education institutions is becoming increasingly important to provide access to local, regional, and national data base as well as library resources. At the K-12 levels, interactive cable delivery of curriculum materials could become an important way to provide wider access to high-quality instruction.

- Provision of information services to the end user at the higher education level, in addition to traditional data processing responsibilities, will be increasingly important.

B

User Needs

Information systems departments will increasingly be required to focus on a variety of end-user needs, including:

- At the K-12 level for academic courseware use, a major priority should be teacher training/staff development.

  - Staff development is most often coordinated between the software publishers and the media center, curriculum consultants, or local school administrators.

  - The willingness of a software vendor to offer staff development services can provide significant benefits to the users and the vendor. Teachers and administrators need training in how software can be used to add value or enhance the educational curriculum as well as on

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how software can be used for classroom management and student performance valuation. In addition, such training can significantly reduce the fear of computers by teachers and administrators, which should increase the level of general computer acceptance.

- At the higher education level, many centralized data processing centers are also becoming information resource centers. This evolution has created a need for personnel to integrate computer usage among the professional information services community, the administration, the faculty, and the student body.

  It also has meant new emphasis on the integration of campuswide data base resources, and the provision of access tools to those authorized to use these resources. A newer mandate is to encourage the development of computer courseware by college faculty.

C

Impact of Technology

Technology factors driving computer systems solutions in the academic education market include:

- Networking solutions that will eventually allow for the implementation of cooperative (peer-to-peer) processing models, including specialized computers for various types of information services: administrative, classroom instruction, departmental planning, on-line access to a variety of information resources, and engineering/scientific computing.

- The significant improvements in workstation price performance levels should lead to increased usage in higher education for departmental administrative and CAI applications. In particular, the NeXT workstation could provide an interesting test cast of the price elasticity of the higher education market.

- At the K-12 level, minicomputer-based turnkey solutions will probably continue to be a preferred delivery mode for administrative applications, particularly for small- to mid-sized districts, where the strongest growth potential for district-level administrative software exists. Turnkey systems classroom management applications should provide above-average growth.

- Desktop publishing at both the K-12 and higher education levels should continue to be one of the stronger growth segments in the administrative applications market, particularly at the local school level.

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D

Budget Analysis

In 1988, respondents experienced growth in their IS budgets averaging 3%. Projections for budget expenditures in the 1988-1989 period indicate growth averages approximately 2%. Most of the increase in IS budget expenditures is earmarked for communications and improvements in salaries and fringe benefits. These increases reflect inflationary cost pressures and expenditures for software/hardware maintenance.

In general, private secondary and post-secondary school budgets are estimated to be growing at a faster pace than those of public secondary and post-secondary schools. This difference reflects in part the ability of the private secondary and post-secondary schools to increase tuition annually at a rate in excess of the rate of inflation.

Exhibit IV-1 shows the 1988 budget distribution for respondents in INPUT's 1988 higher education IS Budget Survey and projects the growth in specific budget categories in 1989.

E

Factors Impacting 1988-1989 Budgets

Factors impacting the level and types of budget expenditures in 1988 and 1989 most frequently cited by respondents to INPUT surveys are included in Exhibit IV-2.

F

Critical Issues Facing IS Organizations

Exhibit IV-3 includes some of the most frequently mentioned critical strategic issues facing higher education IS organizations.

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EXHIBIT IV-1

1988 BUDGET DISTRIBUTION AND 1988-1989 CHANGES IN THE HIGHER EDUCATION SECTOR

Budget Category	1988 IS Budget (Percent)	1988-1989 Expected Budget Growth (Percent)
Personnel (Salaries and Fringe Benefits)	39.0	3.0
Hardware		
- Mainframes	8.8	0.0
- Minicomputers	5.0	1.0
- Workstation/PC	3.0	4.0
- Mass Storage Devices	4.0	2.0
- Other Hardware	1.2	1.0
Total Hardware	22.0	1.2
Data & Voice Communications	8.0	4.0
Professional Services	1.0	2.0
Turnkey Systems	2.0	0.5
Software Maintenance	4.0	4.0
Hardware Maintenance	9.5	4.0
Outside Processing Services	1.0	0.0
Supplies	4.0	2.0
Travel, Subscriptions, etc.	1.0	0.0
Applications Software	3.4	2.0
Systems Software	5.1	2.0
Total	100.0	2.0

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EXHIBIT IV-2

FACTORS IMPACTING LEVEL AND TYPES OF EDUCATIONAL BUDGET EXPENDITURES

- Maintenance Costs
- Staff Salary Increases
- Network Growth
- State Budgets
- Budgetary Constraints
- Increased End-User Usage
- Across-the-Board Price Increases
- Growth of Micro and Mini Applications

EXHIBIT IV-3

CRITICAL ISSUES FACING HIGHER EDUCATION IS DEPARTMENTS

- Balancing of State Budgets
- Impact of Moving to 4GL Programming Tools
- Replacing Obsolete Applications
- Increasing Demand for Campuswide Services
- Stable Budgets and Rising Demands
- Increasing User Requirements
- Increasing Technical Complexities
- Utilization of CASE Products
- Networking Requirements/Distributed Computing
- Need to Harness Workstation Computing Power
- Centralization versus Decentralization
- Personnel Retention
- Cuts in Federal Aid Programs

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G

Education Industry Sector—Demographic Data

The following table (Exhibit IV-4) provides summary data on expenditures in the various academic educational markets in 1987-1988, as well as demographic data on the number of institutions and employees. Data sources represent a combination of U.S. Commerce Department statistics and INPUT market research.

EXHIBIT IV-4

EDUCATION INDUSTRY SECTOR
DEMOGRAPHIC AND EXPENDITURES DATA

Standard Industrial Classification	Industry Name	Type of Statistic	Data
All	Education	Expenditures (1988-89)	$328.0 Billion
		Number of Establishments	16,940*
		Number of Employees	3.7 Million
821	Elementary and Secondary	Expenditures (1988-89)	$196.0 Billion
		Number of Establishments	13,600*
		Number of Employees	2.7 Million*
822	Higher Education	Expenditures (1988-89)	$132.0 Billion
		No. of Establishments (1985)	3,340
		Number of Employees	1.0 Million*
823	Academic Library and Media Centers	Expenditures (1988-89)	$2.7 Billion*
		No. of Establishments (1986)	3,398*
		Number of Employees	27,500*

* INPUT Estimates

Sources: *U.S. Industrial Outlook, 1989*
Statistical Abstract of the United States, 1988

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Competitive Analysis

A Introduction

The large computer systems vendors are beginning to show a much more proactive interest in the higher education administrative systems market and the computer-assisted instruction market, with a variety of purchase incentive programs.

To date, the college courseware commercial market has not really been developed. There is precedent for academics creating college courseware with the development of simulation-type courseware at various universities, particularly for the history and economics curricula, along with programs developed as a part of research grants in a number of departments for internal use.

Among the leading independent software vendors in the higher education administrative applications market are: Information Associates, Systems and Computer Technology Corporation, and American Management Systems.

In the K-12 administrative systems market, minicomputer hardware platforms appear to dominate, including those made by DEC, Wang, and IBM. In the higher education administrative systems market, mainframe equipment from IBM and minicomputers from DEC are leading platforms, with administrative software solutions provided primarily by independent software vendors and the larger computer systems vendors.

