Market
Analysis
Program
(MAP)

Industry Sector Markets 1991-1996

Education Sector

INPUT®

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INDUSTRY SECTOR MARKETS 1991-1996

EDUCATION SECTOR

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Introduction

Introduction

A
Purpose and Methodology

1. Purpose

The basic objectives of this Market Analysis Program vertical market report are to:

- Provide the reader with the 1991 information services industry forecast for the education sector
- Identify the business issues and trends that are driving the use of information services within the academic education industry
- Discuss the information services market within the academic education industry, including market sizing and the factors driving market demand for each delivery mode
- Discuss the competitive environment and profile a representative selection of information services vendors in the academic education industry

2. Methodology

Much of the data on which this report is based was gathered during 1991 as part of INPUT's ongoing market analysis programs. Trends, market size, and growth rates are based primarily upon in-depth interviews with users within the academic education industry and the IS vendors serving the academic education industry. INPUT maintains ongoing relationships with, and a data base of, all users and vendors that it interviews. Interviewees for the research portion of this report were selected primarily from this data base of contact names.

In addition, extensive use was made of INPUT's corporate library located in Mountain View, California. The resources in this library include several on-line periodical data bases, subscriptions to over 50 computer and general business periodicals, continually updated files on over 3,000 information services vendors, and the most up-to-date U.S. Department of Commerce publications on industry statistics.

It must be noted that some vendors are unwilling to provide detailed revenue breakouts by delivery mode or industry. Also, vendors often use different categories of industries and industry segments, or view their services as falling into different delivery modes from those defined by INPUT, and INPUT must estimate revenues for these categories on a best-effort basis. Thus, the delivery mode and individual segment forecasts should be viewed as indicators of general patterns and trends rather than as specific, detailed estimates for individual years.

When detailed information is provided by vendors, it is frequently offered under an agreement of confidentiality. Therefore, vendor rankings based on these revenue figures should be considered indicative rather than definitive, and the revenues themselves viewed as approximations only.

B
Industry Structure

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 and payroll administration, admissions, 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 counseling

- Networking of intracampus and intercampus IS resources

- Cross-industry administrative application tools, including word processing, electronic spreadsheet and data base management software, are included in INPUT's annual *Office Systems* and *Planning and Analysis* cross-industry reports.

Academic research/courseware applications include:

- Software for curriculum instruction and computer literacy at all academic levels, including vocational/technical schools
- Teacher-, 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 of 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 and news services utilities through value-added, private, or dial-up networks)

As shown in Exhibit I-1, the educational information services market is fragmented into a number of individual segments, with academic education industry vendors usually addressing one or two of the segments.

EXHIBIT I-1

Types of Academic Education Market Vendors

- Administrative software and services specialists
- Library administration software and services specialists
- Textbook publishers/educational curriculum specialists
- Home entertainment software specialists
- Turnkey systems/VAR vendors
- On-line data base vendors
- Professional services and systems integration vendors
- Government and education sector processing services vendors

Education industry sector demographics and expenditures data are presented in Exhibit I-2.

C
Organization and Contents of Report

The remainder of this report is organized as follows:

Chapter II, Trends, Events, and Issues, provides background information on the structure and demographics of the academic education industry and the business issues and trends that are driving the use of information services within this industry.

The section on trends and events focuses on two areas:

- General business trends, which include:
  - A slowing annual GNP growth rate of about 1.0% expected for the first part of the 1991-1996 period—down from the 2.5% to 3.5% annual growth rate experienced in the second half of the 1980s

EXHIBIT I-2

Education Industry Sector
Demographic and Expenditure Data

SIC	Industry Name	Type of Statistic	Data
820	Education	Expenditures (1990-1991)	$380 billion*
		Number of schools (1990)	87,800
		Number of instructors (1990)	3.5 million
		Number of students (1990)	59.8 million
821	Elementary and Secondary	Expenditures (1990-1991)	$227 billion
		Number of schools (1990)	84,000*
		Number of instructors (1990)	2.8 million
		Number of students (1990)	46.2 million
822	Higher Education	Expenditures (1990-1991)	$151 billion
		Number of schools (1990)	3,800*
		Number of instructors (1990)	760,000
		Number of students (1990)	13.6 million
823	Academic Libraries	Expenditures (1990-1991)	$3 billion*

* INPUT estimates

Sources: *U.S. Industrial Outlook*, 1990; *Statistical Abstract of the United States*, 1990; *Digest of Education Statistics*, 1990.

- An inflation rate of 3% to 4%, projected to be slightly below the annual rate of 3.5% to 4.5% experienced in the second half of the 1980s
- A continuation of the current recession, at least through early 1992, with a projected easing of recessionary indicators later in the year

• Academic education industry-specific trends and events, including:

- Much greater public awareness of deficiencies in the U.S. educational system

- Very modest increases in educational budgets, many of which are allocated for salary improvements to reflect inflation and to address discrepancies between salaries for computer-related jobs and salaries for jobs in the industrial sector

- A trend to microcomputer/workstation administrative software with the growth in department-based solutions

- A trend towards networking at all levels of education

- In the courseware market, particularly at the K-12 level, increasing interest in cross-disciplinary software applications

- Growing interest in client/server applications and graphical interfaces, along with the implementation of computer systems and software standards

The section on issues identifies specific questions and situations that should be addressed in developing a business strategy in the educational industry.

Chapter III, Information Services Market, looks at the academic education industry from two viewpoints:

- By delivery mode. How are these services delivered? INPUT's major categories of delivery modes are:

  - Processing services
  - Network services
  - Applications software products
  - Turnkey systems
  - Systems integration
  - Systems operations
  - Professional services

- By industry segment. Who is buying information services? What segments within the academic education industry are buying what delivery modes?

- Market forecasts are provided by delivery mode and industry segment.

Chapter IV, Competitive Environment, profiles a small, but representative cross-section of the IS vendors to the industry and discusses some of the factors that affect the competitive dynamics of the educational marketplace.

In addition, there are two appendixes:

- Appendix A presents industry-specific definitions
- Appendix B presents the Forecast Data Base and Reconciliation

The Forecast Data Base contains a yearly (1990-1996) forecast of user expenditures by delivery mode for the academic education industry as a whole and for each industry segment. The Forecast Reconciliation compares this report's forecast with the forecast provided in INPUT's previous academic education industry report and explains the reasons for any major differences.

Trends, Events, and Issues

II

Trends, Events, and Issues

This chapter discusses trends, events, and issues in the education industry.

Section A, Trends and Events, highlights the external forces driving the education industry and how the industry is responding to these forces.

Section B, Issues, identifies specific questions that should be asked and situations that should be addressed by IS vendors in developing a business strategy that is responsive to the industry trends discussed in Section A.

A
Trends and Events

Exhibit II-1 identifies the key general business and industry trends impacting the use of information systems and services in the education industry. These are discussed in sections 1 and 2.

EXHIBIT II-1

General Education Industry Trends

- Flat to minimal growth in governmental spending
- Changing demographics of student populations
- Curriculum reform demands

1. General Trends

a. External Trends

The principal external trends currently shaping programs and expenditures in the education industry include the following:

- Flat budget growth related to federal and state government spending constraints
- The need to address the requirements of an increasingly diverse population
- Wide discrepancies in school facilities based on local district/county support
- The need for curriculum reform and other measures to increase the quality of the U.S. workforce
- Pressures for regionalization, rationalization, and sharing of high-quality educational resources to help reduce overhead expenses

Of these trends, budgetary constraints promise to be the most important, at least for the next two to three years. Limited GNP growth and renewed pressure on state and local governments to fund the requirements will continue to impact the ability of educational institutions to expand their use of information systems and services both in the classroom and in support of administrative processes.

Three of the trends noted above deserve further comment.

Federal and State Government Spending - The federal government has, of late, become concerned with the increasingly superior performance, in the world labor market, of the graduates of other educational systems. This concern has manifested itself in a number of studies and initiatives, one of the most recent of which is the proposed America 2000 strategy. America 2000 proposes six national educational goals, suggests a non-profit short-term foundation (NASDC) to provide $150-200 million for educational research and development, asks American communities to make a commitment to improving education (America 2000 Communities), and for those that do, proposes a $535+ million legislative program to fund at least one prototype school per Congressional district (535 of them, to be precise) with up to $1 million in Federal funds.

