1,000,000 STUDENTS

digital

CONTENTS

COMPUTERS IN THE CLASSROOM

The message of this brochure is simple: computers are in classrooms around the world from the moment a child enters school until the day he departs. Elementary schools, middle schools, secondary schools, vocational schools, colleges, universities, research centers—all use computers.

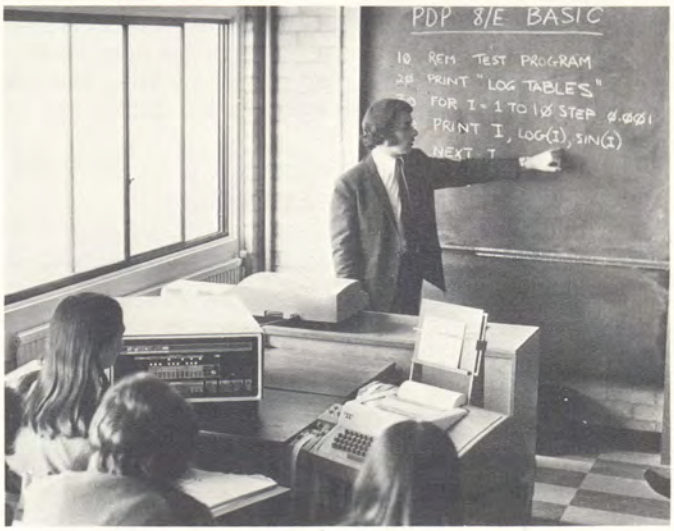
Computers are not a fad or technological gimmick that will soon fade away. They are with us, and with us to stay. In a few years, a school without a computer will be obsolete.

Digital Equipment Corporation furnishes more computers for interactive student instruction than any other manufacturer, bar none. It's no accident. DEC Educational Systems are easy to use. They're trouble free. They expand easily. They're powerful. They offer the widest available choice of applications software. And yet they're the lowest cost line of educational computer systems available anywhere.

DEC's user group, DECUS, is the most active computer user group in the world. Educators and schools can exchange ideas and programs through the Educational Special Interest Group section in DECUS.

DEC and its users have accumulated more experience in educational and classroom computing than any other user group. On the following pages, you'll read what some 60 DEC users are doing with their computers.

Summing it all up, over 1,000,000 students use DEC computers every year. If you're not already, shouldn't you be using one too?



DEC COMPUTERS IN UNIVERSITY COMPUTER AND RESEARCH CENTERS

UNIVERSITY OF WESTERN ONTARIO

London, Ontario, Canada

A DECsystem 10, interfaced to several other computers of different sizes and speeds (Honeywell 115s, Univac 9300, IBM 7040, and DEC PDP-8s), enables the computing center to provide on-line computing services via timesharing terminals or remote batch stations to users throughout the university.

A high proportion of the 12,000 students use the terminals and remote stations located in the departments of applied mathematics, chemistry, computer science, geography, astronomy, geophysics, economics, geology, physics, psychology and botany.

UNIVERSITY OF PITTSBURGH

Pittsburgh, Pennsylvania

The University of Pittsburgh is currently using a dual DECsystem 10, which is one of the largest DECsystem 10 installations in the world. The DECsystems 10 replace two IBM 360/50 systems and an IBM 7090 batch processing system.

The two DECsystems 10 will operate in a multi-processing configuration, supporting local batch, remote job entry, and interactive terminals, as well as a large common file system. Twenty-six "public" terminals are supported by the system at remote sites in addition to five public terminals at the computer center. Five remote job entry stations are also supported. Most are available for student use 24 hours a day, 7 days per week.

UNIVERSITY OF CALIFORNIA

Irvine, California

The University of California at Irvine uses a DECsystem 10 as the heart of its data processing center. The system also assists in faculty and graduate research in the physical sciences.

Dr. Paul F. Condon, Associate Professor of Physics, said the type of research being carried out with an assist from the DECsystem 10 included a variety of projects in solid-state and high energy physics requiring large matrix inversion and matrix diagonalization. Also, reduction and analysis of data from bubble chamber research is performed.

Dr. Condon explained that most of this work is done in the batch mode because of the size and complexity of the problems involved. The sequence of commands required to run the programs is often so long that processing in any other way would be impractical and uneconomical.

The timesharing capabilities are used for teaching programming and social science research. The system also handles student registration, course grading and inventory control.

BOWDOIN COLLEGE

Brunswick, Maine

Bowdoin College, with an undergraduate enrollment of approximately 1,000 students, uses a DECsystem 10 in a combined academic and administrative computing center. The DECsystem 10 replaced all existing equipment for academic instruction, for general research in psychology, chemistry, biology and physics, and for administrative jobs such as payroll, inventory, and student records.

Bowdoin also shares its DECsystem 10 with a number of public and private secondary schools and colleges in Maine via timesharing terminals.

UNIVERSITY OF UTAH

Salt Lake City, Utah

DECsystem 10's unique ability to allow real-time activity to run concurrently with timesharing plays a key role in the computing program at the University of Utah. In a dual processor configuration, one of the processors is used to support a university-wide graduate student timesharing system. The other is designed for graphics research. Digital signal processing experiments, as well as other on-line experiments, are carried out through special interfaces.

Part of the graphics research involves three PDP-9s connected on-line to the DECsystem 10. One PDP-9 is interfaced directly through a CPU and supports four Univac 1559 scopes. Each of the other two PDP-9s also contains a scope. One is located on campus in the physiology department at the medical center and the other is at Montana State University. These displays are used in interactive graphics research.

Another part of the graphics research is centered on Evans and Sutherland Corp's high-performance 3-D, line drawing display processor, and a halftone display processor which generates perspective drawings that are properly shaded to provide a realistic effect.

CATHOLIC UNIVERSITY OF AMERICA

Washington, D.C.

A DECsystem 10 installed in the computer center satisfies the instructional computer needs of the 2,200 undergraduate and 4,000 graduate students in the various academic departments. Use is made of both the timesharing and batch capabilities of DECsystem 10. The university is currently in the process of converting their administrative programs from their IBM 360/25 to the DECsystem 10. The heaviest users are the departments of chemistry, civil and mechanical engineering, psychology, physics, aerospace and atmospheric sciences.

ROCKEFELLER UNIVERSITY

New York, New York

Unlike other colleges, Rockefeller's raison d'etre is not education but research. Work is being carried on in philosophy, physics, chemistry, physiology, medicine, and many other subjects. Projects range from studies of animal learning patterns and the effects of methadone in the treatment of narcotics addicts to the influence of contraception on population trends.

Integral to Rockefeller's varied research program is a centrally located computer, a PDP-15. Data is provided to this machine from other smaller computers, from paper tape, punched cards and teletype terminals.

The PDP-15 is also directly coupled to a LINC-8 which acquires information from three neurophysiology laboratories. The LINC-8 acts as a front-end controller while the PDP-15 performs the high speed computation.

HATFIELD POLYTECHNIC

Hertford, England

The Hatfield Polytechnic, one of the main centers in England for teaching computer science, uses a 28-terminal DECsystem 10. The system is used for teaching and research at the Polytechnic with direct on-line links to three other colleges and schools in Hertfordshire.

Hatfield School, in association with the Polytechnic, was the first school in the United Kingdom to establish an advanced level course in computer science. The use of computing facilities is now an integral part of all the engineering, science, and business studies courses at the Polytechnic.

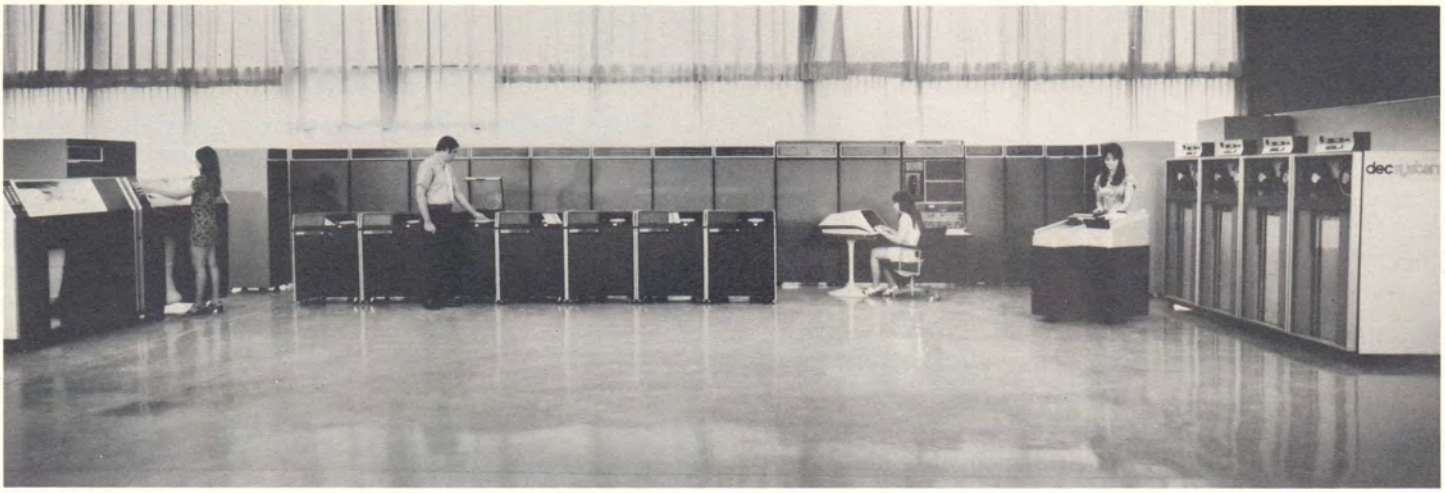
In selecting the DECsystem 10, particular emphasis was placed upon good response time at the 28 terminals. Also important was the wide variety of programming languages, including FORTRAN, BASIC, ALGOL, COBOL, LISP, SNOBOL, assembly language, and a JOSS-type language.

SOUTHERN METHODIST UNIVERSITY

Dallas, Texas

A major expansion of computer facilities at SMU and the purchase of two large computers, will enable members of the TAGER network to have access to the large-scale computing power usually found only in large business firms. TAGER, an acronym for The Association for Graduate Education and Research, was formed five years ago by seven north Texas colleges and universities to make the best use of their facilities through cooperative programs. Programs sharing instructional television and computer facilities have currently been implemented.

One of the new computers is a DECsystem 10 which will be available to TAGER students on a time-sharing basis. Students in SMU's Statistics Department, the Business School, and the University Computer Center will be able to interact with the computer via remote terminals. The DECsystem 10 will also act as a controller for the other large computer, a Univac 1108. The DECsystem 10 can handle 32 simultaneous users, and preprocess data from some 10 remote batch terminals for the 1108 at the same time.



