REPORT OF THE
DEPARTMENT OF EDUCATION

Studying Incentives To Advance Computer Assisted Instruction

TO THE GOVERNOR AND
THE GENERAL ASSEMBLY OF VIRGINIA

House Document No. 28

COMMONWEALTH OF VIRGINIA
RICHMOND
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GENERAL ASSEMBLY OF VIRGINIA -- 1986 SESSION

HOUSE JOINT RESOLUTION NO. 118

Requesting the Department of Education to study initiatives to advance computer-assisted instruction.

Agreed to by the House of Delegates, February 10, 1986
Agreed to by the Senate, March 6, 1986

WHEREAS, the 1980's have seen a great rise in the importance of computers in our everyday lives; and

WHEREAS, computers have been used primarily as administrative tools in areas of student and financial accounting, reporting, research, and statistical analysis; and

WHEREAS, though personal computers are now being used in many homes throughout the United States, still many school children do not have access to personal home computers because their families cannot afford them; and

WHEREAS, being very flexible instruments, computers have a definite potential for use as educational tools; and

WHEREAS, the application of computers has already been expanded to provide computer-assisted instruction within and without the classroom; and

WHEREAS, the above usage has, of necessity, called for more awareness, education and training of students and for all involved in preparing students for the future; and

WHEREAS, to facilitate the awareness, education and training required, a comprehensive and integrated state plan for instruction and for funding the purchase and replacement of equipment and software would be necessary; now, therefore, be it

RESOLVED by the House of Delegates, the Senate concurring, That the Department of Education is requested to study initiatives to advance computer-assisted instruction. It should also determine the criteria for a comprehensive state plan that would provide awareness education and training in grades K-12, articulation between public and higher education, equity in access to computers for school children, and a funding mechanism for the purchase of hardware, software and the replacement of obsolete equipment and materials.

The Department shall complete this work prior to November 15, 1986, and report its findings soon thereafter.

EXECUTIVE SUMMARY

For years educational institutions at all levels, business, the military, government, and the home have used elements of technology for educational purposes. Training films, video and audio tapes and discs, radio and television programs, and telecourses have been and continue to be used in various ways for instruction. With the availability of the microcomputer, computers have joined the list of educational technology tools. The number of computers in the nation's K-12 classrooms is estimated to be 1,075,000.

Most Virginia schools have at least some computers, but only a relative few have them in sufficient numbers to provide significant student access. A sampling of Virginia school divisions revealed an average of one personal computer for every 41 students. A recent study by Johns Hopkins University which queried principals and teachers at 2,361 public and non-public elementary and secondary schools, states that during an average week at a typical computer-using school, only one-quarter of the student body used computers. Likewise, 37 percent of elementary school teachers used computers, compared to only 15 percent of secondary school teachers.

The accumulation of evidence on the effectiveness of computers in education has been restricted by the limited access of students to computers and by the relative newness of the technology in education. But enough evidence has been gathered on the relatively limited applications of computers in education to give confidence that the technology can produce effective results. The National Task Force on Educational Technology report, April 1986, states that "the computer is a device uniquely suited for education."

Virginia has reason to be proud of those school divisions that have taken a leadership role in the application of computer technology. However, resources in most school divisions have only allowed computer applications in programs such as computer science/math, business computer applications, and computer literacy; support is not widely available for the total integration of the computer in the K-12 curriculum. Although all school divisions are required to offer computer literacy instructional units for all students, a small percentage have the opportunity to use the computer as an instructional tool in subsequent classes and school assignments.

Many Virginia educators still lack basic computer literacy skills, and a majority have received no formal inservice on teaching with the computer. In addition, most educators do not have access to computers and training to enable them to use instructional management and productivity software.

Virginia's public schools should be developing a technology-based educational environment where computers are not used as "add ons," but are an integral part of the educational system. To offer this environment, most Virginia schools will need many more computers, students and teachers will need much more access to them, and our educators will need more knowledge about how to use them effectively in the teaching/learning process.