In the K-12 administrative systems market, turnkey and integrated software (provided on a modular basis) represent popular delivery modes, including products from Cogito Data Systems; Pentamation Enterprises, Inc.; Infocel; and National Computer Systems, Inc. J & K Computer Systems provides IBM with administrative software products on an OEM basis and through a number of VAR relationships. This has as helped make J & K one of the largest suppliers of administrative software packages to the K-12 administrative market, as measured by unit sales.

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The primary suppliers to the K-12 courseware market are the large number of relatively small independent software vendors, the textbook/curriculum suppliers, and integrated hardware/software turnkey applications providers. Among the leading independent software vendors in the K-12 courseware market as measured by market share are: Scholastic, Inc.; Sunburst Communications; Spinnaker Software (home education market); and Claris Corporation (an Apple Computer subsidiary). In the integrated systems delivery mode (turnkey systems), two of the larger vendors are Computer Curriculum Corporation and Control Data Plato.

Leading suppliers of information services in the library markets include the OCLC On-Line Computer Library Center, Inc. consortium; CLSI, Inc.; Wilson Corp.'s WILSONLINE; Research Libraries Group; BRS Information Technology; DIALOG Information Services; and Follett Software Company.

B Company Profiles

1. Academic Financial Services Association (2277 220th Street, Long Beach, California 90810)

a. Products/Services

Academic Financial Services Association is a leading independent provider of processing services for student loans for colleges and universities, as well as for banking and financial institutions. Approximately 90% of total revenues are from processing/network services and 10% from professional services.

The company utilizes Stratus minicomputers for its processing/Network Services for student loan servicing.

The primary professional service is consulting.

The company was founded in 1966 and continues to be a privately owned institution.

b. Markets Served

Approximately 50% of revenues are from the college and university markets and the other 50% from banks and other financial institutions. The estimated number of clients nationwide is in excess of 800.

The U.S. constitutes 100% of the company's total geographical market.

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2. American Management Systems, Inc. (1777 North Kent Street, Arlington, Virginia 22209)

a. Products/Services

American Management Systems provides information management systems product to federal government agencies, state and local governments, colleges and universities, energy companies, and telecommunication companies.

The blend of products and services includes: standard application and systems software, along with consulting, software development, and related services to provide a total information management solution to the customer base.

In the education area, AMS markets software products to colleges, universities, and local school districts. The company's principal administrative systems software for the educational market is College and University Financial System (CUFS), a financial management system that provides the following functions: fund accounting, general accounting and management functions, external report generation, grants management, budgeting, cash management, purchasing, and job cost accounting. The various functional modules are fully integrated in a data base management structure.

b. Markets Served

The company's largest market segments are the federal government, financial services institutions, state and local governments, and universities.

The company is a leading factor in each of its principal market segments.

In the educational area, the company's target market includes the 300 largest colleges and universities.

State/local government and educational revenues have grown from approximately $10 million in 1982 to $29 million in 1987.

The principal market segments served in the educational administrative area include: financial management and purchasing, alumni records and development, and student billing and records for colleges and universities; financial management and purchasing in general; and financial management and purchasing for school districts.

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c. Company Strategy

AMS focuses on providing a problem-solving approach to large organizations. This approach most often requires a combination of project management, professional services, industry-specific applications, and custom software.

3. Information Associates, Inc. (Unit of Management Science America, Inc.; 3000 Ridge Road East, Rochester, New York 14622)

a. Products/Services

IA is the leading vendor of on-line, integrated financial and human resources administrative software and related professional services for higher education. IA's software is designed and maintained for IBM's mainframe computers using OS/MVS and DOS/VSE using CICS and for DEC's VAX product line using VMS.

IA is now a wholly owned subsidiary of Management Science America, Inc., which acquired IA in mid-1986.

Its principal product line, Series Z, is a fully integrated, on-line, and database-oriented solution that includes five major systems—Financial Records System (FRS), Student Information System (SIS), Human Resource System (HRS), Alumni/Development System (ADS), and Loan Management System (LMS). Each system is designed to stand alone or to interface with other Series Z or non-IA systems.

The company's support services include consulting, project management, telecommunications support, customized systems design, full system training, installation, documentation, and follow-up support.

b. Markets Served

The principal market served is the higher-education administrative services market with packaged applications software. IA's installed base of customers includes over 500 higher-education institutions worldwide, including large state universities, community colleges, private universities, major research institutions, and small colleges.

c. Company Strategy

IA's principal strategy is to provide complete solutions to its customers' administrative information services needs, including extensive support services for implementation and longer-term maintenance. In particular, a major competitive strength is its major commitment to customer training.

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d. Recent Activities

Recent product introductions include:

- The Loan Management System (LMS) module is the latest member of the company's Series Z system for higher education administration. LMS is a complete financial information and management system designed for a loan manager and staff, business offices, and outside agencies involved in the loan administration process. It includes five separate applications based on a common data base: loan management, which provides a borrower's demographic, loan, and transaction data; billing; federal regulations compliance, which includes the processing rules required to administer Perkins (NDSL), HPSL, NSL, and GSL programs; due diligence; and collection. A number of LMS reports are designed to print on preprinted forms.

- The Client Support Network (CSN) provides three interactive communication services: Action Mail, for on-line services and software product assistance; Bulletin Boards, to relay information among users of CSN and provide information on mid-release systems modifications and notifications of future software releases; and electronic mail. The services are provided through TYMNET.

- The Executive Support System (ESS) provides PC linkage to a mainframe data base as well as workstation support for a desktop PC. ESS can be used for a number of analytical functions, such as strategic planning, trend analysis, and budgeting, and also provides for the downloading of data into familiar PC software, such as spreadsheet, data, and word-processing programs and color presentation graphics applications.

e. Future Direction

Technologies that IA is evaluating for possible future use in its product offerings include: voice response technology; "generalized" downloader software to micros and word processors, data base management software and hardware, non-IBM/DEC hardware, artificial intelligence, fourth-generation languages, and enhancements to Series Z.

4. Sunburst Communications, Inc. (39 Washington Avenue, Pleasantville, New York 10570)

a. Products/Services

Sunburst Communications is a leading developer and marketer of educational software application packages. Its current software line includes more than 120 programs in problem solving, mathematics, science, language arts, early elementary, computer literacy, and teacher utilities

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for the pre-K through adult market. The software is designed for the Apple, Atari, Commodore, IBM, Macintosh, and Tandy microcomputers. Much of its academic software addresses cross-curriculum programs with word processing and file and data base management tools programs that address reading, writing, and the inquiry educational development processes. Major well-known individual products are Magic Slate™, a children's word-processing package; the Super Factory; Bank Street School Filer, a data base package; and Muppet Learning Keys™, an early-learning package that includes a special keyboard.

b. Markets Served

Sunburst Communications provides curriculum software as well as integrated software and textual teaching materials to the K-12 grade levels. Its principal product concentration has been at the K-6 level. More recently, the company has expanded its word processing learning to reading and writing programs at the preschool level.

c. Company Strategy

The company continues to emphasize problem-solving software as its basic approach to software development. It is also continuing to expand its development efforts along the core products dimensions of word processing and data base management learning tools. Another strategic thrust is in the area of integrated software-textbook (and related learning materials) products. Sunburst provides a variety of resources to help teachers implement computing in their classrooms, including classroom lesson plans and videotapes for inservice teacher training.

d. Recent Activities

Recent product introductions include: the Muppet Slate word processing product for preschoolers (utilizing large fonts and a combination of text and graphics); an upgrade of Magic Slate for the elementary level, which includes editing capabilities for the teacher; and a new integrated software-textbook program for teaching geometry.

e. Future Directions

Future emphasis will continue to be on the problem-solving approach to educational software development, with the basic premise of providing through its software programs only those teaching methods that cannot be accomplished by other methods, such as paper and pencil. The idea is to enhance the motivational process, to promote a creative approach to learning, and overall, to enhance the teaching process.