DEC SYSTEM 10s
AT UNIVERSITY COMPUTER and RESEARCH CENTERS

Bowdoin College
California Institute of Technology
Carnegie-Mellon University
Case Western Reserve University
Catholic University of America
Colorado School of Mines
Cornell University
Emory University
Essex University England
Faculte de Medicine de Paris, France
Harvard University
Hatfield Polytechnic, England
James Cook University, Australia
Louisiana State University at New Orleans
Massachusetts Institute of Technology
Ohio State University
Oxford University
Pennsylvania State University
Princeton University
Southern Methodist University
Stanford Research Institute
Stanford University
Stevens Institute of Technology
Syracuse University
Technical College of Aachen, Germany
Technical University of Berlin, Germany
University of Bochum, Germany
University of Bonn, Germany
University of California at Irvine
University of California at Los Angeles
University of Heidelberg, Germany
University of Kiel, Germany
University of Manchester, U.K.
University of Maryland
University of Michigan
University of Munich, Germany
University of Oregon
University of Pittsburgh
University of Queensland, Australia
University of Utah
University of Washington
University of Western Ontario, Canada
Western Michigan University
Yale University

DEC COMPUTERS IN UNIVERSITY AND COLLEGE DEPARTMENTS

CORNELL UNIVERSITY

Ithaca, New York

In the spring of 1971, the Division of Biological Sciences opened an interactive computing facility for its students offering them FOCAL, and more recently FOCAL and BASIC, at four teletype consoles. The facility was designed and implemented by Professor Howard C. Howland of the Division's section of Neurobiology and Behavior.

Serving several computing and mathematics courses in the Division, the facility uses an unique ticket-reservation system whereby students in courses are issued tickets for ½ hour computing sessions which they can schedule at times most convenient for themselves. Students throughout the university can also purchase unreserved computing sessions over-the-counter at a nominal fee.

The facility uses an EduSystem 20 consisting of a PDP-8E computer with a high speed paper tape reader and punch, and 12k of core. The heart of its "real-time random-access, user-interrogatable reservations system" is a big reservations peg board in full view of all users. A carpeted floor, acoustic tile ceiling and plenty of work tables make the facility a pleasant place in which to compute.

Professor Howland has written several manuals for the facility's users including: "A FOCAL Primer" and "Solving Quantitative Homework Problems in FOCAL."

EMORY UNIVERSITY

Atlanta, Georgia

A PDP8/I with disk is being used as part of a management game at the School of Business. The games give the student the opportunity to manage a company in a dynamic situation, and test his skills in such areas as finance, marketing, production, and sales. "The traditional case method does not hold the student's interest as well as the games," said Professor R. L. Jensen, who teaches the game course and wrote the associated computer programs. "The student can read the whole case before he starts and his solution to the problems becomes fixed—right or wrong. The games do not work this way. Each problem or situation follows from the first. The student learns what will happen next only after he solves the previous problem."

As mini-computers go, the system is fairly large, but the price—$58,000—is well below other huge systems traditionally used for models and games.

UNIVERSITY OF SOUTH FLORIDA

Tampa, Florida

A LAB-8 computer system is used to introduce and demonstrate the concept of time averaging of communications signals. The system is used in a series of experiments designed to bridge the gap from deterministic signals to random signals in such a manner as to give physical significance to theoretical concepts. Four demonstrations are performed: (1) autocorrelation and cross-correlations of deterministic waveforms; (2) time averaging, autocorrelation of random signals; (3) cross-correlation of random signals; and (4) input/output relationships of linear systems.

The LAB-8 equipment is also used in Electrical Circuit I to demonstrate real convolution. The concept is demonstrated by visual display of the reflecting, shifting, multiplying, and averaging operations that are part of calculating a single output point. Since the computer makes the calculations rapidly enough to display the points, the display proceeds in an animated fashion. Using the same impulse response, the output signal is calculated for various input signals. This technique clearly shows the power of the convolution method.

Dr. James Bowers of the E.E. Department, summarizes that "the computer is included in the E.E. curriculum: (1) to relate important theoretical concepts in such a way that students obtain a physical understanding of the analytical equations; (2) to give students an appreciation of the use of a small computer as a component of an overall system, as opposed to the common idea that the computer is merely a computational device; (3) to give the student the needed practice and assurance that he can quite easily learn to utilize a small computer for a variety of applications.

KEELE UNIVERSITY

Keele, England

A PDP-8 computer is being used for on-line computation in speech research and sensory electrophysiology. Uses include analysis of electroencephalograph waves and measuring the response to sounds of single nerve cells in the brains of animals. The computer is also used to extract important parameters to be fed back through a speech synthesizer.

STANFORD UNIVERSITY

Palo Alto, California

A PDP-8 is used to teach students the fundamentals of elementary Russian. The computer is preprogrammed by the course instructor. It prints out the instructions to the students, and questions are then asked in Russian via a tape recording. If the answer is wrong, the computer prints out, "NO, TRY AGAIN" or some similar message. If, on the second try, the answer is still wrong, the correct answer is printed out in the Cyrillic (Russian) alphabet. The computer is also programmed to keep track of the student's progress and give him new material as his competence increases.

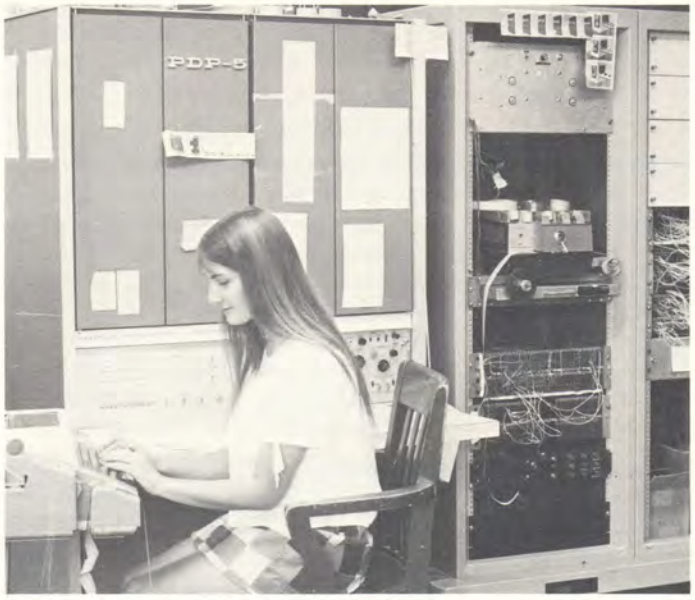
UNIVERSITY OF CONNECTICUT

Storrs, Connecticut

The Computer Science Group of the E.E. Department has been exploring potential educational applications of small computers in classroom-related projects for the past several years. The Department has available three DEC computers —PDP-5, PDP-8e and PDP-9. The PDP-5 and PDP-8e are utilized for both hardware and software purposes. Undergraduates taking software courses have semester projects writing assemblers or other assembler-level programs. Seniors with computer science or other electrical engineering projects often use the PDP-5 or PDP-8e to implement their software and/or hardware projects. Typical hardware projects have been designing and constructing a mini-operating system using an available and modifiable, old, high volume paper tape reader and storing system program on mylar tape; designing and implementing an audio cassette recorder as a programmable digital storage device. Typical software projects have been compiler writing, or combined-function program preparation systems, such as editor-assembler-debuggers. Successful projects are often incorporated into the computer systems.

The PDP-9 system is used primarily for graduate student and specially qualified senior research projects. The projects generally encompass a wide range of topics. For example, the system has been used as an aid in music composition; as a tool to investigate machine production of speech; and as a controller of psychological experiments which helped develop mathematical models of how people process sensory information. Some current projects are automatic signature recognition, real-time control of servo systems, and on-line processing of neurophysiological data in a biomedical engineering application.

As a result of the available small computer facilities and their potential engineering applications, the electrical engineering student at the University of Connecticut has an opportunity to explore almost any on-line small computer application in his realm of interest.



UNIVERSITY OF MELBOURNE

Melbourne, Australia

The Department of Psychology at the University of Melbourne uses a PDP-11 to score and interpret various tests. The computer will also help train students to properly conduct ability and personality tests. The PDP-11 allows large numbers of subjects to be tested simultaneously under identical conditions.

The computer will be used in personality and behavior studies. The PDP-11 will monitor the responses of subjects to varied sequences of visual or auditory tests. Responses such as body movements and physiological data such as heart rates can be monitored while the computer controls the projection of slides on a screen.

In social psychology, experimenters will study the social relationship between the subject and a second person simulated by the computer. This will enable human behavioral models to be tested for validity.

UNIVERSITY OF COLORADO

Boulder, Colorado

In the Department of Physics and Astrophysics, Leonard Finegold uses a PDP-8/L computer with analog-to-digital converter and oscilloscope to allow students to do a series of nuclear counting and other experiments. In addition, the computer is used for straight-forward computation and problem solving.

Finegold reports, "Surprisingly, even though several students had previously taken and passed a course in FORTRAN, they often behaved as though they had hardly been exposed to computing. Upon questioning, it became clear that in a conventional FORTRAN course, a student might have made only a few passes at the computer. However, most students were quite adept by the end of *one* class period on the mini-computer. Operating in a conversational mode, it has been an excellent way both of teaching students computing and of encouraging them to routinely use a computer."

DEC COMPUTER SYSTEMS AT COLLEGES AND UNIVERSITIES

Of all the Colleges and Universities in the free world with computers, over 75% have one or more Digital Equipment Corporation systems. Many colleges, like MIT, the University of California, the University of Wisconsin, and Oxford University, have more than 10 DEC computer systems. They range from the original DEC PDP-1 to the latest PDP 11/45. They include computers in the mini families, PDP-5, PDP-8, and PDP-11, medium scale machines, PDP-7, PDP-9, and PDP-15, large scale systems, PDP-1, PDP-6 and PDP-10, special purpose hardware, PDP-12, PDP-14, PDP-16, logic labs, computer labs, and modules.

DEC COMPUTERS IN MEDIUM AND SMALL COLLEGES

CARLETON COLLEGE
Northfield, Minnesota

Carleton boasts one of the most sophisticated systems of small computers assembled on any campus today. Heart of the instructional system is a TSS/8 with remote user terminals located in most academic buildings on campus. But in addition, the system has high speed interfaces to smaller PDP8/L computers which allow an 8k PDP8/L to be loaded from the TSS/8 in just 12 seconds! Students have extended FOCAL enormously so it is now called FOCARL. Also, graphics were added to PS8/L FORTRAN.

Some idea of the power of the system can be gained from a recent student project by Robert Hyatt to convert the Stanford Statistics Package for the Social Sciences (SPSS) designed for a CDC 6600 computer to the TSS/8. It is actually better in many ways than the original SPSS in that it is totally interactive.