Consequently, the recommendations contained in this report call for ongoing planning at all levels concerning the implementation of educational technology with adequate funding and support mechanisms to implement those plans, for a revision of existing curriculum to include the skills and knowledge required by an information-age society, for employment of computer technologies to improve the teaching/learning process, and the massive training of educators to use technology both as a teaching and personal productivity tool.

RESPONSE TO HOUSE JOINT RESOLUTION NO. 118

Introduction

In response to House Joint Resolution No. 118, the Department of Education convened a task force of educators to assist in developing initiatives concerning instructional computing in Virginia schools. The task force was comprised of representatives from public schools, institutions of higher education, the Virginia Educational Computing Association, and the Division of Instructional Media and Technology, Virginia Department of Education. A list of task force members is contained in the appendices.

The task force developed comprehensive recommendations, directed toward local school divisions, the Department of Education, and institutions of higher education, which are included in their entirety in the appendices of this report. The six broad recommendations contained in the "Recommendations and Cost Estimates" section of this report are supported and further explained by the full task force document.

In addition to the input received from the task force, a survey of Virginia school divisions was conducted in June 1986 concerning educational computing issues. Eighty school divisions replied to the survey (57%). The 80 responding localities represent an excellent cross section of Virginia school divisions. Findings from the survey are referenced frequently in this report.

A prime source of input and direction was also provided by the report, "Transforming American Education: Reducing the Risk to the Nation," which was prepared for the Secretary of Education, United States Department of Education, by the National Task Force on Educational Technology, April 1986.

The national economy is undergoing a fundamental, structural change; an "industrial evolution" is said to be ushering in the "information age." This evolution has major ramifications as to how the Commonwealth can best accomplish the critical function of educating its citizenry to compete successfully and survive in a technological society. Consequently, it is essential that the specific education and training strategies the Commonwealth should pursue to meet the demands of a technological age be determined.

The report of the Joint Subcommittee studying initiatives to advance computer-assisted instruction made to the General Assembly of Virginia in January 1984 (House Document No. 34) identified a number of issues concerning the advancement of computer-assisted instruction in Virginia schools. This report will address many of those issues while identifying specific education and training strategies.

Terminology

A major problem in mapping directions for the effective use of computers in instruction is the lack of uniformity and consistency in terminology used when discussing this area. For example, "What does computer-assisted instruction really imply?" For the purposes of this report, computer-assisted instruction will be broadly interpreted to mean applications of instructional computing in general.

Not only does computer-assisted instruction (CAI) have a much broader interpretation to most educators than it did in the very early days of computer use in schools, but CAI can now involve much more than just the use of a computer. For instance, interactive videodisk technology employs a computer to control color motion video and text. CD-ROM (Compact Disk Read Only Memory) employs a computer to access data stored in a laser-read format. CAI should also imply these and other similar technologies. For the purposes of this report, therefore, computer-assisted instruction will also be used synonymously with the term, "technology-based education," and will refer to any system where the computer helps control the presentation of data.

Background Information

For years educational institutions at all levels, business, the military, government, and the home have used elements of technology for educational purposes. Training films, video and audio tapes and discs, radio and television programs, and telecourses have been and continue to be used in various ways for instruction.

With the availability of the microcomputer, computers have joined the list of educational technology tools. The number of computers in the nation's schools has increased dramatically. A market research firm estimates that the number of computers in K-12 classrooms increased from 291,000 in June 1983 to 1,075,000 by June 1985.

Most Virginia schools have at least some computers, but only a relative few have them in sufficient numbers to provide significant student access to a work station. At present, there is an average of one personal computer for every 40 students in the nation's public schools. Eighty Virginia school divisions sampled in the 1986 survey reported a 41 to 1 ratio.