The reaction to this proposal is mixed. Since America 2000 works closely with state governors, many feel that increased federal *and* state involvement in education is not beneficial. Proponents of this and other similar programs and strategies point out that something must be done to

improve the performance of our educational system, and that limited state and local budgets virtually mandate another source of funds—e.g., the federal government. State spending for schools has been limited in many communities because of tax reform initiatives such as California's Proposition 13, which limited property tax revenues—a major source of education dollars. Many states, California included, are considering revisions to these tax initiatives that would increase the tax base and provide more funds for schools. Whether tax reform changes are implemented, especially in a recessionary period, remains to be seen, as is the case with increased federal involvement in the educational system, through programs\strategies such as America 2000.

Quality of the U.S. Workforce - As noted above, there is strong evidence that the performance of the graduates of many other countries' educational systems are better prepared to compete in the world labor market than are the graduates of U.S. schools. This observation has caused U.S. educators, driven in some cases by U.S. businesses, to consider making significant changes to the teaching methods, curriculum and testing techniques in use today. The hope is that such revisions, when defined, refined and implemented, will produce a workforce with skills that offer a competitive edge in the world market. America 2000 addresses this issue, in part, but solutions to the problem (which not all agree is severe) will require decades to implement.

Diversity - More and more educators and educational systems are recognizing the many faces of diversity now appearing in U.S. classrooms. There are diverse ethnic backgrounds, social/economic backgrounds, languages used, intellectual abilities, emotional conditions, physical abilities, parental goals, peer pressures and more. In many cases, the concept of diversity exceeds traditional educational boundaries and embraces social needs such as day care, and feeding children who aren't fed at home. These differences, in general, have always existed, and the classroom teacher, over the years, has dealt effectively with student diversity in a variety of ways. What has changed is the increased awareness of the existence of student diversity, the impact it has on the classroom—on teachers and students—and the need for the school system to deal effectively with it, rather than placing the full burden on the teacher alone. Fortunately, concurrent with need recognition, there is now widely available one of the most effective tools to use with a heterogeneous class mix: computers. In-class PCs, running sophisticated curriculum software, allow a teacher to more easily tailor instruction to individual student needs. In addition, the student has a powerful tool which, once mastered, is useful at all levels of education. CD ROMs allow students to view the same material, but hear narrative in two or more languages. Diversity is a challenge, but it no longer has to be a major stumbling block for the educational system. As with most technical solutions, however, implementation can be costly, and levels of implementation will always be subject to budget constraints.

b. Education Industry Growth Rates

The U.S. Department of Education projects that expenditures for educational services for K-12 and higher education will rise to $380 billion for the 1990-1991 school year, which represents a 7% increase over 1989-1990. Total educational services expenditures are estimated to represent 6.8% of the GNP. About 80% of educational expenditures are financed by public funds.

The U.S. Department of Education estimates that the total enrollment in the nation's schools was about 59.8 million in the fall of 1990, which was an increase of less than 1% from 1989. However, preschool and elementary school enrollments have been growing at a slightly higher rate, reflecting an increase in the national birthrate since 1977. Meanwhile, secondary school enrollment showed a 1.8% decrease from 1989 to 1990, but is expected to grow at a CAGR of 2.3% from 1991 to 1996. The largest percentage increases in K-12 have been in the West, with slight declines in the Northeast and Midwest.

College student enrollment increased to 13.6 million in the 1990-91 school year, which, according to the U.S. Department of Education, represented a 1% population increase over 1989-1990. Approximately 22% of the total enrollment was in private schools of higher education. Of those in colleges and universities, 12% were pursuing graduate degrees.

Buried in the U.S. Department of Education's *1990 Digest of Statistics* are two sobering facts. The student population at all educational institutions will grow, in the period 1990 to 2000, at about three times the growth rate experienced from 1980 to 1990. The heaviest growth will be seen in elementary and secondary (K-12) schools. The number of students at institutions of higher education, on the other hand, will grow at a lower rate in the period 1990-2000 than they did from 1980 to 1990 (0.55% versus 1.01%). These populations, and their corresponding CAGRs, are summarized in Exhibit II-2. Still, in absolute terms, the projected CAGR of about 3/4% for K-12 and 1/2% for higher education over a ten-year period is quite modest. Over a twenty-year period, the total student population, at all institutions, will only grow by 10%.

EXHIBIT II-2

Enrollment in Educational Institutions
Student Population in Millions

Level	1980-1981	1990-1991	2000-2001	CAGR (Percent) 1980-1990	CAGR (Percent) 1990-2000
All Institutions	58.3	59.8	64.3	0.25	0.73
Elementary and Secondary	46.2	46.2	50.0	0.0	0.79
Higher Education	12.1	13.6	14.3	1.01	0.55

Source: Digest of Education Statistics, 1990.

2. Overview of Trends in the Education IS Industry

Exhibit II-3 summarizes the information services trends within the education industry as discussed in this section.

a. K-12

Academic Courseware

Early emphasis, for academic courseware, was primarily on the instructional use of computers for computer literacy training. In recent years, however, there has been increased acceptance of computer-assisted instruction (CAI) at the K-12 level to enhance the learning process in individual curriculum areas. This also reflects a transition in the K-12 educational software markets from the specialized use of computers primarily for advanced student instruction and drill and practice applications for slower learners, to more mass market utilization. There is also a growing tendency to weave technology into the curriculum—that is, to not "teach computers," but use them to support courseware.

EXHIBIT II-3

Education Industry—Information Services Trends

K-12

- Academic Courseware
  - Increased acceptance of CAI
  - Growing awareness of a need for networks
  - Improved quality of courseware
  - Continued limited availability of classroom computers
- Administrative Applications
  - Expanding use of teacher/classroom management systems
  - Districtwide record-keeping automation
  - Availability of microcomputer-based administrative applications

Higher Education

- Academic Courseware
  - Slow grow in use of commercial CAI
  - Expanding CAI development on campus
  - Creation of consortiums to expand CAI use
- Administrative Applications
  - Growing expansion of intra- and intercampus networks
  - National networks being established
  - Experimentation with video classroom/off-site instruction
  - Establishment of campuswide networks for instructor productivity

Academic Libraries

- Expanded use of on-line and CD ROM services
  - Interlibrary E-mail networks in place
  - National library catalog system developing
  - Experimentation with text management and retrieval technology

However, over the past few years there hasn't been significant overall growth in the usage of curriculum-specific applications. Instead, usage increases tend to be more for cross-disciplinary applications such as for reading/writing enhancements (with newer desktop publishing applications in K-6) and for critical problem solving skills, particularly for reinforcing research skills in the social sciences. Science research tool kits are also showing strong acceptance. Math subjects such as geometry and algebra represent one area where more curriculum-specific computer applications are finding wider acceptance.

Other applications finding stronger acceptance include: statistical manipulation, word processing, and data base access tools and services; again, these tend not to be curriculum specific.

Networks—Currently there appears to be limited use of networks, although vendors are expanding their products in this area. Issues here include the high cost of installing and supporting networks, and how vendors can price such products on a profitable level. Site licensing contract pricing in some school districts probably can't be priced high enough to achieve an adequate return on development expenses.

In many schools and school districts, a rather mundane fact has slowed both the introduction of computers and the use of networks. Older school buildings have neither the classroom power outlets nor campus telephone technology to support a PC, LAN or workstation environment. Technology is not the issue. The cost of updating facilities has become a significant concern in a period of budget restrictions.

One area of high interest addressed by the Office of Technology Assessment in a recent report called *Linking for Learning* is distance learning. This is defined as "the linking of a teacher and students in several geographic locations via technology that allows for interaction." Technology used involves VSATs, satellites, interactive cable, etc. Some of the principal benefits of this technology include: providing access to higher quality instruction and materials to a wide student/teacher base and the ability to integrate the complementary educational strengths of business/industry and education. The major impediments today appear to be the cost and the necessity of coordinating such activities district or statewide.