Carleton also has running on the TSS/8 a simulation model of the college. It is used for planning in all areas, including building requirements and tuition.

Bruce Thomas at Carleton is producing computer-animated films using a PDP8/L computer driving a storage tube device and recording the results directly with a standard super-8 movie camera. The small computer, working at a relatively slow speed, generates arbitrarily complex frames, which are then recorded using single frame photography. This means that the small computer can produce the same film that more elaborate systems would at substantially less cost, simply taking more time to do it.

Uses have included graphical demonstrations from classical and quantum mechanical wave motion, damped oscillating systems, antenna radiation patterns, and phonon dispersion curves. The method is appropriate for any display that can be presented with an interesting time dependent factor. By using the films to supplement the direct use of the computer, a significant improvement in classroom presentation is provided.

The administrative system centers around an RSTS-11 which permits on-line registration and updating of records. While an IBM 1401 was being phased out, the RSTS-11 was used to simulate the 1401 thus allowing a smooth transition from one machine to the other.

GEORGIA INSTITUTE OF TECHNOLOGY

Atlanta, Georgia

A new course in practical computer technology and small computer applications for engineering students has been prepared at Georgia Tech. The curriculum provides all types of engineering and technical students with an appreciation and understanding of the use of small computers in data acquisition, monitoring, and control applications. Topics of study include digital logic (gates, flip-flops, scaling, etc.), hybrid logic (Schmitt triggers, ADC's and DAC's), computer organization and operation and the elements of control systems. The course emphasizes techniques for integrating small computers into total industrial and scientific systems.

In the laboratory, each student designs and builds a succession of computer interfaces using state-of-the-art, integrated circuit technology. A PDP-12 computer is used to run and test each circuit, using programs written and coded by the student. This "hands-on" approach has the advantage of acquainting the student through live experience with computer operations.

RIPON COLLEGE

Ripon, Wisconsin

An EduSystem 50 with six terminals provides Ripon College computer power for both academic and administrative applications. Terminals are located in the departments of science, mathematics, psychology, and romance languages. Robert Taylor, Computer Center Director, feels that the major advantage of the system is that users can interact in a conversational manner with the computer. The student does not have to arrive at the computer with his problem perfectly analyzed and his program written; rather he can "converse" with the computer in BASIC or FOCAL, and work out his final solution "on-line." Terminals are available in most hours of the day and evening.

The system is also employed by the administrative elements of the college, including the registrar, alumni records, admissions, and business offices.

WABASH COLLEGE

Crawfordsville, Indiana

Dr. Thaddeous Seymour, President of Wabash College, is convinced that undergraduates of a small liberal arts college should utilize interactive computing as a tool just as much as graduate research students. Computing is not an esoteric or complex thing but should be regarded as an everyday, but very powerful, tool.

Wabash selected an RSTS-11 system on the basis of its extended version of BASIC, called BASIC-PLUS. It has an "immediate mode" of operation which allows it to be used as a calculator yet its extended capabilities lend themselves to far-reaching, imaginative student projects. Also the system has a large, on-line disk storage unit permitting a large library of programs to be saved, then easily and quickly recalled.

The main terminal room in the computer center is left open 24 hours a day for student use. Additional terminals are located in other academic buildings on campus and a portable remote terminal is available for at-home use by faculty members.

BEMIDJI STATE COLLEGE

Bemidji, Minnesota

With the installation of a PDP-8/I EduSystem 40, Bemidji State College became the educational computer center of Northern Minnesota. The computer is used solely for educational purposes in mathematics, business and computer science courses. It is used to teach programming and as a tool for statistical computation in research projects. A number of area high schools and vocational schools are also tied in to the system.

On campus there are teletype terminals in the computer center and in a classroom building. Data Processing Director Lyle Dally noted that the new computer will have "regional impact" with future plans calling for hook-ups with schools throughout Northern Minnesota. The system currently handles 7 users and could be expanded to handle 16 or more users simultaneously.

WEBER STATE COLLEGE

Ogden, Utah

At the Ogden Skills Center of Weber State College, an RSTS-11 is being used with CAI drill, practice and tutorial exercises to teach fundamental skills to disadvantaged Chicano farm laborers and other adults. An RSTS-11 system was selected for the ease with which its BASIC-PLUS combined with a CAI "author language" allows the writing of CAI exercises by knowledgable, but technically unsophisticated teachers.

Under the direction of Gerry Mukai, teachers have produced CAI exercises in English, mathematics and history. Initial dialogue and questions are presented in English but then if a student gives an incorrect response, cues are presented in Spanish. According to Mukai, Weber may have "the only bi-lingual computer in the world."

DEC MEDIUM SCALE COMPUTER SYSTEMS IN COLLEGES AND UNIVERSITIES*

Arizona State University	Tempe, Arizona	PDP-15
Associated Colleges of Central Kansas	McPherson, Kansas	TSS/8
Brigham Young University	Provo, Utah	TSS/8, PDP-15
Brooklyn College	Brooklyn, New York	TSS/8
Callier Speech & Hearing Center	Dallas, Texas	RSTS-11
Cambridge University	Cambridge, England	TSS/8, PDP-15
Carleton College	Northfield, Minnesota	TSS/8, RSTS-11
Carnegie-Mellon University	Pittsburgh, Pennsylvania	TSS/8, PDP-15
Catholic University of Lourain	Leuven, Belgium	TSS/8
Clarkson College	Pottsdam, New York	TSS/8
Clemson University	Clemson, South Carolina	TSS/8, RSTS-11 PDP-15
Cornell University	Ithaca, New York	PDP-15
DePauw University	Greencastle, Indiana	RSTS-11
Duke University	Durham, North Carolina	PDP-15
Florida State University	Tallahassee, Florida	TSS/8
Harvard University	Cambridge, Massachusetts	PDP-15
Helsinki University	Helsinki, Finland	PDP-15
Hollins College	Hollins College, Virginia	TSS/8
Indiana University	Bloomington, Indiana	PDP-15, TSS/8
Kent University	Kent, England	RSTS-11
Lawrence University	Appleton, Wisconsin	RSTS-11
Loyola College	Baltimore, Maryland	RSTS-11
McGill University	Montreal, Quebec	PDP-15
New York University	New York, New York	PDP-15
Northern Arizona University	Flagstaff, Arizona	TSS/8
Northwestern University	Chicago, Illinois	PDP-15
Oak Ridge Associated Universities	Oak Ridge, Tennessee	TSS/8
Ohio State University	Columbus, Ohio	PDP-15
Ontario Institute for Study in Education	Toronto, Ontario	TSS/8, PDP-9
Polytechnic Institute of Brooklyn	Brooklyn, New York	TSS/8
Purdue University	West Lafayette, Indiana	RSTS-11, PDP-15
Ripon College	Ripon, Wisconsin	TSS/8
Rockefeller University	New York, New York	PDP-15
Seattle-Pacific College	Seattle, Washington	RSTS-11
St. Lawrence College	Cornwall, Ontario	TSS/8
Stanford Research Institute	Stanford, California	RSTS-11
State University of New York	Stony Brook, New York	PDP-15
Syracuse University	Syracuse, New York	PDP-15
Trinity College	Hartford, Connecticut	TSS/8
Trondheim Technical	Trondheim, Norway	RSTS-11
University of Amsterdam	Amsterdam, Netherlands	PDP-15
University of Berlin	Berlin, Germany	PDP-15
University of Bonn	Bonn, Germany	PDP-15
University of Brussels	Brussels, Belgium	PDP-15
University of Calgary	Calgary, Alberta, Canada	TSS/8
University of California	Los Angeles, California	PDP-15
University of Chicago	Chicago, Illinois	PDP-15
University of Colorado	Boulder, Colorado	PDP-15
University of Edinburgh	Edinburgh, Scotland	PDP-15
University of Frankfurt	Frankfurt, Germany	PDP-15
University of Illinois	Urbana, Illinois	PDP-15
University of Kansas	Lawrence, Kansas	PDP-15
University of Lund	Lund, Sweden	PDP-15
University of Massachusetts	Amherst, Massachusetts	PDP-15
University of Melbourne	Melbourne, Australia	PDP-15
University of Memphis	Memphis, Tennessee	PDP-15
University of Minnesota	Minneapolis, Minnesota	TSS/8
University of Missouri	Columbia, Missouri	PDP-15
University of Munich	Munich, Germany	PDP-15
University of Oregon	Eugene, Oregon	PDP-15
University of Pennsylvania	Philadelphia, Pennsylvania	PDP-15
University of Pittsburgh	Pittsburgh, Pennsylvania	PDP-15
University of Rochester	Rochester, New York	PDP-15
University of Stuttgart	Stuttgart, Germany	PDP-15
University of Tennessee	Knoxville, Tennessee	PDP-15
University of Texas	Austin, Texas	PDP-15
University of Utah	Salt Lake City, Utah	PDP-15
University of Utrecht	Utrecht, Netherlands	PDP-15
University of Wien	Vienna, Austria	PDP-15
University of Wisconsin	Milwaukee, Wisconsin	TSS/8
U.S. Naval Academy	Annapolis, Maryland	PDP-15
Wabash College	Crawfordsville, Indiana	RSTS-11
Walla Walla College	Walla Walla, Washington	RSTS-11
Weber State College	Ogden, Utah	RSTS-11
Western Michigan University	Kalamazoo, Michigan	PDP-15
Wheaton College	Wheaton, Illinois	RSTS-11
Yale University	New Haven, Connecticut	PDP-15

*This is a very abbreviated list of worldwide installations.

DEC COMPUTERS IN COMMUNITY AND JUNIOR COLLEGES AND IN VOCATIONAL/TECHNICAL SCHOOLS

SANTA ROSA JUNIOR COLLEGE
Santa Rosa, California

Most mathematics and science classes make use of the EduSystem 40 at Santa Rosa Junior College. Milton Hoehn of the math department reports that teachers and students have written a library of over 150 short programs. Most are simple in nature and are used to illustrate a point in a lecture or lab or they are often-used formulae or data reduction techniques. The programs are particularly useful in statistics where, once a student understands a concept such as linear regression, he would like to be able to use it without the tedious and repetitive calculations. Now, with the aid of the computer, this can be done.

The computer is used in plotting also. Frequently, students have a difficult time visualizing the shape of a function or approximating the value of its roots. Simple computer routines permit the student to select a range and plotting interval and the computer gives the student as rough or detailed plot as he wishes.

MERCER COUNTY COMMUNITY COLLEGE
Trenton, New Jersey

Using a PDP-8/I, 32k word disk, an analog-to-digital, and digital-to-analog converters along with six DEC Computer-Labs, Prof. Irving Engelson, Chairman of the Electrical Engineering Department, has developed a unique training program. Students learn about the theory of computer logic and the rudiments of how to maintain the internal computer circuitry.