A recent study by Johns Hopkins University reports that lack of student access to work stations does not take advantage of the computer's most basic benefits. The study, "Second National Survey of Instructional Uses of School Computers," states that "a typical high school student could profitably use computers for writing compositions, for memorizing whatever facts are truly unavoidable, for understanding relationships and concepts in mathematics and science courses; but that each of these separate uses might occupy 30 minutes to three hours of computer time per week." The report argues that a high school student might profitably use computers for an hour or two per day.

The report, which queried principals and teachers at 2,361 public and non-public elementary and secondary schools, further states that during an average week at a typical **computer-using** school, only one-quarter of the student body used computers. Thirty percent of grammar school students used computers during the average week, while only 21 percent of the typical high school's student body used the machines. Likewise, 37 percent of elementary school teachers used computers, compared to only 15 percent of secondary school teachers.

The accumulation of evidence on the effectiveness of computers in education has been restricted by the limited access of students to computers and by the relative newness of the technology in education. But enough evidence has been gathered on relatively limited applications of computers in education to give confidence that the technology can produce effective results. An analysis of 169 research studies found that computers were an effective teaching tool at the elementary, secondary, postsecondary, and adult education levels. (Kulik) A report on this analysis in the publication, "Electronic Learning," states, "In the area of affective/motivational outcomes of Computer-Assisted Instruction, the news is almost all good."

The National Task Force on Educational Technology report, April 1986, states that "the computer is a device uniquely suited for education. With related technology, it enables people to deal with vast amounts of information. It can be programmed to adapt learning to the needs of each student, providing corrective advice and allowing the student to proceed as rapidly or as slowly as he or she is able. However, the computer will never replace the teacher. As an excellent information processing tool, it will require the teacher to become an expert at guiding and managing learning."

There are negative aspects that need to be immediately addressed as educational institutions make increasingly large investments in educational technology. Again, citing the National Task Force on Educational Technology report, "technology has often been misused or underused." Outlined in the report are several major examples:

Lack of Planning: Too often, decisions for purchase and use are made without well-conceived plans to integrate technology into the overall educational plan.

Inequitable Distribution: Data suggests that poor school districts in remote rural areas and some urban neighborhoods lack the means to provide equal access for each student.

Inadequate Software: Early preoccupation with hardware obscured the more essential need to be discriminating and critical about the quality of educational software. Although such software has become better designed in recent years, considerable improvements still need to be made.

Increased Cost: For most school divisions the cost of technology usually remains minor in relation to overall school costs; however, the issue of cost effectiveness will become an increasing problem as technology increases as a percentage of total costs. Poorer districts will be affected first, but cost effectiveness will become an issue for all districts.

Obsolescence: Educational consumers have become concerned about obsolescence and the lack of compatibility among technologies. The astounding leaps forward in the improvement of products and services and the resulting wide product diversity tend to confuse the educational consumer and user.

Computer Literacy

All Virginia school divisions will have a computer literacy program in place by 1988 so that "by graduation each student shall be provided educational experiences directed toward objectives outlined in **Computer Literacy for Students in Virginia** issued by the Department of Education" (1983 Accreditation Standards). Computer literacy programs in Virginia school divisions range from two week units of instruction to semester courses. Some school divisions deliver computer literacy to students by the integration of competencies into the K-12 curriculum where appropriate.

Computer Science

Computer science is the usual designation for courses which provide in-depth study of the computer, generally in the context of mathematical applications using a programming language and the computer as problem solving tools. BASIC (usually taught in a first year course), and PASCAL (normally employed in an AP Computer Science course) are the languages most frequently used. Schools which offer computer science do so as an accommodation to students with the ability and interest to pursue this more advanced study of computers.

In a June 1986 survey, a representative sample of school divisions (80) reported computer science classes and that student access to hardware which supported instructional objectives in this area was adequate to good. A small percentage of high schools also offer the AP Computer Science offering.