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5. Cogito Corp. (Unit of IntelliTEK Computer Corp., KY; 130 Sewaren Avenue, Sewaren, New Jersey 07077)

a. Products/Services

Cogito develops and markets turnkey systems and processing services for school administration applications. Its principal software product is Cogito XXI™ used for student administrative processing. (Cogito had 1985 revenues of $11.5 million—12% of its sales came from batch processing services to schools and 10% from sales of turnkey systems for middle and secondary school administration.) The company also provides microcomputer-based software systems and batch processing services for fleet maintenance management as part of its Mainstem Corporation subsidiary.

b. Markets Served

Cogito primarily serves the middle schools and secondary schools with administration software and services.

c. Company Strategy

Cogito is concentrating on the processing services for the educational and fleet maintenance markets, having sold its processing services business that handled petroleum industry applications.

Cogito is broadening the hardware platforms for its applications software and will look to IBM personal computers to reach new customers.

6. Minnesota Educational Computing Corporation (MECC) (3490 Lexington Avenue North, Saint Paul, Minnesota 55126)

a. Product/Services

MECC's collection of software packages covers the age range from preschool to adult and subjects ranging from language arts, the social studies, and sciences to computer literacy, music, and mathematics.

MECC started out fifteen years ago as a statewide (Minnesota) computer educational consortium. MECC is now wholly owned by the state of Minnesota but is funded by membership fees and other vendor services. The Consortium currently has four member systems: The State Department of Education (433 school districts), the Minnesota Community College System (18 campuses), the Minnesota State University System (7 campuses), and the University of Minnesota (5 campuses). Products and services include: courseware, special projects, user services, technical services, management information systems, product distribution, and administrative services.

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Many of these products are available in network versions.

One of its best-selling courseware packages is the Oregon Trail package, which was one of the first simulation packages for the K-12 market. All its applications are written for Apple computers. Its product offering also includes instructional support materials. With approximately 300 total curriculum software packages available, MECC provides the one of the largest total selections of educational software of any publisher.

Other services provided by MECC include training of educators, coordination of statewide contracts for computer equipment, and support for the acquisition and operation of microcomputers.

b. Markets Served

MECC's software products cover all content areas for grades K-12 as well as for vocational-technical and higher education. It is among the largest publishers of educational computer courseware. Its principal market is K-12.

c. Recent Activities

A recent area of product development is for the science curriculum solutions based on an integration of simulation software, laboratory interfaces, and utility software such as data bases, spreadsheets, and graphics packages.

Another new product is the MECC Management Master, which is a software management tool for hard disk storage of several of its standalone programs. It addresses the physical issues of disk management as well as the integration of programs along particular curriculum pathways and the evaluation of student performance.

MECC recently teamed up with the University of Minnesota College of Education to create the Center for the Study of Educational Technology. The Center will provide a vehicle for disseminating University research results in the field of educational technology.

d. Company Strategy

A principal strategy of MECC relates to its approach to distribution. MECC markets products primarily through selling memberships on a sliding scale fee based on a district's enrollment. Membership entitles districts to one complete set of MECC's new products with discounts of an average of 30% off the catalog price for additional products. This also includes a copy service for MECC's software. Products have lifetime warranties, and MECC also provides a Help Line for technical support. This is its version of site licensing. Membership programs provide an estimated 50% of MECC's revenues.

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Nearly all of MECC's profits go back into software development. MECC spends approximately 25% of revenues for product development. In the software development process, it gets extensive feedback from teachers.

MECC also sponsors an annual Educational Computing Conference and Workshops.

e. Future Directions

New software applications utilizing multimedia technology, such as overhead-projection systems, interactive video disk players (for realistic graphics), and CD-ROM are being evaluated for future development.

7. Claris Corporation (440 Clyde Avenue, Mountain View, California 94043)

a. Products/Services

Claris develops, acquires, publishes, and supports graphics-based software applications for Macintosh and Apple II computers. Most of its products are for the Macintosh, but one of its best-selling programs is AppleWorks, which integrates word processing, spreadsheet, data base, and mailmerge functions, for the Apple II computer family. Its leading Macintosh software products include: MacWrite 5.0, MacPaint 2.0, MacDraw II, MacProject, SmartForm Designer, and SmartForm Manager.

b. Markets Served

Claris products are used in business, government, home, education and scientific/engineering markets. In the education market, in addition to curriculum applications, administrators use Claris software for word processing, desktop publishing, recordkeeping, automatic forms creation, and presentation graphics.

Claris is the second largest software company in the Apple software market.

c. Company Strategy

Much of Claris' product line was inherited from Apple Computer, its founder and major shareholder. Claris' future product strategy is to expand through enhancements to its existing product line, acquisitions of innovative products and technologies, and internal development of new products. Claris was created in part to eliminate competition between Apple-labeled software and third-party developers.

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Claris markets its products through Micro D, a leading supplier of Macintosh products, and sells direct to large retail chains and authorized Apple Computer dealers.

The company has a national accounts program for K-12 and higher education and state, local and federal government and also markets through value-added resellers (VARs).

In addition, Claris has a strong international focus where it works with local distributors.

d. Recent Activities

Claris Corporation was founded in April 1987 as a spinoff from Apple Computer, which continues to hold an investment position in the company.

Apple Computer contributed key employees, as well as some of its leading application software packages, such as MacWrite and MacDraw.

e. Future Directions

Claris' principal focus will be to bring innovative Macintosh software to the market.

Its products will serve general-purpose and advanced users. It will not pursue highly specialized or entry-level markets.

8. J & K Computer Systems, Inc. (Mesa Executive Park, Suite 270, 1255 West Baseline, Mesa, Arizona 85202)

a. Products/Services

J&K's major administrative application product is the IBM Comprehensive Information Management (solutions) for Schools, which consists of programs licensed to IBM for use with the IBM System/36 product.

When the System/36 PC was announced in June 1985, IBM announced nine new applications for these systems which were developed by J&K.

In July 1985, IBM named J&K as a Complementary Industry Competency Center (CICC) for the K-12 Public Education Industry. J&K also now supports a network of over 100 VARs that market and support its CIMS product line.

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b. Markets Served

J&K's principal market is administrative software for K-12 school districts.

In terms of installed units, J&K has the largest installed base of administrative system software at the K-12 level.