Driving Forces—Driving forces contributing to the use of computer applications in the K-12 academic environment include:

- Perceived improvement in the quality of courseware, with more deliberate attempts to work with educators in developing such programs
- Friendlier computer interfaces, which make the computer a less intimidating tool

- Embracing presentation modes that take advantage of the current generation of more powerful personal computers and related technologies such as interactive simulation, videodiscs and CD ROM

- Teachers' and administrators' increasing familiarity with computers, through their use of cross-industry word processing, record keeping, and budgeting tools. Teachers are also coming to recognize the advantages computers offer for dealing with diverse learning skills in the classroom.

- In the future, lower costs of high-performance platforms with graphic user interfaces could be a significant stimulant to computer use. One stumbling block to increased computer use today (in the K-12 classroom) is the presence of only a few computers in the room. Ideally, there should be a computer for every child in the classroom. Exhibit II-4 notes the average number of students per micro during the period 1983-1988, and offers INPUT's estimate of 1991 numbers. The increase in micro population has been dramatic, and at the public school level more than tripled from 1983 to 1988. Today, many progressive (and financially fortunate) school districts have reduced that number to ten students per micro, and many believe that for the near term, 10:1 is a workable ratio.

- Closer ties between business/industry and the school systems—in terms of funding subsidies, training, and creating relevance for the student with the real world—are extremely important. Some school districts call such relationships "creative alliances with business," and aggressively pursue them in support of school requirements.

- There is growing recognition of the need, in larger school districts, for a dedicated coordinator for educational technology and testing. This individual is responsible for choosing, acquiring and installing the micro resources used in the classroom (or resource center) and works with teachers to acquire or develop courseware. The coordinator assures that the school/district objectives for the use of computing resources are achieved.

Inhibiting Forces—The primary inhibiting force for greater academic use of computers at the K-12 level is budget constraints, which can result in the following:

- Insufficient numbers of computers in individual classrooms to effectively achieve academic objectives

- Greater need for cooperation between curriculum consultants in the school systems and vendors in creating quality programs

- Lack of teacher training in computer use

EXHIBIT II-4

Microcomputers per Student
Elementary and Secondary Schools

Year	Student per Micro	
	Public Schools	Private Schools
1983	92.3	N/A
1984	63.5	56.2
1985	45.5	41.6
1986	36.5	33.7
1987	30.8	28.8
1988	26.9	23.5
1991*	15	13

* INPUT estimates

Source: *Statistical Abstract of the United States*, 1990.

Administrative Applications

Leading trends in K-12 administrative applications include:

- Teacher/classroom management applications. In addition to automating the teacher's grading and other record-keeping functions, these applications can 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 record-keeping 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 record-keeping procedures. This has led to the development in various states of regional data processing consortiums that perform the data processing functions for individual school districts. These are funded by the individual districts.

- Large districts, in particular, are buying their own minicomputers to provide services not provided by the service bureaus and to bring in-house the type of data processing functions provided by the service bureaus. This reflects complaints about the overhead costs as well some limits on applications provided by the service bureaus. In some cases, this has led 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, budgeting, word processing and desktop publishing, and test scoring.

b. Higher Education Institutions

Overview

Information services markets within higher education include:

- General administrative, including student record keeping, 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
- On-line data bases and library facilities access
- Research support

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.

More recently, there appears to be considerably more professor/student involvement in the development of courseware through the use of HyperCard, which also provides access to video disk and CD ROM. Much of this is placed in the public domain for sharing with other professors and universities that can use the tool to customize their presentations. This is particularly evident in medical school instruction. An example includes the Dartmouth-developed Interactive Medical Record application. A major advantage in medicine instruction for such multimedia tools is that textbooks become quickly out of date with the rapid changes in drugs and in medicine in general. The Macintosh, for example, can also provide relatively high-quality visuals at a relatively low price for blood cell analysis, parts of the brain, etc.

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

- The high development costs to produce several types of programs for 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 skills by many college faculty

The computer hardware manufacturers—such as IBM, DEC, and Apple—have shown the most interest in CAI software development for the higher education markets. To stimulate this market, along with deep discounts on computer hardware they are also providing grants to professors to write programs.

DEC has had a 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 has created a Higher Education Software Consortium to market various packages of its software applications and tools to colleges and universities at a low fee scale, depending on enrollment size. Schools will also pay annual fees depending on which of four product categories is chosen: Selected System Platform Programs, Engineering/CIM Programs, Business Applications, and Selected Business Systems Programs.

Not surprisingly, universities with a major scientific/technical emphasis have shown the greatest interest in computer courseware. However, some of the strongest encouragement for courseware development at the higher education 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.

Administrative Applications

At the university level, most of the major information services applications have been administrative and research oriented, and, increasingly, are involving network solutions. The most prevalent use of computer systems at the faculty and student levels is for such cross-industry applications as word processing, spreadsheets, DBMS, graphics, and statistical modeling.

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

- Human resources—particularly the integration of payroll and personnel
- Alumni information management/fund-raising applications
- Financial aid management
- Departmental applications

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/on-line search capabilities.
  - More recent university data networks include a backbone network tied into several smaller departmental local-area networks. Ethernet and TCP/IP tend to dominate in such configurations. 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 (although funds for this are limited), as well as higher bandwidth networks to interconnect technical workstations to supercomputers.

- Network applications such as 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 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.

- A major new intercampus networking initiative is the National Research and Education Network (NREN) that would link colleges, universities, government agencies, industry, and businesses at network speeds of up to 45 megabits.

  - This resource would connect local and regional data networks throughout the country, which could greatly enhance university and private industry research capabilities and communications.

  - A goal of such a network would be the creation of a virtual library. Principal long-term implementation issues that will need to be addressed include development of common network communications protocols (such as those based on ISO/OSI models), copyright issues, and common user interfaces.

- A trend on campuses relating to intra-networking is the much tighter coordination amongst IS management with library administration and academic computing, which is now being centralized under a chief information officer.

- The connection of campuswide micro-to-mainframe facilities that provides a combination of local processing with access to information in central data bases more frequently on a terminal-to-mainframe basis

3. Academic Libraries

Inter-library linkage is the major trend in the use of computers in academic libraries. Trends in library administration software and services include:

- Automation of internal administrative processes

- On-line or CD ROM access to bibliographic material from 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 inter-library 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 On-line Computer Library Center (OCLC). This will provide academic libraries with on-line access to bibliographic materials from all these sources by accessing the major on-line cataloging utilities such as OCLC. This would be greatly enhanced by the National Research and Education Network (NREN) program.

- A related purpose of LSP is to provide 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.

OCLC is working on an automated system for scanning and indexing text which will include its automated document architecture processing and tagging project. This library imaging project will deal primarily with periodical literature and portions of books. The long-term goal is to provide access to desktop computers either through fax boards or on image processing systems. Higher speed networks will be necessary to implement distribution systems at this level.

The automation of library card cataloging and data base search capabilities has led to much more use of on-line desktop computer access to library mainframe computers from off-site facilities. A new product for implementing this capability is NOTIS, an on-line library cataloging system developed at Northwestern University which has been installed at over 100 universities and corporations. A new front-end tool (for IBM mainframes) to create a graphical (easy to use) access to NOTIS on-line resources is the Macintosh front-end called MacNOTIS, a HyperCard interface jointly developed by Apple and Texas A&M University. It provides for direct or dial-in communications and data transfer between Macintosh computers and an IBM mainframe.

B
Issues

Exhibit II-5 summarizes the issues facing the three subsectors of the education market that may react to expanded application of information technology.

EXHIBIT II-5

Education Industry—Issues

K-12

- Price sensitivity—cost per user
  - Inconsistent quality of courseware
  - Constrained funding at local, state, and federal levels
  - Flattening enrollment
  - Profitability of educational versus commercial software
  - Out-of-date classroom computing
  - Teacher computing skills

Administrative Systems

- Movement to new technology such as RDBMS
  - Campuswide administrative systems integration
  - Budget restraints and accountability

Academic Library Management

- Connection with nationwide library networks
  - Cost of CD ROM information sources
  - Use of new text management and retrieval technology

1. K-12 and Higher Education

Inhibiting Factors—There are several forces inhibiting growth in the education software and services markets.

- Price sensitivity of the educational market: at the K-12 level, $50 per user (for courseware) appears to a price cap. Educational software is frequently sold with rights to duplication, with pricing structures that can vary by size of district, as well as 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.