Business Computer Applications

Most high schools also offer courses which focus on the use of the computer in the business environment. The courses are usually offered in high school business education programs with the emphasis on the study of applications software such as word processors, database managers, and electronic spreadsheets.

In the June 1986 survey, all sampled school divisions (80) reported business computer applications classes and that student access to hardware which supported instructional objectives in this area was adequate to good.

Virginia school divisions also offer over 50 vocational business data processing programs. Many of these offerings are in vocational technical centers and focus on developing business data processing skills found in entry-level jobs in the data processing area. The recent survey also indicated that student access to hardware which supported these instructional objectives was adequate to good.

Using the Computer as a Tool

The computer can also be used as a tool to expedite and facilitate instructional tasks rather than as an object of instruction, or as a means of presenting subject matter per se. Applications software such as word processing, electronic spreadsheets, and database management can be used in a number of curriculum areas to reduce the tedious aspects of an assignment, freeing the student to concentrate more on the concept or skill being learned.

Using word processing software in writing instruction to facilitate the tasks of editing, revising, and correcting; data base management programs in social studies to compile and analyze categorical information; and, electronic spreadsheets to facilitate the collection and manipulation of tabular data for a science experiment are a few examples of the use of "tool" software in the curriculum.

The degree of integration into the K-12 curriculum of this type of instructional computing will be discussed in the explanation of computer-assisted instruction.

Computer-Assisted Instruction

Usually identified simply as "CAI," this instructional application involves using the computer, supported with appropriate software (sometimes called courseware), to perform certain instructional functions.

The following are examples of widely recognized variations of CAI software: **Drill and Practice** programs provide activities to reinforce or practice concepts and skills already taught or learned; **Tutorial** programs present new concepts or skills by means of examples and questions that check for students' understanding; **Simulation** programs present models of complex situations or processes; **Instructional Games** are essentially drill-type programs which employ "arcade" graphics and elements of competition to add excitement and motivation when practicing skills and testing knowledge; and, **Problem Solving** software may serve as a utility into which variable data is entered, and the program performs complex and time-consuming calculations, or can present problem solving situations with which the student interacts and confirms with experimental observation.

A variety of specialized software is also available to support instruction in music, art, and certain vocational classes. Music composition software and hardware, drawing programs and graphics tablets, and computer-assisted design programs are several examples in this area.

The instructional use of the computer as a tool, or in a computer-assisted mode, should be naturally integrated into the curriculum where appropriate; however, the degree of computer integration in the K-7 curriculum reported by the June 1986 survey was not significant. Of eight subject areas surveyed, none showed even a moderate integration rating (the reporting scale was 0 to 4 with "2" being considered moderate).

The degree of computer integration in the 8-12 curriculum reported in the survey was also not significant. Of eight subject areas surveyed, only one (math) showed a rating of moderate integration.

Computer-Managed Instruction

This area, referred to as "CMI," includes the various uses of the computer in planning, preparing, monitoring, and analyzing instruction. Teachers can use a variety of programs to manage student files and classroom inventories, to score tests and record grades, to track student progress and prescribe instruction, and to produce instructional materials such as worksheets, tests, and lesson plans.

While providing great potential in assisting the teacher with many time consuming tasks, most Virginia teachers have very limited access to CMI software and supporting hardware. The referenced June 1986 survey revealed that the availability of computer resources to support productivity tool use (software used in many CMI activities) was rated as poor.

Computer-Based Instruction

Computer-based instruction is a term widely used to describe a mini-computer based hardware/software system that can deliver major portions of course content (if not the entire course) in a given subject area, and/or to provide follow-up instructional activities and testing components for an entire subject. Distinguishing characteristics of a "CBI" system are its comprehensive instructional management system, and the ability of the hardware to support a virtual "laboratory" of work stations from a single central processing unit.

Several Virginia school systems have made significant investments in computer-based instructional systems. The cost of these systems is presently considered prohibitive by most small and medium sized school divisions.