The systems are provided through the following information sets: financial management system, employee management, warehouse inventory, fixed asset inventory, student management system, student grading, student scheduling, optical scanning, student attendance, student evaluation, and library management. These applications are fully integrated and thus can be purchased and installed on a modular basis.

c. Company Strategy

The company's strategy is to distribute its software principally through IBM representatives who market the software in conjunction with System/36 and System/36 PC hardware. In May 1983, a contract was signed with IBM in which IBM licensed J&K's Financial Management System and Student Administration System products. IBM now markets these systems as The Comprehensive Information Management for Schools program offering.

9. Pentamation Enterprises, Inc./Education Systems Division (One Bethlehem Plaza, Bethlehem, Pennsylvania 18018)

a. Products/Services

Pentamation Enterprises provides remote computing and facilities management processing services, software products, and turnkey systems to a variety of industries. An estimated 35% of total revenues are from the educational market. Approximately 75% of total revenues come from processing services, of which approximately 40% is from facilities management contracts; 10% from software products; 10% from turnkey systems; and the remaining 5% from terminals and peripherals.

Pentamation's Education Systems Division provides integrated financial and student management systems. The student management software is used for student registration and scheduling, grade reporting, and class attendance accounting. The "business office" package includes personnel and payroll, budgeting, revenue and expenditure accounting, and general ledger. These products run on DEC VAX computers.

Pentamation is a systems cooperative marketing partner of Digital Equipment. Its principal delivery mode is as a systems integrator, including a major emphasis on professional services, such as training and facilities management.

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b. Markets Served

Principal markets include education, health care, and municipal governments. Pentamation Enterprises is the largest (in terms of revenues) independent supplier of administrative computer software for K-12 school districts in North America.

c. Recent Activities

In January 1986, Pentamation introduced two on-line, integrated, computer-based systems for the information processing needs of small and midsized schools districts. The systems combine comprehensive business office software and student services software with Digital Equipment Corporation's PDP-11 and MicroVAX hardware.

In January 1988, Ferranti plc (Manchester, England) acquired Pentamation's Healthcare Systems Division. The principal health care markets served were acute care hospitals and long-term-care facilities. Part of the proceeds were used to retire all outstanding bank debt of Pentamation.

10. OCLC On-Line Computer Library Center, Inc. (6565 Frantz Road, Dublin, Ohio 43017)

a. Products/Services

On-Line Computer Library Center (OCLC) is a non-profit membership organization engaged in computer library service and research.

From its facility in Dublin, Ohio, OCLC operates an international computer network that libraries use to acquire and catalog books, order custom-printed catalog cards and machine-readable records for local catalogs, maintain location information on library materials, arrange interlibrary loans, and gain access to other data bases.

OCLC also provides decentralized computer systems and standalone microcomputer-based systems for individual libraries or clusters of libraries. OCLC was established to provide access to an on-line catalog of records, supplied by its members and other parties, as a resource to be shared among the world's libraries.

The sharing of bibliographic text through the OCLC utility reduces costs and increases availability of library resources. Through institutional cooperation, the OCLC network has become a vast collaborative enterprise for scholarship and research.

On-line services are provided on dedicated A&T lines and through CompuServe.

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b. Markets Served

The primary users of OCLC's services and products are libraries, in educational and other institutions. More than 8,000 libraries contribute to and/or use information in the OCLC *On-Line Union Catalog*, the world's largest data base of library bibliographic information. OCLC has participating libraries in over 20 countries. Thousands of libraries have merged their catalogs electronically in the OCLC data base.

In addition to books and serials, the data base includes references to numerous sound recordings, software, maps, musical scores, and AV materials.

c. Recent Activities

OCLC has recently established an electronic publishing and delivery division to develop CD-ROM data bases and search software for CD-ROM.

At the end of 1987, Library of Congress minimal level cataloging records were added to the OCLC *On-Line Union Catalog (OLUC)*.

Interlibrary loan requests to the Library of Congress are now available via the OCLC Interlibrary Loan Subsystem.

d. Company Strategy

The present goal of the Board of Trustees is for OCLC to maintain preeminence in providing an international bibliographic data base in electronic form, and services based on that data base.

e. Future Directions

OCLC is a participant in the Linked Systems development project, which will tie the major academic libraries, the Library of Congress, and OCLC into an information network for bibliographic utilities distribution.

Other projects for the future include: moving beyond bibliographic delivery to the electronic delivery of texts (documents) and providing more service to the end user (patrons) in addition to the professional librarian.

Also, OCLC will continue to actively address the more dynamic growth in local standalone systems delivery.

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11. National Computer Systems, Inc. (11000 Prairie Lakes Drive, Eden Prairie, Minnesota 55344)

a. Products/Services

National Computer systems (NCS) manufactures and markets a broad variety of information management products and services used in data collection, information analysis, and reporting. NCS has three major operating units: scanning systems and services, software systems, and leasing.

The company markets two lines of large scanning systems, the Sentry 70 and the Sentry 80 series, and two small desk-top scanner lines, the Sentry 2050 and the Sentry 3000. NCS is a leading supplier of computer-based optical mark reading (OMR) systems.

NCS also markets software, forms, and tests to drive its scanners. These include standardized software programs for use with OMR systems for specialized applications including test scoring, grade reporting, time and attendance reporting, and classroom scheduling.

In addition, the company provides a service bureau for customers who do not want to purchase scanners.

For fiscal 1987 (January) approximately 55% of NCS' sales were in the education market.

b. Markets Served

National Computer Systems primarily markets its products to the educational market and to a lesser extent to the government and financial markets.

In the education markets, NCS' scanning equipment, forms, and software services can be networked among classrooms, individual schools, and district offices for student test scoring and other types of pupil accountability requirements.

c. Recent Activities

In early 1988, National Computer Systems purchased, for an undisclosed amount of cash, the Anderson Jacobson service division.

In the fourth quarter of fiscal 1988, NCS won a major new contract from the U.S. Department of Education—the Guaranteed Student Loan/National Direct Student Loan Processing Environment contract—which is worth approximately $40 million over its five-year life and which strengthens NCS' role in the student financial aid marketplace.

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12. Infocel (5711 Six Forks Road, Raleigh, North Carolina 27609)

a. Products/Services

Infocel develops and markets minicomputer- and microcomputer-based turnkey systems using the Pick operating system for vertical markets.

Infocel offers integrated software modules for financial management and administrative support, including word processing, electronic mail, spreadsheets, library management, scheduling, student records, report cards, and instruction, in a total automation solution.

The turnkey system for school administration includes a telecomputer that automatically calls parents when students miss school.

b. Market Served

Infocel's turnkey systems are marketed to government and educational institutions, including cities, counties, school boards, public utilities, and community colleges.

c. Company Strategy

Infocel plans to provide a full range of on-line, integrated, multiuser turnkey systems with installation, training, and ongoing support aimed at its target markets.

d. Future Direction

The company plans to offer system integration services. Also, Infocel plans to offer systems based on hardware from several vendors to lessen dependence on a single vendor.

13. Systems & Computer Technology Corporation (4 Country View Road, Malvern, Pennsylvania 19355)

a. Products/Services

Systems and Computer Technology Corporation (SCT) provides a broad range of systems integration and related services.

Particular information services include:

- Applications software that provides integrated information and production programs for student, financial, human resource, and alumni information needs.

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- Information resource management (IRM), which is the largest segment of SCT's services business. SCT provides on-site management and staffing for an organization's information resources, from data processing and office automation to management information systems, telecommunications, and functional-user support. Other services are facility management, strategic systems planning, site design, hardware specification and installation, network design and implementation, training, and software selection and development.