- Recognition by software publishers of inconsistent quality of academic computer software, and an increasing awareness that the software must enhance the learning process in ways that traditional learning tools cannot, should lead to improved software products.

- Constrained funding sources in the educational community: educational budgets at all levels have been restricted in recent years because of spending constraints imposed by state budget appropriation 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 the K-12 level has come from federal (special needs) educational programs. However, many federal education programs have been cut back in recent years. A major federal funding program for K-12 academic computer software purchases today is the Chapter I program for disadvantaged and limited English proficient (LEP) children. Depending upon how (and if) the federal America 2000 program is implemented, it may provide as much as $150-200 million from the newly formed non-profit NASDC, and $535 million from the *535+* program to provide $1 million per Congressional district. These funds, however, are not targeted specifically for information services resources and courseware, and, when they become available may be applied to almost any area of academic endeavor.

- 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. As shown in Exhibit II-2, however, enrollment is expected to grow dramatically in the 1990s, and in the long term, the K-12 educational market will increase at a steady, but modest, rate.

  - Recent budget shortfalls in many public school districts are reflecting the impact from this demographic trend because state support of public schools is based in large part on enrollment.

  - Enrollment rates, however, are beginning to increase for the early junior high years. In addition, there is some indication that a higher percentage of high school graduates are choosing to go on to college.

- The profitability of educational software compared to the profitability of software sold to the corporate market. Profit margins for curriculum software publishers are estimated to be below those achieved by companies marketing software to the corporate markets as well as those achieved by textbook publishing companies. A pretax margin of 10% is estimated to be the norm for educational software companies, compared to 20%+ margins achieved by companies in many other software markets.

- At the college level, little academic courseware material has been developed by software publishers, which is due in part to high software development costs at this level and lack of royalty incentives for professors to develop software for the commercial educational markets.

- Software development is time consuming, especially in an environment where teaching, research, and publication already involve major time burdens. In addition, the development of software programs often does not reinforce research effort, as is the case in the publication of textual material.

- The complexity of the software requirement will require some continuing partnership between software vendors and the college faculty community.

- A "hodge podge" of computers exists in many school districts as well as in the college and university environment, mainly as a result of their having been purchased (frequently at the departmental level) for a variety of specialized needs. This situation is further aggravated by the growing obsolescence of much of this equipment as new generations of more sophisticated software require more advanced hardware. This situation, incidentally, provides a significant opportunity for systems integrators.

Third-Party Suppliers - The major third-party suppliers to the higher education markets have not responded rapidly enough to the growing trend toward desktop computing with higher education-specific applications. Faculty and departmental administrators are currently relying on standard packages, but there is a need for specialized applications—particularly those based on a client/server system.

Costs - The increasing cost of education, with almost flat growth in universities, will require information services vendors to help improve the quality of the teaching and administrative processes by enhancing the price/performance attributes of workstations with new applications. This will also require more emphasis on the training of teachers and professors to increase computer usage in their curricula.

2. Administrative Applications (Higher Education)

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

- Distributed (client/server-based) processing solutions involving the integration of end-user processing needs, including those of departmental administrators, professors, and students.

- Campuswide data base management and library resource management systems. The cost of a central campus IS department to provide maintenance of current applications as well as the need to provide more systems integration support should provide a significant opportunity for information services vendors.

In addition, to achieve greater efficiency in computer applications delivery, information services vendors should make greater use of the cost/benefit analysis programs used by business to justify new computer applications. This will require providing proposals for campuswide and long-term systems integration applications for university operations and financial administration, and, in some cases, for the more advanced K-12 school districts.

- For example, for more centralized control of budgeting and auditing procedures, there needs to be systems integration among departments, central IS facilities, and financial administration. Relational and distributed architectures with integrated data bases and functionality are key ways to address such issues.

- The inevitable migration towards the use of standard RDBMSs, operating systems (UNIX), networking operating systems and integrated network management will ultimately achieve the desired goal of a common environment for all major educational information resources.

3. Academic Libraries

With the development of major intercampus/library networking programs, such as the Linked Systems Project, library administrative systems will need 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.

The implementation of standard interfaces and networking protocols is key to the success of intra- and intercampus library resource access. The proposed Z.39 standard is addressing the need for a standard research strategy.

CD ROM turnkey systems should continue to provide a growth rate above the total education market in the library sector, particularly for the public library systems where budgets allow for expenditures on telecommunication access to on-line data bases.

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.

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

Information Services Market

Information Services Market

This chapter discusses the markets for information services in the education industry. Information in this chapter draws on the statistics presented in Chapter I and the trends and issues discussed in Chapters I and II to outline the anticipated future directions of the market for information services.

One of the key items discussed is the set of trade-offs between the prepackaged solutions—such as processing services, applications software and turnkey systems—and custom solutions, which involve consulting or internal systems development and systems integration support.

User expenditure forecasts are provided for the education industry by industry sector and by delivery mode. Assumptions driving the forecasts are presented. Note that these forecasts do not include functional general-purpose information services, such as for human resources, accounting, or generic planning and analysis. The markets for these types of information services are presented in other cross-industry Market Analysis Program reports rather than in the industry-specific reports.

Section A, Overview, discusses the overall size and growth rate of the education industry's expenditures for information services.

Section B, Delivery Mode Analysis, breaks out the overall data into INPUT's seven standard delivery modes.

Section C, Industry Segment Analysis, provides a breakout of this same forecast in terms of the major market segments within the education industry. These segments are:

- K-12 Administrative
- K-12 Courseware
- Higher Education Administrative
- Higher Education Academic/Courseware
- Academic Libraries

A
Overview

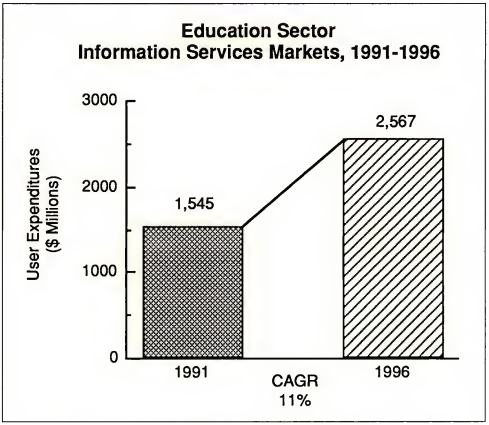
The academic education information services market is diverse. It includes software and services for K-12, colleges (including two-year vocational/technical schools), universities, and libraries. There are also the separate administrative and curriculum courseware markets.

Information services requirements are unique for each of the segments. As a result, most of the companies that provide information services to the academic education market 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 two different vendor types.

The academic education market (as distinct from the education and training market) in 1991 is expected to be $1.5 billion, or slightly more than 1% of the $113 billion total information services market in 1991.

INPUT is projecting a 13% CAGR in the total information services market between 1991 and 1996. The academic education market during the same period is expected to increase at a CAGR of 11%, from $1.5 billion in 1991 to $2.6 billion in 1996, as shown in Exhibit III-1.

EXHIBIT III-1



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

- The current trend of essentially flat enrollments (less than 1% CAGR) in the secondary school environment. 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 current demographic trends in the secondary schools. However, the percentage of high school students pursuing higher education is increasing.

- Budgetary constraints in all the academic education markets reflecting reductions in state aid to education, based in large part on changing patterns in student enrollments, cutbacks in federal grants for education, and reductions in the corporate tax base in many inner-city and rural environments, and a general response to the prolonged recession. Increases in funding have largely been for intervention programs involving children at risk.