Using the analog capability allows simulation of many applications; control of physical or chemical processes, for example. Information from the analog sensors is fed to the PDP-8/I via the "A to D" converter, calculations performed, and then digital output is converted back to electrical impulses by the D to A converter.

MOHAWK COLLEGE
Hamilton, Ontario

How to control repetitive machine tools is being taught students at Mohawk College of Applied Arts and Technology by means of a PDP-12 computer and DEC's PDP-14 solid state machine controller. The controller is meant to replace the electromechanical relay networks used in virtually all mass production. On an assembly line or in similar repetitive production operations, the PDP-14s may be supervised by a computer. At Mohawk, the PDP-12 will do the supervision. As part of their studies, the students will relate computer control to a variety of industries. Rather than requiring extensive redesign as do relay networks when a change in production is necessary, the PDP-14 requires only a minor modification in its prewired memory.

RED RIVER COMMUNITY COLLEGE

Winnipeg, Manitoba

Using a PDP-8, Red River offers a two year course in Computer Technology. Training is provided in the hardware and software aspects of computers, their internal operation, associated peripherals and applications.

This program equips graduates to take jobs in the areas of computer maintenance, management and operation of a small computer center, support hardware and software specialists in R and D, and development of computer systems for data acquisition, graphic display and computer control. Students learn both assembler language and higher level languages like FORTRAN, BASIC, and FOCAL.

DURHAM COLLEGE

Oshawa, Ontario

Durham, a College of Applied Arts and Technology, uses its PDP-12 and PDP-8/s computers to train computer technologists, and also in its chemistry and physics departments. The computer technologist course concentrates on the technical aspects of the computer and its associated systems, as opposed to business-oriented EDP and programming courses offered elsewhere. The program consists of one year general technology, one year concentrating on electronic circuits and systems design, and one year concentrating on data acquisition, process control and computer interfacing.

Durham also teaches its students to critically evaluate computer configurations for varied industrial and scientific tasks. Each industrial situation demands a different configuration of computer, options, and peripheral devices. Says John Davidson of the Electronic Technology Department, "This kind of instruction is very useful to those students who may later be involved in helping an employer decide which computer to buy."

DON BOSCO TECHNICAL HIGH SCHOOL

Paterson, New Jersey

Students at Don Bosco are using a PDP-8/L computer to operate machine tools. Using FOCAL, an English-like computer language, students derive the formulas needed to operate a lathe. At the lathe, one student is the controller and reads the proper, computer-produced, instructions to a fellow student lathe operator.

The machine shop instructor feels that the computer enables students to do tasks before impossible because of the time-consuming mathematics involved. Also, student work is more advanced. They are not limited to simple formulas but now might work with a number to the 3.14159 power, for instance. This gives the future machinist, technician, or production or design engineer a better idea of the potential of machinery control.

The computer is also used in physics, chemistry, math, electronics and automated drafting.

DEC COMPUTER SYSTEMS AT COMMUNITY AND JUNIOR COLLEGES*

NAME	CITY/STATE
Algonquin College	Ottawa, Ontario
Anoka Ramsey State Junior College	Coon Rapids, Minnesota
Barstow College	Barstow, California
Bellevue Community College	Bellevue, Washington
Berkshire Community College	Pittsfield, Massachusetts
Brevard Junior College	Cocoa Beach, Florida
Bucks County Community College	Newtown, Pennsylvania
Butler County Community College	Butler, Pennsylvania
Camden County College	Blackwood, New Jersey
Centennial College	Scarborough, Ontario
City College of New York	New York, New York
Community College of Allegheny County	Pittsburgh, Pennsylvania
Conestoga College	Kitchener, Ontario
Cuyahoga Community College	Cleveland, Ohio
Durham College	Oshawa, Ontario
Fanshawe College	London, Ontario
Federal City College	Washington, D.C.
Foothill Junior College	Los Altos Hills, California
George Brown College	Toronto, Ontario
Georgian College	Owen Sound, Ontario
Gordon College	Wenham, Massachusetts
Humber College	Rexdale, Ontario
Lambton College	Sarnia, Ontario
Loyalist College	Belleville, Ontario
Macomb County Community College	Warren, Michigan
Malcolm X. Junior College	Chicago, Illinois
Mercer County College	Trenton, New Jersey
Mohawk College	Hamilton, Ontario
Niagara College	Welland, Ontario
Northern College	Kirkland, Ontario
Oklahoma State Technical School	Okmulgee, Oklahoma
Onondaga Community College	Syracuse, New York
Queensborough Community College	Bayside, New York
Red River Community College	Winnipeg, Manitoba
Ryerson Polytechnic Institute	Toronto, Ontario
Santa Rosa Junior College	Santa Rosa, California
St. John's River Junior College	Palatka, Florida
St. Lawrence College	Kingston, Ontario
Sir Sanford Fleming College	Peterborough, Ontario
Taft College	Taft, California
Wharton County Community College	Wharton, Texas

*This is a partial list representative of installations in the United States and Canada.

DEC COMPUTERS IN PUBLIC SECONDARY EDUCATION

PROJECT LOCAL

Westwood, Massachusetts

Project LOCAL, for Laboratory Program for Computer-Assisted Learning, founded in 1967 is one of the oldest computer programs in secondary schools in the country. From the original five school members, Lexington, Westwood, Natick, Needham and Wellesley, the project today has grown to serve over 20 schools. The project originally used commercial timesharing services and cost over $100 for each student served. In the 1968–69 school year, costs were reduced to $25 per student, after substituting five small computers for the timesharing service. The computers consisted of three EduSystem 20s and two EduSystem 50s. In subsequent years, the addition of more terminals to each system has driven the per student cost even lower.

Project Director Robert N. Haven listed four application areas where the small computers are used: as a tool in problem solving, as a vehicle for administering drill and practice sessions, as a calculator in laboratory experiments, and as a medium for demonstrating the operation of math and science concepts.

Walter Koetke of the Lexington High School Math Dept. and an editor of "The Mathematics Teacher" stated, "Computer accessibility clearly increases and sustains student motivation to levels rarely achieved in similar settings without the computer...Perhaps of greater significance is the algorithmic type of thought and the approach to general problem solving that programming a computer teaches a student."

DEERFIELD HIGH SCHOOL

Deerfield, Illinois

Using an EduSystem 10, Deerfield offers a one-semester computer science course "Fundamentals of Digital Computation." The course stresses the mathematical, logical, and mechanical concepts necessary to understand and work with digital computers. The computer is also used in regular math classes.

Commenting about the computer science course, math department chairman, Karl Wildermuth, explained, "in order to understand programming, you have to understand the mechanics." Major areas covered in the course, now in its 5th year, are algebra of logic, basic EDP components, basics of programming, and computer languages. A similar 10-week course is offered to adults in night school.

Currently about 150 students use the computer regularly and about 1500 are exposed to it in their math classes a minimum of three times each semester, Mr. Wildermuth noted.

HUNTINGTON COMPUTER PROJECT

Huntington, New York

Two EduSystem 50 time-sharing systems have been made to serve as simulation or modeling devices in the study of biology, chemistry, physics, social studies, and mathematics. The results of this two-year NSF-sponsored study indicate that the computer can be made to function as a laboratory, a tool by which teachers can broaden the scope of their teaching well beyond present limits. Simulations make possible projects that could not otherwise be considered due to cost, time limitations, potential danger, the necessity of elaborate equipment, and needed expertise.

In a study of disease epidemics, for example, the student defines a population, immunization, and infection percentages, and the recovery rates. The computer then plots the course of the disease and the student can alter the variables to see which has the greatest effect. Other biology simulations are in genetics, pest control, membrane transmission, enzyme reactivity, and photosynthesis.

In social studies, one simulation allows the student to vary rates of consumption, production, government spending, and taxes to determine the effect on the economy. Other economic simulations exist in foreign trade, depression and equilibrium, installment buying, costs of production, pollution control and a mini stock market.

SOUTH PORTLAND HIGH SCHOOL

Portland, Maine

School officials in South Portland boast of their EduSystem 50 that they have "the most sophisticated computer system of any installed in a Maine secondary school." In addition to terminals at South Portland High School, high schools in the communities of Kennebunk, Gorham, Westbrook, Yarmouth, and Cape Elizabeth are linked to the system. Each school pays less than $350 per month for computer time and telephone line usage.

South Portland High School has had a computer program since the fall of 1967 when it was hooked into the time sharing system at Dartmouth College. Dartmouth, which had awarded South Portland its Keiwit Cup for best school usage of the computer, encouraged the school to buy its own computer. South Portland chose the EduSystem 50 for its multi-language capability and the ease with which other schools can gain access to the system.

The computer is used primarily in the business studies and math departments. "Math students, who use the computer to work out problems, save an incredible amount of time, and it takes nearly all the drudgery out of their work," notes mathematics department head, Ann Waterhouse.

MIDDLE COUNTRY SCHOOLS

Centereach, New York

In a unique experiment in Computer Managed Instruction (CMI), an EduSystem 50 is used to efficiently manage the individual curricula of over 2400 junior high school students in Centereach.

Students are taught both by teachers (about 50% of the time) and by executing frames in programmed instructional textbooks. Every 200 or 300 frames the student takes an achievement test (using an optical mark test form).

The computer immediately grades his test in the classroom and keeps a record of his score. Based on his performance, he may go on with the next set of frames, do a set of remedial frames or receive tutorial help from a teacher. In the latter two cases, he could ultimately retake a similar, but different, achievement test.

Each student proceeds at his own pace until he has completed all of the instructional "strands" which may, depending upon the material used, cover from one to six years in one or more subject areas.

In addition to scoring and recording the tests, the computer also keeps a comprehensive record of all students, provides periodic reports on progress and achievement, identifies exceptional cases and analyzes tests and test questions. It is probably the most thorough measuring device for "accountability" when used in conjunction with predetermined behaviorial objectives and validated tests.

The EduSystem 50 also provides terminals for remedial drill and practice, student problem solving and simulation exercises.

IROQUOIS FALLS HIGH SCHOOL

Iroquois Falls, Ontario

In 1968, Iroquois Falls started using an EduSystem 10 to introduce and integrate computer science, where appropriate, to all courses of instruction from the second year of high school (9th grade) on up. There are also two elective courses, Computer Science I and II, for those students who wish to go more deeply into computer principles and advanced mathematics. In addition, a course, Principles of Data Processing, is offered jointly by the Math Department and the Commercial Department.

In regular math classes in the 9th grade, students are introduced to flow charting, simple algorithms and binary and octal numbering systems. In the 10th grade, they learn BASIC and FOCAL, operation of the hardware and they write and execute programs. In subsequent years, instruction progresses to more difficult programming, advanced logic, the calculus and assembly level languages. Students work on both group and individual projects.