- Telecommunications services for networking computing and communications resources into an integrated information system.

- Custom software development

b. Markets Served

SCT primarily serves educational institutions (colleges, universities, trade schools) and government jurisdictions (cities, counties). In the higher education, administrative software and services market, SCT is the largest factor in the systems integration delivery mode.

c. Company Strategy

The company has repositioned itself primarily as a systems integrator, with proprietary software and services and third-party relations with hardware OEMs such as IBM and H-P.

d. Recent Activities

SCT signed more than $47 million of new business and contract renewals in fiscal 1987, more than twice the amount of business signed by the company in fiscal 1986.

In 1987, SCT signed a marketing assistance agreement with IBM for the higher-education market. As an Authorized Marketing Assistant under IBM's Industry Marketing Assistance Program (IMAP), SCT will work with IBM branch offices throughout the United States to identify prospects in the higher-education marketplace. Also, SCT can participate in the marketing and installation of IBM 9370 Information Systems and IBM 4300 Processors in conjunction with SCT's administrative applications software and information services for colleges and universities.

In 1987, the company introduced two new software product lines—SYMMETRY Series and BANNER Series—both of which incorporate relational data base management systems. The SYMMETRY Series brings relational technology to IBM mainframe users, while the BANNER Series is aimed at midrange IBM and DEC users. These new products for midrange IBM and DEC users double the potential markets

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for the company's products in higher education. The SYMMETRY Series includes student, financial, human resource, and alumni/donor administrative information systems for colleges and universities. BANNER incorporates a number of new technologies such as: functional distribution of processing; rule-based architecture; and OracleR, a relational DBMS from Oracle Corp. This distributed processing architecture addresses end-user-oriented computing in administration information systems.

14. CLSI, Inc. (320 Nevada Street, Newtonville, Massachusetts 02160)

a. Products/Services

CLSI provides turnkey-automation solutions to libraries. Its programs manage cataloging, circulation, and interlibrary resources and provide search services through on-line catalogs, on-line interlibrary service, and on-line remote data bases. The company's LIBS 100 Systems automate acquisitions, circulation control, cataloging, and serials management and provide an on-line catalog for public access. Other CLSI products include CL-CAT, CL-CIRC, CL-Perline, and CL-MedLine.

DataLink is a communications gateway to other on-line information sources such as commercial data bases and on-line catalogs on computer systems at other libraries.

b. Markets Served

CLSI focuses exclusively on the library automation market. Measured in terms of unit installations, CLSI is the leading supplier of library automation systems with over 290 systems installed and more than 1,300 libraries on-line to these systems.

c. Company Strategy

CLSI is committed to continued development and delivery of superior library automation systems that help libraries monitor their acquisition and circulation activities, participate in resource-sharing and interlibrary loan efforts, and provide patrons with easy and comprehensive access to information in both print and on-line media.

The company has been a pioneer in the use of lightpens and lasers to scan barcodes for recording circulation activities and in the introduction of touch-screen technology to the library community, and was the first vendor to offer an on-line catalog for public access that allowed patrons to search the data base by interacting with touch-sensitive, programmed areas on specially designed CRT screens.

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d. Recent Activities

Recent product introductions include a new UNIX operating system offering in addition to its proprietary systems offerings. New hardware platforms for running the UNIX-based products are Altos Computer Systems and Sequent Computer Systems.

Another new product is its CD-ROM catalog, which is a standalone product that provides access via a workstation not only to the local card catalog, but also to other bibliographic sources in the library's system.

In May 1985, CLSI was acquired by TBG (formerly Thyssen Bornemisza), an international corporation. In July 1986, CLSI became the core organization in a newly established library group within TBG's Systems and Technologies strategic unit.

15. PLATO Educational Services (Control Data Corporation, 8100 34th Avenue South, Minneapolis, Minnesota 55440)

a. Products/Services

PLATO comprises principal educational products and services offered through Control Data's Computer-Based Training Program (CBT). It is provided as the local PLATO Delivery System (LPDS) or delivered on-line through dial-up networks on a CYBER System. The on-line delivery mode is primarily used by higher-education institutions. LPDS is a computer system that can connect up to 30 individual student workstations with a file server, which functions as the system manager, to create an instructional local-area network. This hardware technology is combined with specialized LPDS courseware curriculum. The LPDS System Manager provides for individualized instruction as well as student performance evaluation. Also included in the educational products are MAS and PCD3, authoring tools for the development of educational applications. Software and related curriculum materials are also available on a standalone basis for use with IBM PC XT/AT computers and compatibles.

b. Markets Served

PLATO's total computer-based educational training program addresses the K-12, higher-education, adult education, and technical and industrial education markets. For its networked PLATO programs, the company primarily addresses large K-12 schools districts with student enrollment in excess of 10,000. Its standalone floppy disk programs address the needs of the smaller school districts.

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c. Company Strategy

Distinct from many other educational software publishers that provide software with more of a supplemental approach to curriculum, PLATO provides a complete curriculum package approach, including associated learning materials.

d. Future Directions

In the future, PLATO plans a stronger emphasis on adult education centers that provide computerized managed instruction (CMI) for applications such as graduate equivalent exams (GEDs).

Also, more emphasis will be placed on computer networking, possibly multivendor PC networking capability. In addition, future software applications may be developed for use on Apple Computers.

16. Scholastic, Inc. (730 Broadway, New York, New York 10003)

a. Products/Services

Scholastic is one of the largest publishers of educational software. It is also the largest publisher of paperback books and magazines for children in the English-speaking world. The company also publishes professional magazines for teachers, hardcover young adult books, textbooks, supplementary teaching materials and sponsored educational programs. Scholastic Productions publishes video cassettes and television programming for network, independent, and cable broadcasting. Scholastic's materials for schools include 37 classroom and professional magazines published in the United States. The company's professional magazines for teachers include periodicals on childhood education, home economics, computer education, educational administration, and athletics.

b. Markets Served

A principal market served by Scholastic is the academic magazine, textbook and software, and supplementary teaching materials market for K-12. Another principal market for Scholastic is the general paperback book market for young people, where it is the market leader. In educational software for K-12, Scholastic is considered the largest supplier.

c. Corporate Strategy

Scholastic's primary mission is to produce quality educational materials for young people. Scholastic works closely with professional organizations and maintains its own network of educational advisors.

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In competing with the large textbook publishers in the educational market, Scholastic positions itself as a supplementary publisher or a niche player. Scholastic is among the half-dozen largest publishers in the elementary and secondary school market.

One of its principal educational software approaches is to use tools developed for the business community—word processing, desktop publishing, and artificial intelligence—and apply them to the K-12 learning environment.

d. Recent Activities

Scholastic, Inc. became a privately held company in July 1987 with a management-led leveraged buyout of the company for $84 million in cash and securities. It is now a wholly owned subsidiary of SI Holdings, Inc.

17. Follett Software Company (Division of Follett Corporation; 4506 Northwest Highway, Crystal Lake, Illinois 60014)

a. Products/Services

Follett Software Company is a leading supplier of computer management systems to libraries. Its Circulation Plus™, with an installed base of 5,100 users, is the most widely used circulation system as measured by unit installations. Other products in its integrated library administration group include: Quick Card™, for catalog card production; Textbook Plus™, to control textbook checkout through the utilization of barcode scanning; Plus Link™, which adds networking capabilities to Circulation Plus; and Catalog Plus.