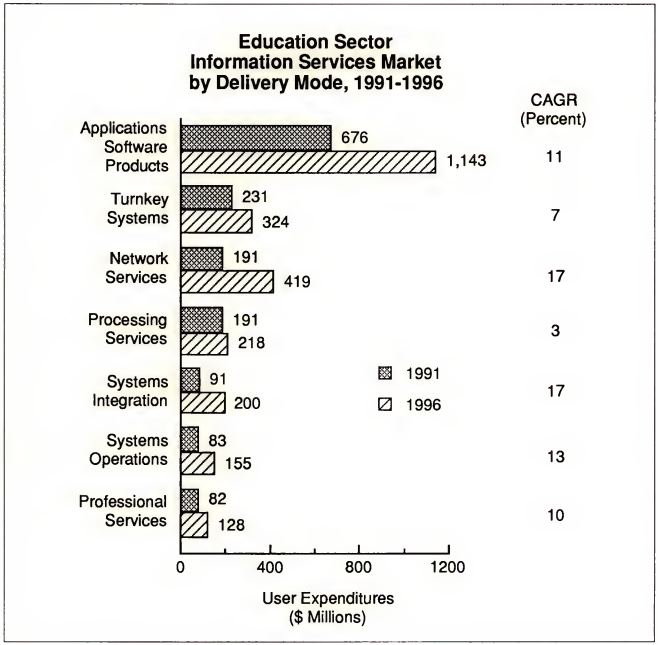
A counterbalancing budgetary factor in the higher education markets is the federally sponsored Sallie Mae student loan repurchase program, which in recent years has been providing much more liquidity in the student loan market. The resulting increased lending capacity for student loans has probably been a factor in allowing universities to increase tuition rates in recent years to help counterbalance fixed expenditure outlays in a flattening student enrollment environment. However, recent reports indicate an increasing student loan default rate, particularly in certain sectors such as post-high school private vocational programs. This could lead to a tightening in credit qualifiers for students.

B
Delivery Mode Analysis

Forecasts by delivery mode for user expenditures in the education sector are shown in Exhibit III-2. INPUT analyzes the vertical information services markets by seven delivery modes. Professional services systems operations is defined as utilizing the client's data processing and/or staff, whereas processing services systems operations involves vendor ownership and professional staffing of the client's data or telecommunications operations.

The next sections discuss the growth projections of each of the delivery modes as depicted in Exhibit III-2.

EXHIBIT III-2



1. Processing Services

INPUT defines processing services for the educational market as transaction processing services. This can involve third-party processing of administrative applications, use of remote supercomputer facilities for research applications, and test scoring and statistical analysis by service bureau-type operations.

Expenditures for processing services in the education information services market will grow at a 3% annual rate, increasing from $191 million in 1991 to $218 million in 1996. Negatively impacting the growth in processing services is the trend of providing administrative applications, in particular, on in-house computers. The service bureau processing services-funded local school district consortiums for administrative applications are not included in the processing services information services market figures. This is considered a captive market. However, the trend is toward more local school district processing, in some cases representing parallel applications. Such service bureau consortia address the need for common state educational department reporting requirements.

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. If the new intercampus NREN legislation is passed by Congress, this could greatly increase the use of remote supercomputing facilities for research activities.

2. Turnkey Systems

Turnkey systems are closely related to processing services, in that they both represent a standard, parametric approach to satisfying users' requirements. Both these alternatives generally provide the least flexibility for the user, and place the user most strongly at the mercy of the vendor. They are most frequently used by the smaller schools, which have simple operations and cannot afford the overhead necessary to provide their own data processing capabilities.

Turnkey systems applications provide an integration of systems software, packaged or customized applications software, a CPU, and related equipment and peripherals.

User expenditure for turnkey systems was expected to show the second slowest growth rate, at 7%, in the educational information services market over the next five years. From $231 million in 1991, the turnkey systems education market is expected to increase to $324 million in 1996.

In recent years, there has been a decline in enthusiasm for the 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 to provide individualized instructional models—for example, in multilingual classrooms. In addition, turnkey courseware providers are unbundling hardware and software product offerings to provide support for standard hardware solutions. This has generally been well received because it increases product flexibility.

Turnkey systems represents a substantial share of the K-12 administrative systems market. This should continue to represent 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. A significant part of the market is also for test scoring systems provided as a turnkey systems solution.

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

3. Applications Software Products

The academic educational market for applications software products includes courseware and administrative software at both the K-12 and higher education levels, and library administrative software. As shown in Exhibit III-2, the educational applications software market is expected to increase from $676 million in 1991 to $1,143 million in 1996, at a CAGR of 11%. INPUT estimates that the 1991 market for K-12 courseware is $395 million, while $67 million was spent on courseware for higher education.

The academic educational software industry consists of a large number of companies, including independent academic courseware developers that specialize primarily in the K-12 markets, textbook suppliers, computer systems companies, and turnkey systems suppliers and smaller VARS (whose software revenues are counted under the turnkey systems delivery mode). Although there is major interest in increasing the amount of computer-assisted instruction in K-12 classrooms on the part of both users and vendors, 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 new generations
- Need for more intensive teacher training (staff development) in computer use
- High delivery costs associated with providing courseware to the K-12 market, particularly with the need for extensive support services

Recent surveys of the K-12 market suggest that the computer program category receiving the most interest is cross-disciplinary applications: writing, desktop publishing, graphics, statistics, and decision support. These surveys also indicate that curriculum-specific applications are not receiving the same level of acceptance. This might suggest that teachers do not yet see the value of computer applications used in conjunction with other teaching media for many areas of curriculum. It also probably recognizes the reluctance of many teachers to step up to this new technological tool and incorporate it into their classrooms. One observer noted that it is very difficult to relinquish the methods by which one was taught, and embrace new techniques and tools to use when one teaches others. Among the differing fields, there is greater curriculum-specific interest and acceptance in the math and science disciplines.

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. For a commercial courseware market for higher education applications to develop, software vendors will have to evaluate the type of financial incentive, such as royalties, that would encourage professors to develop sophisticated programs that would complement textbook teaching. The medical schools appear to be using more commercial computer applications to address the rapid changes in medical technology. The number of HyperCard applications has been rapidly expanding.

The administrative education software market typically involves different sets of vendors for higher education, K-12, and library administration. The strongest growth potential for these markets is projected to be for minicomputer- and workstation-based departmental computing at the higher education level, for PC/workstation-based administrative and classroom management applications in the K-12 market, and for PC/workstation-based library administrative applications.

4. Systems Operations

Systems operations/management involves the outsourcing part of an institution's computer operations. It can involve operation of all the IS data processing facilities—which can be done either on-site or off-site—application development, systems integration, and telecommunications management.

Outsourcing has become a fast-growing market in many industries. As shown in Exhibit III-2, it is of modest size in the education industry, but is expected to almost double by 1996, to reach $155 million with a CAGR of 13%.

In the higher education market, two of the principal vendors of systems operations/management services are Systems and Computer Technology Corporation and Electronic Data Systems (EDS).

As the complexity of computer applications continues to expand in both the K-12 and higher education markets the need for increased networking and distributed/integrated application development will be a stimulus to third-party outsourcing growth. The need for educational IS departments to expand services to more of the user community and respond to the growing demand for network-based applications is rapidly increasing, while, in most cases, IS budget growth remains relatively flat. Increased efficiency of operations and the ability to provide more advanced computer solutions will be key factors in driving the systems operation market in the long term.

At the K-12 level, many of the regional service bureaus that serve the administrative market have staff and budget limitations for developing new applications. A trend towards regionalization of K-12 school districts could also provide an opportunity for outsourcing with the expected consolidation of IS department facilities.

5. Systems Integration

Closely related to professional services is the market for systems integration (SI). At present, this is one of the smallest delivery modes. However, it has the highest projected growth rate. The key distinction between consulting and systems integration is who bears the ultimate responsibility for planning and managing a project. Consulting firms typically provide analytical or technical support to their clients, and seldom bear full responsibility for the end result of the project. Systems integrators act as the general contractor on a project, assume project management responsibility and generally bear some financial risk for the success of the project.

The complexity of today's technology, and the industry's accelerating pace of change, makes it increasingly difficult for the user to manage large projects with a combination of in-house and outside resources. As a result, many firms and educational institutions are transferring the risk and responsibility to SI firms. In combination, the growth of SI, professional services, and applications software reflects a major shift away from external processing to in-house processing, albeit with significant outside assistance.

For instance, in an automated environment, a K-12 school district will require business, human resource, communications and student information systems to meet its administrative processing needs. A sampling of the types of applications that could be implemented in the K-12 administrative environment is noted in Exhibit III-3. The list is not intended to be comprehensive, but the integration of such a broad variety of applications

on one or many systems platforms is a sizeable task, especially when telecommunications are involved. Such a task normally strains the resources of businesses that already have dedicated and sophisticated computer professionals on staff, let alone a medium-sized school district whose primary data processing experience is with service bureaus, departmental systems, and standalone minis. This is an area where a systems integrator brings a skill set and service for which there is a strong need and a rapidly growing market.