DELAWARE SCHOOL AUXILIARY ASSOCIATION

Newport, Delaware

A group of twenty high schools throughout the state of Delaware are offering their students the opportunity to use one of the most sophisticated versions of the BASIC language in the world, BASIC-PLUS. The schools are tied by phone lines to an EduSystem 80 (RSTS-11) computer located in Newport.

Schools are using the system in all areas of instruction, principally mathematics, science and social studies. The richness of BASIC-PLUS is allowing the easy translation of the simulation programs from the Huntington Project, material from Dartmouth's Projects IMPRESS and CO-EXIST, the University of Pittsburgh's Project SOLO and many other sources. System Manager Teresa O. Green wants to put a large library of ready materials at the hands of users. By so doing, even the most hesitant teacher can take advantage of the computer without having to learn programming first. The ability of any terminal user on EduSystem 80 to access files and data on the DECtapes or disk makes a large and varied central library possible.

FORREST GRAMMAR SCHOOL

Winnersh, Berkshire, England

An EduSystem 20 multi-user computer system installed at Forrest Grammar School forms the nucleus of a network set up by the Berkshire Education Committee to extend computer aided learning in the county. Other grammar schools have remote terminals which can be "tuned in" to the system at Forrest over telephone lines.

WHITE MOUNTAINS REGIONAL HIGH SCHOOL

Whitefield, New Hampshire

Thomas Ford, Chairman of the Science Dept., has heavily integrated an EduSystem 10 into the junior and senior physics curriculum. He wrote programs to demonstrate Boyle's Law and Charles' Law, which deal with the interrelationship of temperature, volume, and pressure of gases. Other programs are used in the study of kinetics, velocity and acceleration, spring rates, and mechanical advantage. More advanced students use programs in the Fourier synthesis of a square wave, which demonstrates successive addition to sine waves.

The computer is also used in mathematics classes, as a demonstration tool for lower grades, and for extra-curricula projects.

AREA 9 SCHOOLS

Bettendorf, Iowa

In January 1970, twelve high schools in Clinton, Muscatine and Scott Counties in Iowa went on the air with a DEC EduSystem 50. Applications are spread as widely as the schools themselves, but focus on mathematics, physics, chemistry, and general science.

Donald Schaefer, a physics teacher in Bettendorf High School, has written a series of programs for use with physics lab experiments. One, for example, calculates vector components using measurements obtained by students in a two-ball collision experiment. Another checks students on their calculations of spectrum wavelengths. Other programs for use in the chemistry lab process the data from a heat of chemical reaction experiment and another performs calculations to help the student discover facts about the law of chemical equilibrium.

AYER HIGH SCHOOL

Ayer, Massachusetts

Using DEC Computerlabs and a PDP8/L computer, two courses in computer technology are offered at Ayer. The program consists of seven distinct phases: computer concepts, number systems, circuit concepts, vending machine technology, counting circuits, binary arithmetic and logic circuit design, and computer principles. Most students are planning a career in industry with the rest heading toward college.

Continuous emphasis is placed on practical applications of each type of circuit in the curriculum. The underlying principles are emphasized so that students will have the know-how to design new, unique circuits as they progress through the course. The second course offers programming and an opportunity to use the computer and advanced instruction in the principles of computer technology and integrated circuits.

The seven years of experience indicates that the course has been successful for both students continuing their education in electronics as well as for those seeking employment after high school.

LONG ISLAND REGIONAL INSTRUCTIONAL COMPUTER SERVICE

Dix Hills, New York

LIRICS is the first regional instructional computer network in New York State, and one of the largest in the United States. The Board of Cooperative Education Services (BOCES) #3 in Suffolk County along with two other district BOCES in Suffolk and Nassau Counties administer the DECsystem 10 which provides simultaneous time sharing service to over 60 terminals at 40 schools on Long Island.

Gerry Damm, Director of the Instructional Computer Center, noted that "while the LIRICS system represents a number of firsts, it is not another 'new fangled gimcrack' educational innovation. Many students from Long Island high schools were graduated last June with three and four years of computing experience. Of that group, those attending college will have a firm foundation for participation in the ever growing computer activities on our campuses while others will be entering a business or industrial world where the ubiquitous computer daily assumes a larger role."

THE AMERICAN SCHOOL

The Hague, Netherlands

The American School serves a transient American community of approximately 5,000 people, most of whom are attracted by industry, the military, or the diplomatic corps. Despite the mobile nature of the people, community support, reflected by parents who want more than a pedestrian mathematics program for their children, have made it possible to operate Europe's first computer project for over 3 years.

Charles Lund, director of the program, reports that an EduSystem 40 is used in the project to meet the following objectives. "We want children to learn mathematics. The computer is used to extend the regular mathematics program, not as a substitute for it. We want children to enjoy mathematics. We believe that the learning-by-doing nature of programming and the hands-on experience of operating the computer make mathematics and school more relevant and exciting."

Lund continued, "We feel that there are at least four unique contributions which the computer can make to the study of mathematics. First, in writing programs to perform a task, such as converting fractions to decimals, the student is involved in the problem solving activity of algorithm design. Second, by having students write and run programs computational skills are maintained because they appear in a meaningful framework, while concepts are reinforced. Third, by having a student use his own program to investigate a problem he is allowed to discover mathematical relationships and succeed at his own level of understanding. In this way individualization of instruction becomes a classroom reality and not just an educational catchword. Fourth, by developing, using and revising his program the student is involved in generalizing his algorithm so that it is valid for larger and larger classes of problems."

HALF HOLLOW HILLS SCHOOL DISTRICT

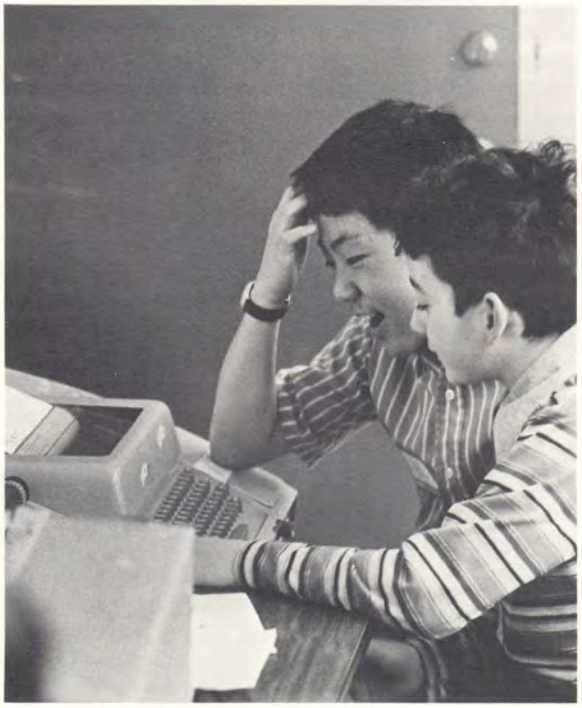
Melville, New York

"Over 1000 children in grades 3 through 12 in the Half Hollow Hills School District are receiving instruction through a system of 16 computer terminals located in three elementary schools, three junior high schools and a senior high school," reports Dr. Warren Koch, High School Principal. The computer, an EduSystem 50, is known affectionately by the students as "Big Hal."

Early graders use district-created, stored, CAI programs in spelling, grammar, math drill and practice, and social studies. But even at this level, students are introduced to the rudiments of writing simple programs. Students at the junior high and high school levels use the computer for problem solving and simulations. Teachers have written an extensive library of stored programs including ones for making ecological decisions, a quiz on the properties of a circle, one that is a study of Charles' Law, one to determine decreased longevity due to smoking, one for quizzing students on nouns, verbs, adjectives, and adverbs, one for drill on German verb endings and vocabulary, and another on finding the GNP for various investment spending and consumption rates. Through the year the staff continues to add to the program library. Programs are kept on DECtape and can be called out at any time to any of the 16 terminals.

DEC COMPUTER SYSTEMS IN PUBLIC EDUCATION*

NAME	CITY/STATE	EDUSYSTEM
Acton-Boxborough Regional H.S.	Acton, Massachusetts	Edu 10
Addison Trial High School	Villa Park, Illinois	Edu 10
Adlai Stevenson High School	Prairie View, Illinois	Edu 30
Albany High School	Albany, California	Edu 20
Amador Valley High School	Pleasanton, California	Edu 20
Amity Regional High School	Woodbridge, Connecticut	Edu 10
Area Nine Schools (Services 12 schools in Iowa)	Bettendorf, Iowa	Edu 50
Attleboro High School	Attleboro, Massachusetts	Edu 10
Barnstable High School	Hyannis, Massachusetts	Edu 10
H. B. Beal Secondary School	London, Ontario	Edu 10
BOCES, Third Dist. of Suffolk (Services 40 schools on Long Island)	Dix Hills, New York	DEC System-10
Booker T. Washington H.S.	Atlanta, Georgia	Edu 10
Bristol High School	Bristol, Rhode Island	Edu 20
Brockton High School	Brockton, Massachusetts	Edu 50
Brunswick High School	Greenwich, Connecticut	Edu 20
Burlington High School	Burlington, Wisconsin	Edu 10
Bucks County Technical	Fairlese Hills, Pennsylvania	Edu 10
Carpinteria High School	Carpinteria, California	Edu 10
Cedar Cliff High School	Camphill, Pennsylvania	Edu 10
Centennial Schools	Warminster, Pennsylvania	Edu 20
Central Cambria Schools	Ebensburg, Pennsylvania	Edu 10
Cherry Hill West High School	Cherry Hill, New Jersey	Edu 10
Clemson University (Services 14 schools in South Carolina)	Clemson, South Carolina	Edu 50
Cleveland Heights High School	Cleveland Heights, Ohio	Edu 10
Clinton High School	Clinton, Massachusetts	Edu 10
Cold Spring Harbor High School	Cold Spring Harbor, New York	Edu 40
Columbia High School	Maplewood, New Jersey	Edu 10
Connard High School	West Hartford, Connecticut	Edu 30
Cumberland High School	Ashton, Rhode Island	Edu 10
Deerfield High School	Deerfield, Illinois	Edu 10
Del Barton High School	Morristown, New Jersey	Edu 10
Delaware School Auxilliary Assn. (Services 16 schools in Delaware)	Newport, Delaware	Edu 80
East Islip High School	Islip Terrace, New York	Edu 50
Easton Vo-Tech School	Easton, Pennsylvania	Edu 10
Eau Claire Technical	Eau Claire, Wisconsin	Edu 10
Edison Technical High School	Rochester, New York	Edu 50
Evanston Township High School	Evanston, Illinois	Edu 10
Everett High School	Everett, Washington	Edu 40
Folsom-Cordova Schools	Folsom, California	Edu 10
Fresno City Schools	Fresno, California	Edu 10
Glenbrook South High School	Glenview, Illinois	Edu 10
Globe Union (Services 10 schools in Wisconsin)	Milwaukee, Wisconsin	Edu 50
Grand Forks Schools	Grand Forks, North Dakota	Edu 50
Granite High School	Salt Lake City, Utah	Edu 10
Guilford High School	Guilford, Connecticut	Edu 10
Half Hollow Hills High School	Dix Hills, New York	Edu 50
Hall High School	West Hartford, Connecticut	Edu 30
Hamden High School	Hamden, Connecticut	Edu 10
Hempstead High School	Hempstead, New York	Edu 20
Highland Park High School	Highland Park, Illinois	Edu 10
Highland Park High School	Highland Park, New Jersey	Edu 10
Homewood-Flossmoor High School	Flossmoor, Illinois	Edu 20
Houston Schools	Houston, Texas	Edu 10
Independent School District 281	Minneapolis, Minnesota	Edu 20
Iroquois Falls High School	Iroquois Falls, Ontario	Edu 10
Jamesville DeWitt High School	DeWitt, New York	Edu 30
Johnston High School	Johnston, Rhode Island	Edu 10
Keiller Mackay Secondary School	Etobicoke, Ontario	Edu 30
Kings Park High School	Kings Park, New York	Edu 10
Kingswood School	West Hartford, Connecticut	Edu 10
Kiskiminetas Spring School	Saltsburg, Pennsylvania	Edu 10
Lebanon Schools	Lebanon, Pennsylvania	Edu 20