The software products are compatible with Apple and IBM microcomputer hardware.

b. Markets Served

Follett Library Book Company and Follett Software Company work together to provide for the library needs of school libraries and small public libraries. Follett Software is one of the leading factors in small library automation. An estimated 20,000 librarians use automation products produced by Follett Software Company.

c. Corporate Strategy

Principal delivery modes include both standalone (single concept programs) as well as total automation turnkey systems. Follett Software Company works closely with Follett Library Book Company is setting up new library programs.

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d. Recent Activities

In April 1985, Follett Software Company was separated from its divisional status within Follett Library Book Company and was established as a separate company under Follett Corporation, a major U.S. educational bookseller.

In 1985, Follett Software Company acquired The Library Software Company and began to focus on library management software.

Recent product releases include its Textbook Plus program, Portable Scan Plus software, and its portable handheld device, the PHD+ (Portable handheld) scanner.

e. Future Directions

In the fall of 1988, Follett Software will be releasing its on-line public access catalog, Catalog Plus™. Integrated with Circulation Plus™, Catalog Plus will provide on-line searches of local library holdings, the status of each item, and whether it is available at the time of the inquiry.

The next release of Circulation Plus™ will have a link to AppleWorks™.

Ideas for new software versions come mainly from customers.

18. Spinnaker Software Corp. (215 First Street, Cambridge, Massachusetts 02142)

a. Products/Services

Spinnaker's principal product focus is home education games. The Sargon computer chess games have been particularly successful. A major emphasis is on interactive adventure games, but Spinnaker also publishes a line of word-processing and spreadsheet software.

b. Markets Served

Spinnaker is the largest factor in the home educational market, with a market share estimated at close to half of the total market. The company markets its products through toy and department stores, as well as through specialty stores and computer-store chains.

c. Corporate Strategy

Spinnaker continues to expand its product lines and distribution channels in the home-computer marketplace. The company has pursued an active acquisition program to diversify product and distribution channels, reduce costs, and increase sales volume.

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A major strategic reason that Spinnaker is diversifying its distribution channels is to take advantage of unpredictable shifts in home computer marketplace selling patterns.

Another strategy has been to de-emphasize the company name in individual educational software series. Software for preschoolers sells under the Fisher-Price brand name.

Spinnaker has spent heavily on advertising to promote its products.

As a publisher, historically, Spinnaker contracts with software authors to sell their programs.

19. Wolfram Research, Inc. (P.O. Box 6059, Champaign, Illinois 61821)

a. Products/Services

Wolfram Research's principal educational software product is Mathematica™. Mathematica was introduced in mid-1988 in conjunction with an announcement by several major computer hardware manufacturers—including IBM, Sun Microsystems, Apple (Macintosh), NeXT, Silicon Graphics, Autodesk, Ardent Computer Corporation, and Stellar Computer, Inc.—that they support it. Autodesk has indicated that it will develop applications linked to Mathematica™.

Mathematica™ is capable of performing calculations in all areas of mathematics. Built into Mathematica is a complete set of mathematical functions, including exponential, trigonometric, Bessel, hypergeometric, elliptic integrals, etc. Mathematica operates not only with numbers and algebraic formulae, but also with graphics. It can plot functions and data in two and three dimensions and can use symbolic descriptions of arbitrary geometrical objects to produce three-dimensional color pictures. In addition to having an extensive collection of built-in functions, Mathematica is also a powerful programming language. NeXT, Inc. has announced its intention to bundle Mathematica with every NeXT computer.

b. Market Segments

Mathematica™ is intended for both the broad educational (academic) and technical markets. Wolfram sees four initial markets for the product: education at all levels, from elementary to graduate school; research at universities, government and corporate laboratories; engineering; and business analysis, including statistics and modeling. It is currently being tested with graduate, undergraduate, high school, and elementary school students.

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c. Company Strategy

Stephen Wolfram, the president of Wolfram Research, is a highly regarded mathematician. He has indicated that he expects that with time Mathematica™ will define a major new category of software, much like word processors and spreadsheet programs.

20. International Business Machines (Armonk, New York)

a. Products/Services

In administration software at the K-12 level, IBM has a reseller software program with J&K Computer Systems for its System/36 computers. This represents one of the largest installed bases of administrative software at the K-12 level.

At the college and university levels, IBM provides the System/38 Administrative System and Colleges and Universities integrated set of programs. The administrative systems includes the following elements: admissions, development for fund-raising projects, student records, and financial aid.

Product offerings for the various education market functional areas include the following.

School/Student Information Management:

- Career School Administration System
- Education Computing Support System
- Graduate Placement
- On-Line Student Registration System
- Registration/Attendance and Grading
- Student Administration System

Financial Aid/Financial Management:

- Guaranteed Student Loan/Pell Grant Tracking
- General Ledger
- Projected/Actual Payment Tracking
- Student Accounts Payable
- Student Financial Tracking
- Vendor Accounts Payable

Computer-Aided Instruction (CAI):

- APL Interactive Training Course
- Fundamental Accounting Principles Courseware

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Library Management and Circulation Control:

- Dobis/Leuven Library System-Dortmund Library System (Dobis)
- Dobis/Leuven Library System-Periodicals Control
- Periodicals Control System

21. Autodesk, Inc. (2320 Marinship Way, Sausalito, CA 94965)

a. Products/Services

Autodesk, Inc., designs, develops, markets, and supports a family of computer-aided design (CAD) software products for personal computers and 32-bit workstations. Its Autodesk Products include: AutoCAD®, the leading CAD software product for the PC hardware environment; AutoCAD AEC® Architectural; AutoCAD AEC®) Mechanical; AutoShare™; and AutoSketch®.

AutoCAD is used extensively in high school industrial/vocational educational programs as a CAI learning tool, as well as in college architectural and engineering programs.

Autodesk also offers a a wide range of services through its Education Department to support the use of CAD in colleges, universities, high schools, vocational/technical institutions, and community colleges.

The CAD Teacher Training Program is designed to provide in-service training to educators. In 1987, over 2000 teachers nationwide participated in the company's CAD Teacher Training Program.

The Autodesk Consortium for Education links institutions of higher learning to exchange information about CAD applications, instruction, and research.

Autodesk has also designated a group of Area Educational Representatives, who are selected Authorized AutoCAD Dealers, to provide special consultative services and product pricing to educational institutions.

More textbooks and related materials have been developed for AutoCAD than for all other CAD software combined. Autodesk's Education Department helps editors of such textual material keep their publications up-to-date and also produces the *CAD Educator*, a quarterly newsletter for teachers.

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C

Technology

1. K-12

There are two basic technological approaches to microcomputer use in the K-12 academic courseware program:

- Free-standing software
- Integrated, multi-user learning systems, often called curriculum delivery systems, which are essentially turnkey solutions with the software and hardware usually developed by the same vendor

Currently there does not appear to be a clear preference for either approach.