EXHIBIT III-3

Representative Administrative Applications
K-12 School Districts

Area	Application
Business Systems	General ledger Accounts payable Accounts receivable Budgeting Purchasing Warehouse inventory and requisition Fixed-asset inventory Work order processing
Human Resource Systems	Personnel data Payroll
Student Information Systems	Student demographic information Grading, testing, reporting Scheduling and registration Attendance, accounting and automated reporting Discipline reporting Achievement reporting
Communication Systems	Electronic mail Meeting scheduling Calendaring Bulletin boards

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 1991 educational market for systems integration will total $91 million. With the highest CAGR for this industry, systems integration is expected to grow at 17% over the next five years and reach $200 million in 1996 (see Exhibit III-2). INPUT estimates that the total systems integration market (involving all industries) will expand at a CAGR of 18% over the same period.

The major reason for the much higher growth expectation for systems integration in the educational market compared to other delivery modes is based on the great need for providing intra- as well as intercampus network capability, which consists of integrating diverse computers, operating systems, and network architectures. At the K-12 level, there is also a growing interest in interconnecting local schools with district headquarters, as well as for providing interactive courseware delivery to improve curriculum quality and cost efficiency.

However, INPUT's survey of higher education IS management indicated that the use of outside systems integrators is currently limited. Contributing factors include the perceived cost of long-term contracts, desire to maintain integration control, and lack of a significant level of implementation of distributed applications. Currently, much of the use of campus networks, involving E-mail and exchanging of files among departments, is accomplished through a mainframe host.

The passage of the NREN federal legislation could greatly expand the demand for integration of various types of individual campus computer systems along with increased use of remote information resources.

An important factor to consider in projecting the long-term use of outside systems integrators is the budget limit placed on the number of IS department staff. Many universities have large development backlogs that primarily involve maintenance of current applications. Distributed networks will require additional skills and involve additional project loads. The dual requirement could create pressure to use outside vendors.

6. Professional Services

The professional services delivery mode is defined as management consulting activity related to information systems consulting, development of custom software, and education and training.

In 1991, the educational market for professional services will be $82 million. It is expected to grow at a CAGR of 10%, reaching $128 million in 1996. INPUT is projecting that the overall professional services market will expand at a CAGR of 9% over the next five years.

The educational professional services market consists largely of services provided at the higher education level in association with sales of administrative software and custom software development. In particular, 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 is increasing the acceptance of third-party-developed administrative software solutions in the higher education market. The demand for combining software and support services in the higher education market is expected to result in parallel growth for both the professional services market and the standalone application software market.

7. Network Services

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

The educational market for network/electronic services is projected to grow at a 17% annual rate, from $191 million in 1991 to $419 million in 1996, with an expected continued strong demand for on-line data base delivery and E-mail facilities. INPUT is projecting that overall, across all information services markets, network services will grow at a 17% CAGR over the next five years.

Currently, much of the use of on-line data base/news services is through academic libraries. However, there are some interesting new K-12 on-line data base programs that appear to be finding strong acceptance for teaching research methodologies in the social studies and science curricula. Also, campuses with more advanced network installations are providing for student access to such services from remote locations, such as dormitories.

Long-term stimulants for growth in this market will require increased attention to easy-to-use interfaces (such as MacNOTIS), pricing of the service based on volume discounts, and resolution of a number of copyright issues.

E-mail is by far the most common use of network services on campuses today. Much of this use is based on mainframe/terminal communications.

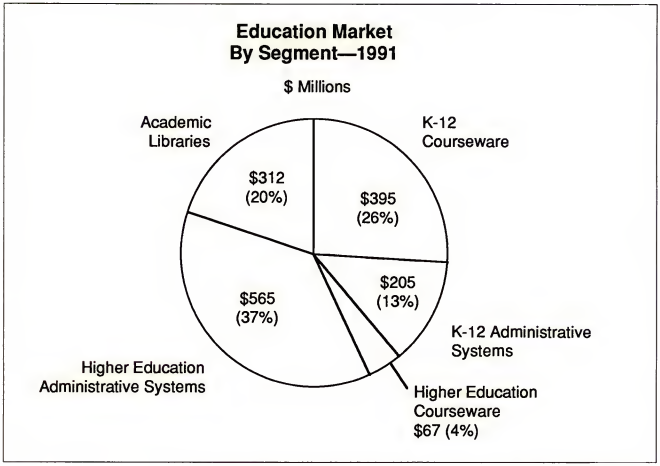
EDI and image processing are some of the higher growth future applications. This will be for a variety of applications including intra- and inter-campus student record keeping and full text/graphics interchange.

C

Industry Segment Analysis

The size of the education market for 1991, by principal segment, is shown in Exhibit III-4.

EXHIBIT III-4

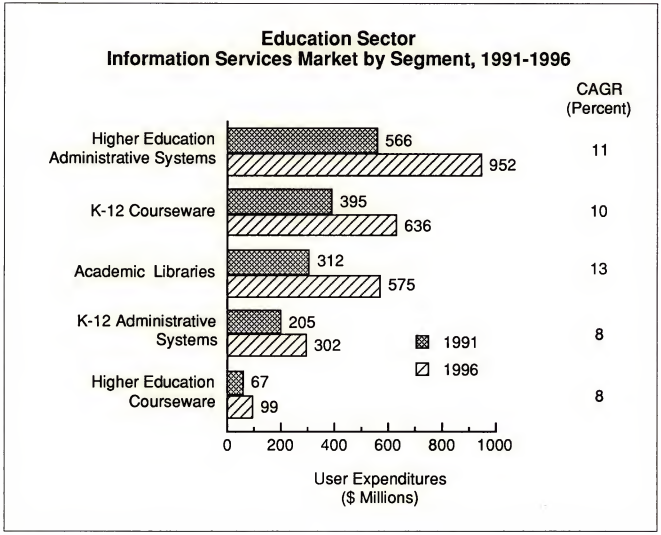


The growth rates for the segments of the education industry information services market are provided in Exhibit III-5. The CAGRs vary by sector according to previous analysis and comment.

- The courseware sectors reflect faster growth in K-12 than in higher education. The acceptance is greater and the availability of commercial software is higher for the K-12 segment.

- Administrative systems expenditures at the higher education level are growing faster due to the greater challenges at the campus level and availability of funds.
- The stronger growth of the academic library segment is fueled by use of network services (on-line data bases) and the objective of building interlibrary networks.

EXHIBIT III-5



Competitive Environment

Competitive Environment

This section discusses the competitive environment for information services within the academic education industry. Leading vendors in each market segment and delivery mode are identified and profiled.

A
Vendor Trends and Characteristics

1. General Trends

The large computer systems vendors are showing a more proactive interest in the higher education administrative systems market and the computer-assisted (courseware) market, with a variety of purchase incentives. This also involves support for professor- and student-developed courseware.

Vendors of systems integration, professional services, and systems operations computer applications are exhibiting greater interest in the academic education market. This interest results from higher growth rates in network-based solutions, particularly in higher education, and the ever-increasing complexity of systems. In addition, budget constraints are a favorable factor in the use of outside services.

To date, the college courseware commercial market is primarily that of general-purpose (cross-industry) applications such as word processing, DBMS, statistical analysis, simulation, graphics, and mathematical modeling. INPUT includes such cross-industry applications within its cross-industry sector reports, published separately from this document.

An emerging courseware market in higher education is related to the increasing use of HyperCard as an application development tool. A number of programs have also been developed by professors as part of research grants. Much of such software is either placed in the public domain for intercampus use or is made available for a minimal charge through software publishers that are endorsed by large computer systems vendors. To date, there has been a modest amount of courseware, spe-

cific to particular higher education disciplines, that is distributed by the larger independent software and computer systems vendors. Examples include products developed for the commercial/industrial market but which are also targeted for higher education as a way of "seeding" the future commercial market for such products. Prominent examples include AutoCAD from Autodesk Corp. as well as many cross-industry software products. Textbook publishers also supply courseware, but their products are targeted primarily at the undergraduate market.

One higher education curriculum area that has been more receptive to course-specific computer software applications has been that of medical schools. There, simulation/imaging computer-based applications, utilizing multimedia technology, allow for more realistic training, and the application needs also correlate with those of the private medical market.