Lebanon Unified High School	Lebanon, Oregon	Edu 10
Lexington High School	Lexington, Massachusetts	Edu 50
Libertyville High School	Libertyville, Illinois	Edu 10
Lincoln High School	Lincoln, Rhode Island	Edu 10
Lincoln-Sudbury High School	Sudbury, Massachusetts	Edu 20
Los Angeles Schools	Los Angeles, California	Edu 10
Marvelwood School	Cornwall, Connecticut	Edu 10
McMinnville High School	McMinnville, Oregon	Edu 10
Mepham High School	Bellmore, New York	Edu 20
Merrick High School	Merrick, New York	Edu 20
Middle Country Schools	Centereach, New York	Edu 50
Middleton High School	Middleton, New Jersey	Edu 10
Milford High School	Milford, New Hampshire	Edu 60
Milwaukie High School	Milwaukie, Oregon	Edu 10
Moorestown High School	Moorestown, New Jersey	Edu 10
Natick High School	Natick, Massachusetts	Edu 40
Needham High School	Needham, Massachusetts	Edu 50
New Hampton Schools	New Hampton, New Hampshire	Edu 10
Newport Mesa Schools	Newport Beach, California	Edu 20
Newport High School	Newport, Oregon	Edu 10
New Rochelle High School	New Rochelle, New York	Edu 20
Nonnewaug Regional School	Nonnewaug, Connecticut	Edu 10
North Country Union High School	Newport, Vermont	Edu 80
North Providence Schools	North Providence, Rhode Island	Edu 10
North Shore Schools	Bothell, Washington	Edu 20
North Smithfield High School	Slatersville, Rhode Island	Edu 10
Ottawa Technical High School	Ottawa, Ontario	PDP-9
Patrick Henry Jr. High School	Granada Hills, California	Edu 40
Philadelphia Schools	Philadelphia, Pennsylvania	Edu 10
Pearl River High School	Pearl River, New York	Edu 10
Portland High School	Portland, Maine	Edu 10
Rich Central High School (Services 7 schools in Illinois)	Olympia Fields, Illinois	Edu 20
Rippowan High School	Stamford, Connecticut	Edu 10
Roxboro High School	Roxboro, Pennsylvania	Edu 10
Salem High School	Salem, Oregon	Edu 10
School District 91	Idaho Falls, Idaho	Edu 10
Seminola High School	Sanford, Florida	Edu 10
Shaker High School	Albany, New York	Edu 20
Smithfield Schools	Esmond, Rhode Island	Edu 10
South Portland High School	South Portland, Maine	Edu 50
South Windsor High School	South Windsor, Connecticut	Edu 10
Spring Branch Schools	Houston, Texas	Edu 10
Springfield Schools	Springfield, Illinois	Edu 10
Stamford High School	Stamford, Connecticut	Edu 10
Summit High School	Summit, New Jersey	Edu 30
System for Educational Time Sharing (Services 20 schools in New England)	Waltham, Massachusetts	Edu 50
Tahonto High School	Berlin, Massachusetts	Edu 10
Temple City Schools	Temple City, California	Edu 10
Torrington High Schools	Torrington, Connecticut	Edu 40
Township of Lawrence H.S.	Trenton, New Jersey	Edu 10
Union High School	Union, New Jersey	Edu 10
Union Free School District #5	Levittown, New York	Edu 20
Upper St. Clair High School	Upper St. Clair, Pennsylvania	Edu 40
Valley Stream North High School	Valley Stream, New York	Edu 20
Viscount-Bennett High School	Calgary, Edmonton	Edu 40
Wallingford High School	Wallingford, Connecticut	Edu 20
Walt Whitman High School	Huntington Station, New York	Edu 40
Wellesley Junior High School	Wellesley, Massachusetts	Edu 20
Weston High School	Weston, Connecticut	Edu 10
West Warwick High School	West Warwick, Rhode Island	Edu 10
Westwood High School	Westwood, Massachusetts	Edu 50
White Mt. Regional High School	Whitefield, New Hampshire	Edu 10
Wilton High School	Wilton, Connecticut	Edu 20
Woonsocket High School	Woonsocket, Rhode Island	Edu 10
Wyandach High School	Wyandach, New York	Edu 40
Williams Free Trade School	Media, Pennsylvania	Edu 10

*This is a partial list representative of installations in the United States and Canada.

DEC COMPUTERS IN PRIVATE SCHOOLS

ST. ANTHONY'S HIGH SCHOOL

Smithtown, New York

When Brother Noel Smith first encountered EduSystem 10, it seemed that such a small computer would not be able to provide comparable service to that which he was currently receiving from a commercial time-sharing service. And, indeed, the following "flaws" were found:

1. Lost ability to store programs on a disc
2. Lost ability to handle large amounts of data
3. Lost ability to run very long programs
4. Lost FORTRAN IV language.

However, after using EduSystem 10 for a short while, the "flaws" were not found to be serious. Storage of programs on paper tape has proved more than adequate; also a disc can be added in a year or two. In the statistics course, which used large data files, it was found that single and multiple correlations and frequency distributions could still be easily done. The need for shorter programs proved to be a very positive point in that students can no longer write sloppy programs but must think and organize their logic more carefully. The excellent BASIC and FOCAL languages with "immediate mode" (like a calculator) and multiple statements per line make the transition from algebra formulas much easier than a language like FORTRAN.

"Of course, the greatest advantage for a user with a limited budget is the unlimited use of the terminal," said Brother Smith. "On my current machine, one student used thirteen hours during the Thanksgiving holiday—a rare opportunity for a rare student."

HILL SCHOOL

Pottstown, Pennsylvania

The Hill School found that physics students had a difficult time performing detailed experiments and writing them up in the same class period. Now, with the aid of an EduSystem 10, students performing a centripetal force experiment use relatively simple equipment to find relationships between variables. They can then decide what range the variables should take, and program the computer to make calculations based on the relationship. The students use the computations as a base for plotting graphs, some of which can be plotted on the computer directly, and then to determine the results and conclusions of the experiment.

Most independent schools offer students a short introductory course in programming, and have them solving problems on their own for all their courses as soon as possible. The Hill School, for example, offers six lectures over a three-week period and then gives the students free access to the computer in their free hours.

The Hill School was a time-sharing subscriber which purchased its own computer. "The original service became so popular that students had to sign up for terminal time three days in advance," said Clifford Little of Hill's mathematics department. "But giving students unlimited access to the terminal resulted in charges exceeding $1000 per month. The conclusion was that we should have our own educational computer system here, so in the long run we could keep our costs down and also give the students more 'hands-on' experience."

THATCHER SCHOOL

Ojai, California

At Thatcher School, all freshmen devote a two-week period to learning the computer language FOCAL, so that they may use the school's EduSystem 10. The course is taught by upperclass members of the computer club. The computer is then available for open use to all students from freshman through senior year.

The computer is also used in conjunction with the summer science program. In an astronomy project, for example, students made night observations and photographs of several minor planets at three different dates. Measuring the position of the planet with respect to stars of known position, they furnished the data to solve the differential equations for the motion, size, shape, and orientation of the planet's orbit. The rather lengthy and complicated numerical calculations were done on the EduSystem 10. Using this approach, students gain a good knowledge of the meaning of differential equations and celestial mechanics.

POMFRET SCHOOL

Pomfret, Connecticut

After a two year study exploring timesharing and various kinds of hardware, Pomfret concluded that an on-premise, free-standing computer made the most sense. Pomfret selected a DEC EduSystem 20.

"Educationally, the in-house system gives the student an opportunity to operate the machine directly," said William Hrasky, chairman of the Science Department. "It destroys the apprehension usually connected with the 'huge brain' at the other end of the telephone line. Debugging programs, the most frustrating aspect of working with a computer, can be done most easily while the programs are on the machine. Where time does not mean money worries at the end of the month, direct debugging of a program while it is on the computer is feasible."

Pomfret also studied adaptability, obsolescence, storage capacity and environmental requirements and became more convinced that the small in-house computer is what's needed today. Hrasky stated, "to wait for what the future will bring is really short-changing today's students."

PORTSMOUTH ABBEY SCHOOL

Portsmouth, Rhode Island

An EduSystem 20 is making math and science come alive at Portsmouth. DOM Geoffrey Chase reports, "One of the problems in the traditional curriculum is that the forest can be obscured by the trees; in particular, the drudgery of doing calculations and (even more) of undoing one's errors can very easily cause a student to forget what he is doing, or why he is doing it. It is a severe negative reinforcement to do a 12 step problem, only to find that line 2 put the decimal in the wrong place. This is one, though not the only, reason why math and the sciences cause so much difficulty to boys at this age." With respect to this facet alone, the computer has a very positive effect.