Impact of Legislation on Instructional Computing in Virginia

The 1983 General Assembly of Virginia passed the following legislation that has affected the integration of instructional computing in Virginia schools:

1. House Bill 373 provided a state tax credit for donated computer hardware. Very few businesses donated computer hardware of any value to Virginia school divisions as a result of this bill. Feedback to the Department of Education indicated that businesses felt that the bottom line tax deduction was not significant, and schools reported that most equipment donated was very outdated.

2. House Joint Resolution 61 established a joint subcommittee to study initiatives to advance computer-assisted instruction in Virginia schools. The report presented to the 1984 General Assembly, House Document No. 34, discussed a number of the problems relating to the integration of computers in Virginia schools. It also identified issues that should be addressed before any recommendations are developed. The Joint Subcommittee felt it did not have sufficient time in which to resolve these issues, and submitted legislation requesting that the study be continued. The legislation did not clear the committee process in the 1984 General Assembly.

3. A provision of House Bill 30 allocated $280,000 to be offered as state matching funds not to exceed $2,000 per school division for the acquisition of microcomputer hardware and/or software. To qualify for these funds, local divisions had to make a good faith effort to obtain additional microcomputer funds from private sources. Localities actually reported over $2,000,000 in local expenditures for this period; $236,000 was generated from private sources. Nine school divisions did not apply for any reimbursement payments.

4. A provision of House Bill 30 designated $50,000 to aid the Department of Education in establishing a Technology Examination Center. This appropriation continued as a line item ending with the 1985-86 fiscal year. This funding has allowed the Technology Examination Center to keep up-to-date with hardware/software developments, and to expand its services with a modern training facility where educational computing classes and workshops are conducted for DOE staff and school division personnel.

5. A provision of House Bill 30 designated $70,000 to aid the Department of Education in providing inservice training related to instructional computing for Virginia educators. This appropriation has continued as a line item ending with the 1985-86 fiscal year. This funding has supported the following services: the production of two ITV series on instructional computing which were subsequently broadcast on statewide public television; an annual computer conference for local school division coordinators of instructional computing; and, consultant fees associated with classes and workshops offered in the Technology Examination Center training facility.

Department of Education Instructional Computing Initiatives

In the fall of 1982, the Department of Education convened a task force of instructional leaders representing Virginia school divisions and institutions of higher education for the purpose of establishing a definition of computer literacy. After hearing testimony from a variety of sources, twelve computer literacy competencies were identified as constituting basic computer literacy. After a field review, these competencies (**Computer Literacy for Students in Virginia**) were sent to Virginia school divisions as a guide to the development of units of instruction in computer literacy.

In July 1983, the Board of Education included the following statement in the accreditation standards for local schools: "By graduation each student shall be provided educational experiences directed toward objectives outlined in **Computer Literacy for Students in Virginia** issued by the Department of Education." This accreditation standard first applies to the 1988 graduating class.

With funding support from House Bill 30 (1983 General Assembly), the Department of Education established the following services and products to assist Virginia school divisions with the integration of instructional computing:

1. In the fall of 1983, a Technology Examination Center was established and equipped with samples of educational computing hardware, software, inservice training materials, periodicals, and software evaluations and indexes. The Center also became a clearing-house for educational computing curriculum materials developed by Virginia school divisions as well as those of agencies outside of Virginia.

2. A guide for local school divisions to use in planning for the integration of instructional computing, **Guidelines for Educational Computing in Virginia,** was developed and widely distributed. In addition to containing a philosophy for the use of technology, the publication contains recommendations for educational computing; planning, purchasing of hardware and software as well as a description of Department of Education resources. A comprehensive staff development model was included outlining competencies needed by Virginia educators in the following areas: computer literacy, utilization of the computer in instruction, and special purpose training.