The K-12 computer courseware market is much more defined, and commercial vendors, such as educational software vendors, textbook publishers, and computer systems vendors, provide a wide variety of products to this market.

The administrative systems market in higher education and the software products market for K-12 are the two largest segments of the total academic education market.

2. Academic Courseware Applications—K-12

Apple hardware and software continue to dominate in the academic (CAI) environment at the K-12 level. However, the rapid change in platform technologies appears to be a stumbling block in the expansion and standardization of software applications. Much of the hardware in school systems is now obsolete, and the cost of frequent upgrades is prohibitive. Also, many of the more sophisticated courseware-specific programs are only available for the more advanced machines, and frequently at much higher costs. The availability of lower cost Macintosh minis will help to alleviate this cost issue.

Currently, many of the courseware-specific applications are developed for the Apple/Macintosh environment. However, several vendors who initially supported only the Apple computer family are now supporting other vendors, particularly IBM, Tandy, and Commodore/Amiga.

Business and industrial arts classes at the K-12 level tend to focus on cross-industry applications and thus primarily use the MS/PC-DOS environment.

Textbook publishers appear to have a marketing advantage in the academic (curriculum) software market because they have established reputations in specific educational communities and can leverage their good will and general marketing efforts with additional software products. They

also appear to be in a preferred position to address the current trend to more closely integrate textual (printed) material with software applications. Efforts between independent software developers and textbook publishers to jointly develop projects do not appear to have had much success to date.

To be competitive, vendors must continue to determine where large market-niche opportunities are developing. They must be aware that:

- Cross-disciplinary applications (such as writing/graphics tools and critical thinking tools) have been receiving strong response, particularly in the elementary schools.
- At the elementary school level, drill-and-practice programs continue to be successful, especially programs for the slower learner.
- Interactive simulation programs are finding strong acceptance in the social science and science areas.

B
Leading and Emerging Vendors

Among the leading independent software vendors in the higher education administrative applications market are Information Associates, Systems and Computer Technology Corporation, American Management Systems, IBM, and EDS (systems operations).

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 the leading platforms.

In the K-12 administrative systems market, turnkey and integrated software (provided on a modular basis) represent popular delivery modes, including products from IBM, Cognito Data Systems/IntelliTEK Computer Corp., Pentamation Enterprises, Inc., Infocel, and National Computer Systems.

The primary suppliers to the K-12 courseware market are the large number of relatively small independent computer-based training developers, the textbook/curriculum suppliers, computer systems vendors, and turnkey systems/VARs. Among the leading software vendors in the K-12 courseware market are Scholastic, Inc., Sunburst Communications, Broderbund Software, Spinnaker Software (home education market), the Learning Company, IBM, PLATO/Roach, and Claris Corporation. In the integrated systems delivery mode (turnkey systems), two of the larger vendors are Computer Curriculum Corporation and the Roach Organization with its PLATO/Roach product.

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

A sampling of leading vendors to the academic education market is provided in Exhibit IV-1.

EXHIBIT IV-1

Selected Leading Education Information Services Vendors by Principal Market Segment

Market Segment	Selected Vendors
K-12 Academic Courseware	Broderbund Software Claris Corporation IBM The Learning Company Roach Organization Scholastic, Inc. Spinnaker Software Sunburst Communications
K-12 Administrative Systems	IBM IntelliTEK Intorel National Computer Systems Pentamation
Higher Education Administrative Systems	American Management Systems EDS IBM Information Associates Systems and Computer Technology
Academic Libraries	CLSI CompuServe Dialog Information Systems Follett Software Company On-Line Computer Library Research Libraries Group Wilson Corporation

C
Selected Vendor Profiles

The following are a representative sample of vendors offering information services to the education marketplace.

1. American Management Systems, Inc. 1777 North Kent Street, Arlington, VA 22209

American Management Systems provides information management systems products and services 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, supported by consulting, software development, and related services to provide a total information management solution to the customer base.

The company's largest market segments are the federal government, financial services institutions, state and local governments, and universities. The company is a leader in each of its principal market segments.

In the educational area, the company's target market includes the 300 largest colleges and universities. In 1990, its revenues from this market were 22% of the total corporate income of $262 million, or $58 million. AMS' state/local government and educational revenues have grown from approximately $10 million in 1982 to $44 million in 1989, and $58 million in 1990.

The company's principal administrative systems software for the educational market is the College and University Financial System (CUFS), a financial management system that provides funds accounting, general accounting, and management functions as well as 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.

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

Established in 1970 and currently employing 3,000, AMS focuses on offering a problem solving resource to large organizations, an approach which generally requires a combination of project management and professional services skills, industry-specific applications, and custom software.

2. Autodesk, Inc. 2320 Marinship Way, Sausalito, CA 94965

Autodesk, Inc., designs, develops, markets, and supports a family of computer-aided design (CAD) software products for personal computers and 32-bit workstations. 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 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. For instance, the CAD Teacher Training Program is designed to provide in-service training to educators. In 1987, over 2,000 teachers nationwide participated in the company's CAD Teacher Training Program.

The Autodesk Consortium for Education links together 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.

In May of 1991, Autodesk announced that it would support the Windows operating environment. The company plans to release an AutoCAD extension kit which would give AutoCAD Release 11 customers utilizing the DOS operating system the option to run AutoCAD on DOS, under Windows, or in both environments, interchangeably. Shipments are scheduled for the first half of 1992.

In the year ended January 31, 1991, Autodesk had revenues of $238 million, up 33% from 1990.

3. Broderbund Software, Inc. 17 Paul Drive, San Rafael, CA 94903-2101

Broderbund Software, Inc., provides microcomputer software products for the education, entertainment, graphics, and business markets. The company indicates that current revenues are in the $50 million+ range.

Within the past few years, Broderbund has focused increasing attention on the educational marketplace. The company's 1989 *Software for Education* catalog listed 26 school-edition titles and 18 lab-pack titles, with a total of 181 versions for various personal computer formats. Broderbund's educational products cover a variety of subject areas for K-12 classes, including reading, language arts, math, science, social studies, fine arts, productivity, and teacher tools.

Broderbund entered the educational market in 1982 with *Bank Street Writer*, an easy-to-use (cross-disciplinary) word processing program published for the home market. In 1984, Broderbund introduced *The Print Shop*, another cross-disciplinary program for creating personalized greeting cards, signs, posters and banners.

Making educational software products that are fun to use has been a major publishing goal of Broderbund, and the products identified above have become two of the most popular educational software applications in the K-12 market.

Another recent educational software product introduction is the *Where is Carmen San Diego* series, which combines social studies and research skills to develop deductive reasoning capabilities. This, too, is a cross-disciplinary product. Other popular product themes include drawing, type manipulation, and science tools.

Hardware platforms supported include: Apple IIe, Apple IIGS, Mac Plus, Macintosh, IBM PC, Tandy, and Commodore.

An estimated 75% of Broderbund's revenues are from the U.S. Broderbund operates two foreign subsidiaries: Broderbund Japan develops and markets Japanese versions of American-developed software in Japan; and Broderbund France markets Broderbund software products in France.

4. International Business Machines Old Orchard Road, Armonk, NY 10504

For administrative activities at the K-12 level, IBM's System/36-based software and services represent one of the largest installed bases of administrative software in that market.

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

IBM's specific product offerings include:

- School/student information management systems

  - 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 products

  - Guaranteed student loan/Pell grant tracking
  - General ledger
  - Projected/actual payment tracking
  - Student accounts payable
  - Student financial tracking
  - Vendor accounts payable

- Computer-aided instruction

  - APL interactive training course
  - Fundamental accounting principles courseware

- Library management and circulation control systems

  - Dobis/Leuven Library System—Dortmund library system (Dobis)
  - Dobis/Leuven Library System—periodicals control
  - Periodicals control system

5. National Computer Systems, Inc. 11000 Prairie Lakes Drive, Eden Prairie, MN 55344

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 desktop scanner lines, the Sentry 2050 and the Sentry 3000. NCS is a major vendor of computer-based optical mark reading (OMR) systems and is generally regarded as the leading supplier of scanning equipment to educational institutions.