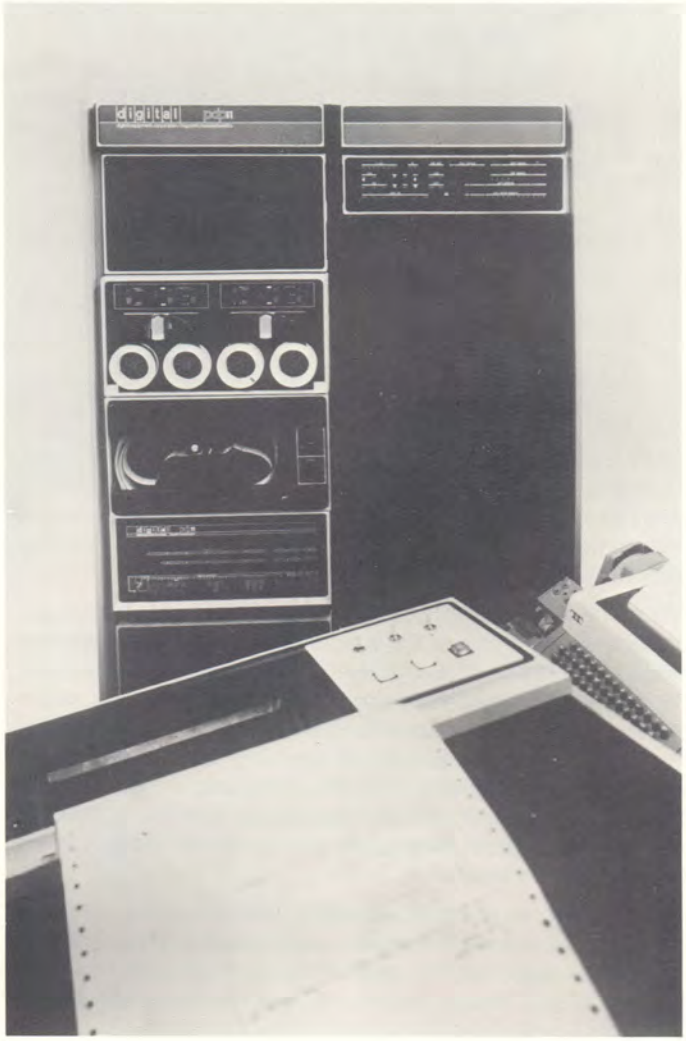
"Also," continues DOM Chase, "these machines have a strange allure for the young. This generation of students was born about the same time as the modern computer; apparently, they experience no communications gap! Perhaps this is also a reason for having them in the School; they certainly will bulk large in the world in which these boys must live."

PHILLIPS ANDOVER ACADEMY

Andover, Massachusetts

An EduSystem 80 (RSTS-11) is being used at Phillips Andover to enhance mathematics instruction from the ninth through the senior year. Students at Phillips Andover have been using terminals to larger computers for a number of years. Hence, an important criteria in the selection of an on-premise computer was that it could offer at least as rich a version of BASIC as students had been using. EduSystem 80 with BASIC-PLUS was selected for its advanced language features, particularly the ability of any terminal to share the system resources such as DECtape, disk, and line printer.

Beginning students can write programs in standard BASIC and not know anything about the advanced capabilities, while more advanced students can use the computer for the most challenging and sophisticated independent projects. Dick Pieters, Math Department Chairman, and the school staff examined the merits of commercial timesharing and a wide range of computer systems before concluding that EduSystem 80 best satisfied the needs of the school.

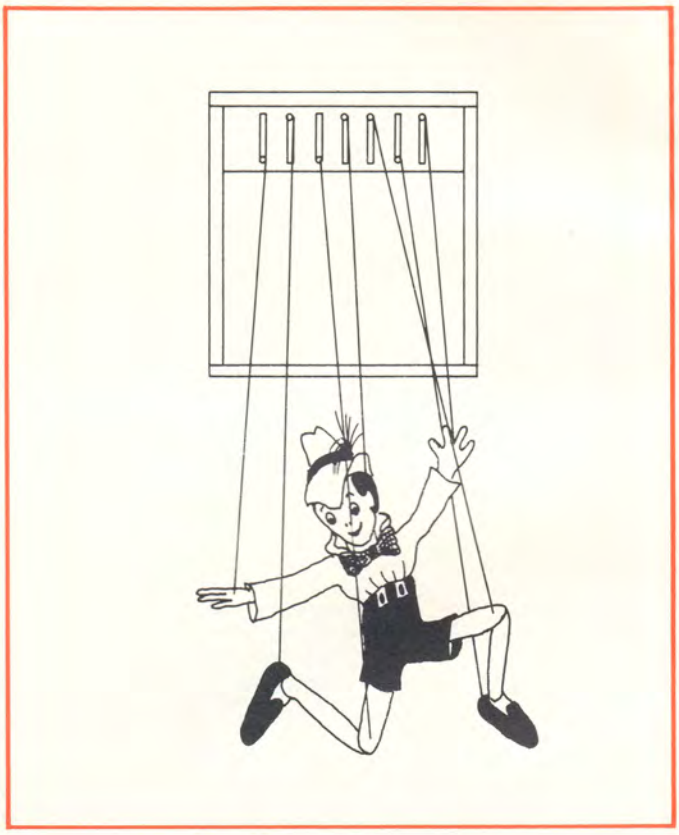


DEC COMPUTER SYSTEMS IN PRIVATE SCHOOLS*

NAME	CITY/STATE	EDUSYSTEM
Asheville School	Asheville, North Carolina	Edu 40
Athenian School	Danville, California	Edu 20
Avon Old Farms School	Avon, Connecticut	Edu 40
Beaver Country Day School	Chestnut Hill, Massachusetts	Edu 30
Belmont Hill School	Belmont, Massachusetts	Edu 20
Birch Wathen High School	New York, New York	Edu 10
Bishops College School	Lenoxville, Quebec	Edu 10
Cedar Cliff School	Camp Hill, Pennsylvania	Edu 10
Central District Catholic	Pittsburgh, Pennsylvania	Edu 20
Choate School	Wallingford, Connecticut	Edu 40
Collegiate Schools	Richmond, Virginia	Edu 10
Delbarton School	Morristown, New Jersey	Edu 10
Don Bosco Technical	Boston, Massachusetts	Edu 10
Don Bosco Technical	Patterson, New Jersey	Edu 10
Ethical Cultureal School	New York, New York	Edu 10
Evansville Day School	Evansville, Indiana	Edu 10
Forsyth Country Day School	Winston Salem, No. Carolina	Edu 10
Fort Worth Country Day School	Fort Worth, Texas	Edu 10
Governor Dummer Academy	Byfield, Massachusetts	Edu 10
Greensfarms Academy	Greensfarms, Connecticut	Edu 10
Groton School	Groton, Massachusetts	Edu 10
Harley School	Rochester, New York	Edu 30
Hill School	Pottstown, Pennsylvania	Edu 10
John Burroughs High School	St. Louis, Missouri	Edu 10
Kents Hill School	Augusta, Maine	Edu 10
Kimball Union Academy	Meriden, New Hampshire	Edu 10
King School	Stanford, Connecticut	Edu 10
Lake Forest Country Day School	Lake Forest, Illinois	Edu 10
Lancaster Country Day School	Lancaster, Pennsylvania	Edu 10
LaSalle Academy	New York, New York	Edu 20
Lawrence Academy	Groton, Massachusetts	Edu 10
Lexington Christian Academy	Lexington, Massachusetts	Edu 10
Loomis Institute	Windsor, Connecticut	Edu 20
Lyman Hall School	Wallingford, Connecticut	Edu 10
Mercersburg Academy	Mercersburg, Pennsylvania	Edu 10
Moorestown Friends Academy	Moorestown, New Jersey	Edu 10
Noble and Greenough School	Dedham, Massachusetts	Edu 20
Northfield Mt. Hermon Schools	Northfield, Massachusetts	Edu 80
Pensacola Catholic High School	Pensacola, Florida	Edu 10
Phillips Andover Academy	Andover, Massachusetts	Edu 80
Pomfret School	Pomfret, Connecticut	Edu 20
Portsmouth Abbey School	Portsmouth, Rhode Island	Edu 20
Princeton Day School	Princeton, New Jersey	Edu 40
Rensselaer Polytechnic	Hartford, Connecticut	PDP 15
Rivers Country Day School	Weston, Massachusetts	Edu 20
Salisbury School	Salisbury, Connecticut	Edu 20
Sewickley Academy	Sewickley, Pennsylvania	Edu 20
Shady Side Academy	Pittsburgh, Pennsylvania	Edu 10
St. Anthony's High School	Smithtown, New York	Edu 10
St. Edmund's Academy	Pittsburgh, Pennsylvania	Edu 10
St. George's School	Newport, Rhode Island	Edu 10
St. John's Preparatory School	Danvers, Massachusetts	Edu 10
St. Mark's School	Southborough, Massachusetts	Edu 20
Taft School	Watertown, Connecticut	Edu 10
Thatcher School	Ojai, California	Edu 10
Thayer Academy	Braintree, Massachusetts	Edu 10
Van Nuys Baptist Elementary Day School	Van Nuys, California	Edu 10
Webb School of California	Claremont, California	Edu 10
Westminster High School	Simsbry, Connecticut	Edu 40
Williams Free Trade School	Media, Pennsylvania	Edu 10
Worcester Academy	Worcester, Massachusetts	Edu 20

*This is a partial list representative of installations in the United States and Canada.

DEC COMPUTERS IN EDUCATIONAL RESEARCH AND OTHER PROJECTS



MASSACHUSETTS INSTITUTE OF TECHNOLOGY ARTIFICIAL INTELLIGENCE LABORATORY

Cambridge, Massachusetts

Computers used in a conversational style are more powerful than teaching machines, but still limited. In the real world, computers do not merely generate numbers and text to print at a terminal. Some are programmed to fly airplanes—not simulators, but real ones. Some generate music, others control lathes and milling machines. "Why not," asks Dr. Seymour Papert, "bring similar action into the school?"

And indeed, an electronic turtle and puppet have been built and can be manipulated by 3rd and 4th grade students, using a language called LOGO implemented on a PDP-11 computer. Another example is a "music-box" which allows programs to generate real, live music. With a motor/relay/sensor controller and a little imagination, the number of exciting projects for students increases enormously and many more are turned on as the work looks less and less like anything in traditional school math. Yet the learning value may be far greater than in a traditional environment.

EDUCATIONAL TESTING SERVICE

Princeton, New Jersey

SIGI, a System of Interactive Guidance and Information, is nearing the field testing phase. SIGI, based on a PDP-11, is designed to help two-year college students make informed and rational career decisions which, of course, help them plan their curricula and prepare for their chosen occupation.

The students engage in this decision-making by talking back and forth to a computer via cathode-ray tube terminals and push buttons. Armed with these tools, the student engages in a dialogue with the computer, which offers him a choice of criteria to determine what kind of job will most closely fit his personal preferences and inclinations.

Whatever the computer suggests for him is based on his own values and priorities. This unique feature of SIGI, its developers feel, will be of untold value to two-year college students now served by too few real live guidance counselors, who haven't got time to explore each student's career planning in depth.