3. In an effort to increase accessibility to basic computer literacy training for all Virginia educators, a series of 16, 30 minute ITV programs was produced focusing on computer literacy competencies. Support materials were developed for the series promoting its use as a 16 hour non-college credit course. The series was broadcast on all public television stations during the 1984-85 and 1985-86 school years. The series and support materials were provided free-of-charge to Virginia school divisions.

4. In September 1984, the Virginia Network for Educational Technology (VNET) was established. The network provides a toll-free access to an electronic bulletin board and mail system which is restricted to educational technology issues. Virginia school divisions and institutions of higher education are able to exchange information on educational technology issues with no expenditure except for a microcomputer and modem as their connection to the network.

5. In January 1985, the Technology Examination Center was expanded to include a classroom facility with large screen projection capability for educational computing classes and workshops. Monthly sessions are provided free-of-charge to Virginia educators. A major objective has been to train local school personnel to conduct similar training sessions in their home divisions. The facility is also used by various curriculum areas of the Department of Education to conduct workshops on the integration of the computer into their specific subject areas.

6. The Department of Education has joined several software distribution consortiums for the purpose of making quality courseware available to Virginia school divisions at a lower cost.

7. An annual conference is conducted for coordinators of instructional computing in Virginia school divisions. Various special topic regional workshops are also conducted on a periodic basis.

RECOMMENDATIONS AND COST ESTIMATES

The following are recommendations developed by the Department of Education with the assistance of a task force of instructional computing specialists. A more detailed explanation of these recommendations is included in the appendices.

1. IMPROVE THE DELIVERY OF INSTRUCTION THROUGH TECHNOLOGY
2. SUPPORT TEACHERS AND ADMINISTRATORS WITH TECHNOLOGY
3. TRAIN EDUCATORS TO USE TECHNOLOGY TO IMPROVE EDUCATION
4. IMPROVE THE RELEVANCE OF LEARNING BY REFLECTING TECHNOLOGY-DRIVEN DEVELOPMENTS
5. PLAN CAREFULLY FOR EDUCATIONAL TECHNOLOGY
6. DEVELOP FUNDING AND SUPPORT MECHANISMS

1. IMPROVE THE DELIVERY OF INSTRUCTION THROUGH TECHNOLOGY

RATIONALE: Historically, it has been recognized that instruction should be tailored to meet the individual learning styles and needs of students. For the first time, computer-driven technology provides a tool to effectively help implement this mode of instruction. Technology-based education can make learning more active and interactive for each student.

FINDINGS: Many Virginia school divisions have already made significant investments in computer technology. Eighty school divisions reported spending over $5,000,000 on hardware and software in just the 1985-86 school year. Many high schools support computer science and business applications courses with computer laboratories. Other labs usually exist at middle school grade levels for computer literacy; however, very little has been done to support the student use of computers in other discipline areas. There are a few exceptions but generally these are experimental and are not even replicated in all schools of the experimenting school division.

RECOMMENDATION: It is recommended that emerging computer technologies be employed to improve the teaching/learning process and that schools use the capabilities of computers to individualize learning experiences, where appropriate, in all curriculum areas.

ESTIMATED COSTS:

The installed base of computer hardware and software in Virginia's public schools is not sufficient to improve the delivery of instruction through the use of technology. Cost estimates will be based on providing a **Foundation Level** of support for the delivery of instruction for all schools. The foundation level of support is explained in more detail in the appendices.

***Grade 4-12 (20 micro) Multi-purpose Lab**	@ $	28,500.00
677,031 students 4-12		
27,081 grade 4-12 classrooms (25 students per class)		
Minimum support = 1 lab per 15 classrooms		
1805 multi-purpose labs required statewide		
Total hardware cost for these labs		$51,442,500.00