Integrated systems require longer-term commitment to a particular solution because of the much greater initial cost of installation and the usual commitment to a proprietary software approach. These systems are used primarily in computer labs rather than individual classrooms. These systems have certain demonstrated appeal:

- Significant motivational benefits as demonstrated in the ability of such systems to hold children's attention for relatively long time periods.
- Individualized instructional capability, along with the automation of certain administrative functions. This can provide the teacher more time for planning and improving the instructional process.

Free-standing software provides more teacher flexibility in the teaching approach but also requires more thorough teaching planning and knowledge of computers.

2. Post-Secondary Education

An interesting new computer systems product for the higher-education market is Steve Job's new computer workstation from NeXT Corporation, which was introduced in late-1988. Principal features include a user-friendly (icon-based) interface called NextStep that provides an application development interface for experienced programers as well as ease of access to the many applications/tools bundled into the NeXT systems. These include: the Lisp programming language, Objective C language, the SQL Server relational data base from Sybase Inc., and Frame Technology Inc.'s FrameMaker document processing systems.

Based on object-oriented programming, NextStep and Object C will allow applications to be developed that include sound, image, and objects in ways not possible in traditional workstation products. Object-based programming also provides for the reusability of code. This will be

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appealing for the development of simulation-based courseware for the higher-education market.

The NextStep environment will also allow developers to link their applications with the SQL Server relational data base and other bundled software in the NeXT platform. Sybase is also planning to add capability for the storage of text and image into an integrated environment. The integration of object-oriented programming capability may also encourage professors to write courseware, if the time required to develop such programs can be reduced compared to other procedural-based programming environments.

If the computer is a success, it might be a major stimulus to college courseware development. A major question now is its proposed price in the $6500 range; this could be too high for a mass-market product in higher-education.

Smalltalk is another popular object-oriented programming language that is increasingly being used in higher-education institutions to teach artificial language technology as well as data structures and introductory programming. It is also being used by college professors to develop simulation courseware applications.

Currently, science and engineering departments, especially at more technical universities, are the principal users of workstations. Major applications include research and CAD/CAM.

3. Library Applications

Turnkey systems are a basic delivery mode for smaller to midsized libraries. Much of the automation of the major academic libraries and bibliographic utilities is done by their own development staffs.

At the K-12 level, library applications software packages based on microcomputer implementations are growing in acceptance.

D

Vendors

The following includes additional information on the competitive environment in the academic education markets.

1. Academic Courseware Applications—K-12

Apple hardware and software continue to dominate in the academic (CAI) environment at the K-12 levels.

A principal issue in the educational academic market is the large number of vendors. A shakeout in the market will probably continue to occur as the demand for more sophisticated software applications increases.

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Industry sources indicate there are close to 700 educational software companies (many of which primarily focus on the home/entertainment market) with thousands of program offerings.

Textbook publishers appear to have a marketing advantage in the academic (curriculum) software area because they have established reputations in the educational communities and can leverage their goodwill and general marketing efforts with the additional software product. They are also in a preferred position to address the current trend to more closely integrate textual (printed) material with software applications.

Efforts to forge alliances in terms of joint development projects between independent software developers and textbook publishers do not appear to have received much of a response to date.

An obvious need for vendors is to determine where the larger market niches are developing.

- At the elementary level, drill and practice programs are proving to be quite successful in programs for the slower learner, in particular.
- Interactive simulation programs are finding considerable acceptance in the social science and science programs.
- Problem-solving (critical thinking) programs are finding success in many curriculum areas.
- Approaches using a core applications tool such as word processing or data base management can be easily expanded into a number of grade levels.
- The mass market, however, possibly lies more in teaching the basics—reading, writing, and math—to motivate the underachiever and reduce the high percentage of dropouts.
- One successful model for product development in the K-12 academic market is the use of core modules that are expanded to provide a family of products. Most often the core model has been a word processing utility.

2. Administrative Applications

In administrative applications, IBM continues to strengthen its position in the K-12 market (where IBM is a major software vendor with its licensee arrangement with J&K Computer Systems) and in the higher-education market. DEC also has a major presence in both the K-12 and post-secondary markets. Information Associates, a subsidiary of Management Science America, is the leading independent vendor in the higher-educa-

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tion administrative software market. In the K-12 administrative market, leading vendors are primarily turnkey systems suppliers, including Cogito Corp., a unit of IntelliTEK Computer Corp.; Infocel; and Pentamation Enterprises. Columbia Computing Services, a Vancouver, B.C. company, also has a significant market share in the K-12 administrative software market.

There are also a large number of locally based, small software vendors in the K-12 administrative software market.

At the post-secondary level, much of the development work is done in-house by the computer center staff. However, there is a considerable need for customization of administrative programs, which could involve professional service contractors.

In the "hot" area of campus networking, DEC and IBM with Ethernet and Token Ring are very active. The RBOCs, through their deregulated subsidiaries, will likely be increasingly active in this market with systems integration and professional services.

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New Opportunities: Recommendations and Conclusions

New product opportunities in the various academic education/library information services markets are included below.

A K-12 Market

1. Academic Courseware

A recent report of the U.S. Congress Office of Technology Assessment, *POWER ON, New Tools for Teaching and Learning*, indicated that a number of intelligent CAI programs (ICAI) are beginning to appear, such as Batteries and Bulbs, from the Educational Technology Center at the University of California, and SOPHIE (SOPHisticted Instruction Environment). Essentially, these are highly interactive intelligent tutoring programs, which can "diagnose students' misconceptions, select appropriate teaching strategies, and carry on dialogues with students." Artificial intelligence technologies incorporated into these programs include natural languages and expert knowledge systems.

The incorporation of currently available artificial intelligence/ expert systems technologies could also help provide the following solutions:

- Improved ease-of-use of the computer system with graphics-based user interfaces (utilizing object-oriented programming development tools such as Smalltalk or a derivative)
- Classroom management applications (with the use of end-user friendly expert system development shells)
- Interactive composition applications that not only check for spelling, but also for syntax, diction, and parallel construction.

Many of the software programs for K-12 that use problem-solving approaches still work primarily with models from the physical sciences—which include setting up hypotheses, posing alternatives, collecting and

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analyzing data, and drawing conclusions. However, other learning models are also being fostered by leading K-12 curriculum organizations, such as the Association for Supervision and Curriculum Development (ASCD), colleges of education and individual curriculum associations.

One such curriculum model comes out of the philosophy of critical theory.

- Critical theory involves the fostering of logical dialogue and discussion for the evaluation of goals or desired ends and the means for achieving such goals. This involves examining problems from a broad conceptual context, including ethical dimensions. Many textbook publishers are currently addressing this learning approach. Much of the theoretical work in this area comes out of the social sciences and the study of problem-solving within various cultural contexts.

- Partnerships between educational software vendors and developers of other types of curriculum material might be created to address this area. In particular, this could lead to the development of software programs that address the various processes of learning, with applications that can cut across a number of disciplines. Such packages could address more of a mass market than programs that are more subject-content oriented.

Integrated (hardware and software) programs with built-in teacher administrative functions could find a significant market in the various bicultural programs. When a teacher must deal with many levels of language facility in a single classroom, such computer technology could greatly improve individual instruction.