NCS also markets software, forms, and tests to drive its scanners. These include standardized software programs for use with specialized applications on OMR systems, 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.

In the education markets, its 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.

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—worth approximately $40 million over its five-year life. This contract strengthens NCS' role in the student financial aid marketplace.

National Computer Systems sells its products primarily to the educational market, and to a lesser extent, to the government and financial markets. In 1989, approximately 43% of its $284 million in revenues were from its Education Group. In 1991, revenues for the six months ended July 31 declined 2.2% from the corresponding 1990 period, as higher education sector revenues were offset by lower third-party maintenance revenues. Excellent cost control, however, allowed pretax profits to rise by 14%. NCS' year, ended January 31, 1991, noted total revenues of $315 million, up from $284 million in 1990.

6. Pentamation Enterprises, Inc. - Education Systems Division One Bethlehem Plaza, Bethlehem, PA 18018

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 revenues come from processing services, 10% from software products, 10% from turnkey systems, and the remaining 5% from terminals and peripherals.

Pentamation's principal markets include education, health care, and municipal governments. Pentamation Enterprises is the largest independent supplier (in terms of revenues) of administrative computer software for K-12 school districts in North America, with 1990 revenues of $52 million.

Its Education Systems Division provides integrated financial and student management systems. The student management software is used for student registration, scheduling, grade reporting, and class attendance accounting. The business office package includes personnel and payroll, budgeting, revenue and expenditure accounting, and general ledger.

Products run on DEC VAX computers, and Pentamation is a systems-cooperative marketing partner of Digital Equipment. Its principal delivery mode is as a systems integrator, with emphasis on professional services such as training and facilities management.

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

7. Systems and Computer Technology Corporation 4 Country View Road, Malvern, PA 19355

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

Specific information services include:

- Applications software, which provides integrated information and production programs for student, financial, human resources and alumni information needs

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

- Systems operations contracts with several higher education institutions, including Dowling College in Oakdale (NY), Delaware County Community College (PA), Cuyahoga Community College in Cleveland (OH), and the San Diego Community College District, among others

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

- Custom software development

SCT primarily serves educational institutions (colleges, universities, and trade schools) and local government jurisdictions (cities and counties). In the higher education administrative software and services market, SCT is a significant vendor of systems integration resources. As a result of its success in this market, SCT has positioned itself primarily as a systems integrator, with proprietary software and services and third-party relations with hardware OEMs such as IBM and HP.

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 works with IBM branch offices throughout the United States to identify prospects in

the higher education marketplace. SCT can also 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 (SYMMETRY is based on SUPRA). The SYMMETRY Series brings relational technology to IBM mainframe users, while the BANNER Series is aimed at midrange IBM and DEC users. These products for midrange IBM and DEC users doubled the potential markets for the company's products in higher education. The SYMMETRY Series includes student, financial, human resources, 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 Oracle®, a relational DBMS from Oracle Corp. This distributed processing architecture addresses end-user-oriented computing in administration information systems.

The BANNER series targets the UNIX market, with products that can run on 80386-based microcomputers up through mainframe computers. The principal programming language is SQL Forms, a 4GL from Oracle. SCT has also established an alliance with Sun Microsystems.

Its 4D Series of software products for higher education institutions runs on IBM and compatible mainframes using Computer Associates' IDMS/R relational data base management system. The company also provides a student information system with an ADABAS data management system.

Markets for SCT's products and services include:

- Colleges, universities, and other educational institutions, including private schools
- State and local government, the federal government, and federal agencies
- Educational, trade, and business associations

An estimated 60% of SCT's revenue is derived from educational institutions and 40% from government. In 1990, SCT had revenues of approximately $49 million and employed about 800 people.

Appendixes

Definitions

No industry-specific definitions have been used in this report.

See the separate volume, INPUT's *Definition of Terms*, for the general definitions of industry structure and delivery modes used throughout INPUT reports.

Forecast Data Base

A

Forecast Data Base

Exhibit B-1 presents the detailed 1991-1996 forecast for the education sector.

EXHIBIT B-1

Education Sector
User Expenditure Forecast by Delivery Mode, 1990-1996
($ Millions)

Delivery Modes	1990 ($M)	Growth 90-91 (%)	1991 ($M)	1992 ($M)	1993 ($M)	1994 ($M)	1995 (M)	1996 ($M)	CAGR 91-96 (%)
Sector Total	1,400	10	1,545	1,703	1,885	2,088	2,323	2,587	3
Processing Services	185	3	191	196	201	207	213	218	3
- Transaction Processing	185	3	191	196	201	207	213	218	3
Turnkey Systems	216	7	231	247	265	283	303	324	7
- Equipment	104	7	111	119	127	136	145	156	7
- Software Products	78	7	83	89	95	102	109	117	7
· Applications	67	7	72	77	82	88	94	100	7
· Systems	11	7	12	12	13	14	15	16	7
- Professional Services	35	7	37	40	42	45	48	52	7
Applications Software Products	606	12	676	746	829	921	1,026	1,143	11
- Mainframe	80	3	82	84	86	87	89	91	2
- Minicomputer	154	11	171	182	197	214	232	252	8
- Workstation/PC	372	14	423	480	546	620	705	800	14
Systems Operations	73	14	83	95	107	120	136	155	13
- Platform Sys Oprns	54	13	61	70	78	87	97	108	12
- Applications Sys Oprns	19	16	22	25	29	33	39	47	16
Systems Integration	81	12	91	106	121	140	166	200	17
- Equipment	28	12	31	36	41	48	56	68	17
- Software Products	6	12	7	8	10	11	13	16	17
· Applications	4	12	5	5	6	7	8	10	17
· Systems	2	12	3	3	4	4	5	6	17
- Professional Services	45	12	51	59	68	78	93	112	17
- Other	2	12	2	2	2	3	3	4	17
Professional Services	76	8	82	89	98	108	117	128	9
- Consulting	18	11	20	22	25	29	32	37	13
- Software Development	48	6	51	54	58	63	68	73	7
- Education & Training	10	10	11	13	15	16	17	18	10
Network Services	163	17	191	224	264	309	362	419	17
- Electronic Info Svcs	102	18	120	142	169	200	235	269	18
- Network Applications	61	16	71	82	95	109	127	150	16

B

Forecast Reconciliation

Exhibit B-2 presents the forecast reconciliation of the 1990 and 1991 forecasts for the education sector.

EXHIBIT B-2

Education Sector
1991 MAP Data Base Reconciliation
($ Millions)

Delivery Modes	1990 Market				1995 Market				90-95 CAGR per data 90 Rpt (%)	90-95 CAGR per data 91 Rpt (%)
	1990 Report (Fcst) ($M)	1991 Report (Actual) ($M)	Variance from 1990 Report ($M)	Variance from 1990 Report (%)	1990 Report (Fcst) ($M)	1991 Report (Fcst) ($M)	Variance from 1990 Report ($M)	Variance from 1990 Report (%)		
Total	1,435	1,400	-35	-3	2,415	2,323	-92	-4	11	11
Processing Services	185	185	—	—	215	213	-2	-1	3	3
Turnkey Systems	216	216	—	—	303	303	—	—	7	7
Applications Software	619	606	-13	-2	1,043	1,026	-17	-2	11	11
Systems Operations	94	73	-21	-22	165	136	-29	-17	14	13
Systems Integration	82	81	-1	-1	188	166	-22	-12	18	17
Professional Services	76	76	—	—	139	117	22	19	13	10
Network Services	163	163	—	—	362	362	—	—	17	17

There were few differences between the 1990 projection for 1990 and the final review. The education sector grew just 3% less than had been projected, reaching just under $4.0 billion.

The most significant difference was in the systems operations market, where 1990 final results were 22% ($21 million) below forecast.

The five-year forecast reflects some adjustments, but in total remains at an 11% CAGR. Forecasted growth is slightly lower for systems operations, systems integration and professional services.

About INPUT

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

Subscription services, proprietary research/consulting, merger/acquisition assistance, and multiclient studies are provided to users and vendors of information systems and services. INPUT specializes in the software and services industry which includes software products, systems operations, processing services, network services, systems integration, professional services, turnkey systems, and customer services. Particular areas of expertise include CASE analysis, information systems planning, and outsourcing.

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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