N.Y. CITY DEPARTMENT OF AIR RESOURCES

New York, New York

A PDP-8/I is being used to monitor air pollution levels. The computer forms the center of a data acquisition system to monitor air over various points in the city for sulphur dioxide, carbon monoxide, and small airborne particles. Thirty-eight automatic remote stations send data to the computer in its central location. The computer logs the readings, analyzes the measurements, and prints out the findings. Wind velocity and temperature are also monitored by the system.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Houston, Texas

A PDP-9 is being used in conjunction with gamma-ray spectrometers to examine samples of lunar material returned from the Apollo 11 and subsequent space flights. The computer is coupled on-line to a dual analog-to-digital converter; it will accumulate and process radiation spectra.

In another system, a PDP-8/s is interfaced to a mass spectrometer which it both controls and acquires data from. Two tests are being conducted by this system: one to find out the total amount of a particular element in a lunar sample, the other, to determine the frequency of occurrence of a particular element with respect to other elements in the sample.

OREGON MUSEUM OF SCIENCE AND INDUSTRY

Portland, Oregon

"The Design and Construction of a Low-Cost High Performance Medium-Scale Digital Computer; Viriological Research on Tobacco Mosaic Virus; Development of Biological Indicators of Pollution Amounts; and the Origin of High Energy Cosmic Particles through Plasma Charge Deviation." These topics sound like doctoral theses, but they are not. They are just a few of the research projects that students—all in high school—are conducting at the Student Research Center of the Oregon Museum of Science and Industry.

"OMSI offers students challenges beyond those offered by the public school system and an opportunity to specialize in an area of keen interest," said Director of Student Research, Hartwell Whitney. Many of the projects at OMSI are related to the EduSystem 50 located on the premises. Based on their work with the computer, students have presented papers at the Spring Joint Computer Conferences, DECUS Symposiums and elsewhere. Several of their projects have been submitted to DEC and have been incorporated in its computer systems.

DIAL-A-DRILL

New York, New York

"Dial-A-Drill" is a product of Computer Curriculum Corp. and is built around a modified PDP-8/I computer and a digitized audio unit. The program supports in-school learning and increases the probability of success for children who might otherwise be handicapped by learning disabilities that could impede their academic growth.

Each student is called at home at a prearranged time every other day by operators using card dialing equipment to keep the system's 16 lines busy. Approximately 2400 students can be served on this basis. The student is given problems orally, by digitized audio and he responds by pressing the touch tone keys on his phone.

The program is a highly individualized drill and practice program in the fundamental skills of elementary mathematics, i.e., addition, subtraction, multiplication, division, and fractions. The curriculum is organized in a strand arrangement which each of the above operations is considered separately. At the end of each lesson, the computer records the position of the student in each strand so he can resume his lesson the next time at the proper place. The computer also generates periodic profile diagnostic reports.

CHILDREN'S MUSEUM

Boston, Massachusetts

Add one computer to the growing list of installed machines, but add 150,000 people to the list of users. Those are the statistics now that the Boston Children's Museum has been given a PDP-8/I by Digital Equipment Corporation as the first hardware acquisition for its new computer center.

The computer has been programmed to play tic-tac-toe, checkers, simulate a lunar capsule landing on the moon, and other games of interest to the 150,000 children a year who visit the museum. Richard Gardner, director of the museum's computer project, said the use of the facility would enable many youngsters to learn about the capabilities and benefits of computerization.

LEARNING RESEARCH AND DEVELOPMENT CENTER

University of Pittsburgh, Pennsylvania

Of the many projects going on at LRDC, one of the most significant is a project to develop and implement a system of Individually Prescribed Instruction (IPI) using a PDP-15. The objective of IPI is to produce an educational environment which would be highly responsive to differences among children. Individualization provides for individualized lesson plans, individualized materials and instructional techniques, and achievement of a required level of subject matter mastery for each student.

At the beginning of the school year, each student is given a series of placement tests in mathematics, reading, and science to assess entering behavior and determine starting level of work. As a result of diagnostic retests, a series of learning experiences uniquely suited to the individual's competencies is prescribed. Materials include worksheets, individual readers, programmed texts, taped lessons and other materials. As the student progresses through each set of experiences, his achievement is evaluated in terms of his performance on the lesson material completed and a series of curriculum-embedded tests.

Upon completion of a unit, if a student demonstrates mastery on a posttest, he goes on to a new unit, otherwise, a new prescription is written for those objectives which are lacking. Through this process of continual re-evaluation, a student progresses from one learning task to another at a rate commensurate with his needs and abilities.

HARRISON ELEMENTARY SCHOOL

Livingston, New Jersey

Carol Wheatley's class of first graders are learning to use the computer at an early age. The computer, a PDP-8, uses experimental CAI software developed by Bill Highleyman of Mini Data Services.

Students use the computer for drill and practice in fundamental arithmetic operations—horizontal and vertical addition and subtraction. Miss Wheatley reports that nearly 50% of her students learned to borrow and carry in just a few weeks using the computer, whereas previously only one or two students learned this concept in first grade at all.

The computer is also programmed to let teachers write their own exercises in any subject area. First grade curriculum materials have been written and used in spelling, alphabetization, word tense, plurals, and simple grammar.

GREECE CENTRAL SCHOOL DISTRICT

Rochester, New York

A unique Mathematics Assessment Program (MAP) is being used to identify the strengths and weaknesses of the existing mathematics program and show where changes should be made. All students in MAP are assessed periodically during the school year over three to six week intervals. Tests generally have multiple choice items relative to specific course objectives at each grade level. Three types of results are generated: (1) monitor data about the overall program, (2) mastery data on individual students and (3) diagnostic data about specific instructional objectives. Teachers' involvement in assessment is high because they make most of the decisions.

Because of the large numbers of tests to be corrected and analyzed, a mini-computer, a PDP-12, is a vital part of the project. The PDP-12 was selected because of its proven dependability, ease of programming and ease of operation.

During 1968-69, the system was piloted in four elementary schools. It is currently being phased into all elementary and junior high schools involving over 400 teachers and 10,000 students.

MC COMB PUBLIC SCHOOLS

McComb, Mississippi

The initial purpose of the McComb Project was to determine the practicality of the Suppes-Stanford CAI Mathematics Drill and Practice Program in a school district remote from the developers of the program. To be viable, such a program must serve all the students in the school district who could benefit from the program at a reasonable cost.

Sixty CAI terminals were connected to a PDP-8 used as a line concentrator initially to a PDP-1 and later to a dual processor PDP-6/PDP-10 computer system at Stanford University some 1830 miles distant.

Children of all ages and backgrounds adjusted fairly easily to the CAI technique. Teachers' initial fear of the program rapidly vanished upon exposure of the system in action and was soon replaced by a high level of enthusiasm.

Pre- and post-testing in a rigidly controlled test situation indicated that in all grades (1 to 6), the CAI group achieved significantly better results in skill building than the control group. Furthermore, the benefits were greatest for disadvantaged students who learned *and* retained mathematical skills in computation, concepts, and applications compared to advantaged children who showed lesser, but still positive gains from CAI.

"We are now convinced in McComb that CAI can individualize instruction," said J. D. Price, Superintendent of Schools. "We have confidence in CAI. It works."

SUMMARY OF DEC COMPUTER SYSTEMS FOR EDUCATION

Configuration	Typical Price	Software	Used to Teach	No. Students
1. EduSystem 5 (Supercalculator) PDP8/ f , 4k memory Teletype	$ 6,000	BASIC FOCAL	Problem Solving	50–70
2. EduSystem 10 (1-user) PDP8/e, 4k memory Teletype	7,000	BASIC FOCAL	Problem Solving Simulations Computer Architecture	50–70
3. EduSystem 20 (1 to 8 user) PDP8/e, 8k memory Up to 8 Terminals	15,000 (4 users)	BASIC FOCAL	Problem Solving Simulations	up to 560
4. EduSystem 30 (fast-batch) PDP8/e, 4k memory Disk or DECtape Optical Card Reader Teletype or DECwriter	19,000	BASIC (batch + interactive)	Problem Solving	400–800
5. EduSystem 30-PS/8 PDP8/e, 8k memory 2 DECtapes or Disks Teletype	17,000	BASIC FOCAL FORTRAN Assembly	Problem Solving Simulations Operating Systems	50–70
6. EduSystem 40 (Combines 3, 4 and 5)	29,000		(Combines 3, 4 and 5)	up to 800
7. EduSystem 50 (TSS/8) PDP8/e, 16k memory 262k Disk DECtape Up to 16 Terminals	54,000 (8 users) 86,000 (16 users)	BASIC FOCAL FORTRAN ALGOL Assembly	Problem Solving Simulations Operating Systems Computer Science	up to 1100
8. EduSystem 60 PDP11/20, 4k memory Teletype	10,800	BASIC Assembly	Problem Solving Simulations Computer Architecture	50–70
9. EduSystem 70 PDP11/20, 16k memory Up to 8 Terminals	40,000 (8 users)	BASIC	Problem Solving Simulations	up to 560
10. EduSystem 80 (RSTS-11) PDP11/20, 28k memory 262k Disk DECtape Up to 16 Terminals	88,000 (16 users)	BASIC-PLUS FORTRAN IV	Problem Solving Simulations Operating Systems	up to 1100
11. LAB 8/e PDP8/e, 8k memory Point plot display A/D, D/A Converters Teletype	13,000	BASIC FOCAL	Interfacing Real-time Systems	50–70
12. PDP-12 Display A/D, D/A Converters Terminal	30,000	BASIC FOCAL LINC Assembly	Problem Solving Simulations Real-time Systems Interfacing	50–70
13. Computerlab	375	—	Logic Design	10
14. Logic Design System PDP8/e, 4k memory I/O Access Panel Student Logic Circuit Kit(s) Terminal	10,000	BASIC FOCAL Assembly	Interfacing Logic Design Computer Architecture Real-time Systems	50–250*
15. Computer/Computer Lab System PDP8/e, 4k memory Computer Lab(s) 8/e—Computer Lab Interface	7,500	BASIC FOCAL Assembly	Logic Design Computer Architecture Real-time Systems	50–250*
16. PDP-15	100,000	FORTRAN IV	Information Systems Real-time Systems	up to 800
17. DECsystem 10 (Simultaneous time-sharing, batch and real-time system)	500,000	BASIC FORTRAN IV COBOL ALGOL TECO SNOBOL LISP Assembly Etc.	Problem Solving Simulations Operating Systems Real-time Systems Computer Architecture Computer Science	2000+

DEC also manufacturers a full complement of logic laboratory equipment, modules, peripherals, and custom hardware and software products, many specifically designed for educational users.

*Upper number of students served requires additional Logic Circuit Kits ($100) or Computer Labs ($350).

digital

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