A major cost for vendors in providing software for K-12 curricula is in delivery and related support services. Approaches for addressing the relatively high marketing costs associated with the educational software markets include:

- Creating partnerships with the larger computer systems vendors, such as:

  - OEM relationships, which could involve providing industry-specific application software for "turnkey systems" solutions, such as the IBM AS/400 program

  - Joint marketing agreements

  - A VAR (value-added reseller) relationship, where the computer systems vendor provides marketing, financing, and other types of support

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- Utilizing electronic delivery systems, particularly for program previewing, training, and followup support services.

- Working with VARs that can provide generalized software and/or tailored solutions for specific district needs.

- Giving future thought to telecommunications interactive delivery modes, such as the Domestic Satellite Services and VSAT (very small aperture terminals) technology, which has recently become interactive in capability, to provide both video training for computer use and delivery of software programs. Future ISDN-related services might also encompass such capability. This type of service would be particularly appropriate for rural areas of the U.S., where education budget problems are particularly acute. The RBOCs might consider this market for information services delivery.

Related closely to the cost of delivery of educational software is the need to find "mass market" opportunities for educational courseware publishers. Suggested approaches include:

- Working with State Departments of Education, particularly in states that have statewide textbook/curriculum adoption programs

- Developing programs dealing with the various processes of learning that can cut across various academic disciplines

- Examining the various "special education" programs, a rapidly growing area in K-12 curricula

- Looking to bilingual instruction or ESL (English as a second language) as a curriculum area that could probably be well-served by an integrated, networked computer laboratory programs approach

2. Administrative Solutions

Minicomputer-based turnkey solutions should continue to represent a popular delivery mode for K-12 school environments.

Networking solutions among district headquarters to local school buildings will provide an opportunity for systems integration and professional services vendors.

Local school building administrative personnel will also be looking to network principal and teacher classroom management applications.

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B

Post-Secondary Market

1. Academic Courseware

To promote the use of courseware at the higher-education levels, relationships should be fostered between professors and independent software and computer systems vendors. Vendors should provide incentives for professors to write software programs for the commercial market.

- Vendors must evaluate the way college professors have worked with textbook publishers in developing printed materials to discover the types of incentives needed by college professors to develop software applications for the commercial market. These might involve royalty payments to the author of the program.

- In the longer term, the software publishers will have to do much of the software development themselves; professors will likely find the development of software too time-consuming when teaching, research, and publication are already major time burdens. In addition, unlike the the publication of textual material, development of software programs does not reinforce the research effort. The complexity of the software requirement will, however, require some type of continuing partnership effort between the software vendors and the college faculty community.

2. Administrative Applications

The need to improve the efficiencies of information distribution through the development of data communications networks will provide opportunities for:

- Distributed processing solutions involving the integration of end-user processing needs, including departmental administrators, professors, and students

- Campuswide data base management and library resource management systems

C

Academic Library Market

With the development of major intercampus/library networking programs such as the Linked Systems Project, there is a need for library administrative systems to implement the Standard Network Interconnection communication protocol being adopted by the major bibliographic on-line reference utilities. This will facilitate on-line access to nationwide reference library collections.

CD-ROM turnkey systems should continue to represent an above-average growth opportunity in the academic library markets, particularly where budgetary issues contain expenditures for telecommunication access to on-line data bases.

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Text management systems for more complete document search capabilities (including conceptual search methods based on expert systems technologies) should be a major growth area for public and academic libraries, in particular.

K-12 libraries will continue to rely more on workstation/PC-based application software for the automation of library administrative tasks.

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Appendix: Forecast Data Base

EXHIBIT A-1

EDUCATION SECTOR
USER EXPENDITURE FORECAST BY DELIVERY MODES, 1988-1993
($ Millions)

Sector by Delivery Mode	1987	Growth 87-88 (%)	1988	1989	1990	1991	1992	1993	CAGR 88-93 (%)
Total Education Sector	1,050	11	1,145	1,275	1,410	1,555	1,785	1,915	11
Processing Services	230	3	230	245	250	255	270	280	3
Transaction Processing Services	160	3	160	170	170	175	180	190	3
Systems Operations	70	4	70	75	80	80	90	90	5
Network/Electronic Information Services	100	15	115	130	150	175	200	230	15
Electronic Information Services	60	15	70	80	90	105	120	140	15
Network Applications	40	15	45	50	60	70	80	90	15
Application Software Products	450	13	505	560	630	700	830	855	11
Mainframe	70	4	70	70	80	80	80	85	4
Minicomputer	130	8	140	150	160	170	180	190	7
Workstation/PC	250	18	295	340	390	450	570	580	14
Turnkey Systems	170	9	180	200	220	240	270	290	9
Systems Integration	50	20	55	70	80	95	110	140	20
Professional Services	50	15	60	70	80	90	105	120	15

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B

Appendix: Forecast Reconciliation

The major increase in the size of the academic education market in INPUT's 1988 *Education Sector Report* compared to the 1987 report involves the following factors:

- The inclusion of the academic library information services markets
- The addition of three new delivery modes: systems integration, professional services, and network/electronic information services
- An undercounting of the K-12 processing services market in 1987
- An undercounting of the K-12 courseware market in 1987

The five-year compound annual growth rate (CAGR) projection of 11% for the academic education markets in the 1988 report remains in line with the 10% five-year forecast made in 1987.

INPUT is projecting a 17% CAGR for the total information services market between 1988 and 1993. The slower growth rate in the academic education markets reflects budgetary constraints, which also reflects modest projected enrollment increases in the K-12 and higher education markets over the next five years.

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EXHIBIT B-1

EDUCATION SECTOR—DATA BASE RECONCILIATION OF MARKET FORECAST BY DELIVERY MODE, 1987-1988

Delivery Mode	1987 Market		1992 Market		87-92	87-92
	1987 Forecast ($ M)	1988 Report ($ M)	1987 Forecast ($M)	1988 Forecast ($M)	1987 % CAGR Forecast	1988 % CAGR Forecast
Processing Services						
- Transaction Processing	128	160	212	180	11	2
- Systems Operations	21	70	22	90	1	5
Total Processing Services	149	230	234	270	9	3
Application Software						
- Mainframe/Mini	35	200	66	260	14	6
- Micro	70	250	147	570	16	18
Total Application Software	105	450	190	830	15	13
Turnkey Systems	107	170	143	270	6	10
Systems Integration	N/A	45	N/A	110	N/A	21
Professional Services	N/A	50	N/A	105	N/A	16
Network/Electronic Information Service (EIS)						
- Electronic Information	N/A	60	N/A	120	N/A	15
- Network Applications	N/A	40	N/A	80	N/A	15
Total Network/EIS	N/A	100	N/A	200	N/A	15
Sector Total	361	1,050	590	1,785	10	11

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About INPUT

INPUT provides planning information, analysis, and recommendations to managers and executives in the information processing industries. Through market research, technology forecasting, and competitive analysis, INPUT supports client management in making informed decisions.

Continuous-information advisory services, proprietary research/consulting, merger/acquisition assistance, and multiclient studies are provided to users and vendors of information systems and services (software, processing services, turnkey systems, systems integration, professional services, communications, systems/software maintenance and support).

Many of INPUT's professional staff members have more than 20 years' experience in their areas of specialization. Most have held senior management positions in operations, marketing, or planning. This expertise enables INPUT to supply practical solutions to complex business problems.

Formed as a privately held corporation in 1974, INPUT has become a leading international research and consulting firm. Clients include more than 100 of the world's largest and most technically advanced companies.

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