***Grade Level Mobile Units (K-8)**	@ $	2,300.00
637,827 students K-8		
25,513 grade K-8 classrooms (25 students per class)		
Minimum support = one mobile unit per 2 classrooms		
12,757 mobile units needed for K-8 statewide		
Total hardware cost for K-8 mobile units		$29,341,100.00
***Subject Area Mobile Units (9-12)**	@ $	2,300.00
Support = 15 units per school	$	34,500.00
311 schools contain 9-12 grades (4,665 units)		
Total hardware cost for 9-12 subject area units		$10,729,500.00
Minnesota Educational Computing Corporation		
software rights to support all labs and mobile units		
(based on membership fee for 960,000 students - -		
$300 per 5,000 students)		
Minimum software rights cost for multi-purpose labs		
and mobile units	$	57,600.00

* Cost estimates are based on state contract unit cost amounts. Major discounts would be available for volume purchases.

2. SUPPORT TEACHERS AND ADMINISTRATORS WITH TECHNOLOGY

RATIONALE: Computer-driven technology will not transform education to meet the needs of society if educators do not learn to use it both as an instructional and as a management tool. Computer technology should be used to allow educators to spend more time on instructional tasks and supervision rather than on clerical and management tasks.

FINDINGS: Eighty sampled school divisions rated administrative computer support for teachers as "poor." Support for building level administrators was rated "poor to adequate."

Evidence shows that teachers can use instructional management and productivity tools (such as word processors, test generators, grade managers, databases, and electronic spreadsheets) to cut down on the time required by clerical tasks, thus allowing more time to be spent on instruction. Using the computer for Computer Managed Instruction allows the teacher to monitor student progress, thus promoting the individualization of instruction.

Educational administrators can make effective use of student and financial accounting, scheduling and attendance programs as well as traditional business productivity tools such as word processing, databases and spreadsheets.

RECOMMENDATION: It is recommended that computer technology be used by all educators to accomplish administrative, instructional management and clerical tasks.

ESTIMATED COSTS:

The installed base for the use of the computer as an administrative tool for teachers and building level administrators is not adequate. This recommendation will only project costs for educator support in the form of computer resource labs. Hardware and software in these labs should be available for overnight loan.

Teacher Resource Lab/Loaner Units (K-12) @ $ 1,700.00

61,242 Teaching Positions K-12
Minimum support = 1 microcomputer and printer per 10 teachers
6124 configurations needed for K-12 teacher support

Software to support K-12 Teacher Resource Labs will be available through state MECC membership (costs included in recommendation one)

TOTAL COST FOR K-12 TEACHER SUPPORT **$10,410,800.00**

3. TRAIN EDUCATORS TO USE TECHNOLOGY TO IMPROVE EDUCATION

RATIONALE: Schools must become staffed with teachers who can effectively integrate instructional technology into the teaching/learning process. A well-planned and executed staff development program must not only offer initial training, but provide continuing experience within the classroom environment. Such staff development should also provide for the sharing of experiences throughout the education profession. An opportunity to utilize technology for both instructional and personal productivity purposes is critical for achieving mastery of these skills.

FINDINGS: It is estimated that 40 percent of Virginia teachers have not mastered basic computer literacy objectives, and that 70 percent need inservice on how to teach with the computer. If there is an error in these estimates by division computer coordinators, it would be on the low side.

Previous experiences have shown that more than just instruction will be necessary. Adequate incentives, release time and resources must be made available, but equally important, the hardware, software, and curriculum must be in place so that educators can put into practice what they learn.

RECOMMENDATION: It is recommended that all Virginia educators achieve Level II competencies as identified in "Guidelines for Educational Computing in Virginia."

ESTIMATED COSTS:

The hardware and software support base needed to make effective staff development training a reality is already outlined in recommendations one and two. Needed curricular changes are outlined in recommendation four. This section will deal only with the costs associated with providing the actual instruction needed to assure that teachers can effectively integrate computer technology into the teaching/learning process. A Department of Education publication, **"Guidelines for Educational Computing in Virginia,"** outlines several levels of staff development in instructional computing for Virginia educators. Level II staff development objectives include Level I competencies.

INSERVICE STAFF DEVELOPMENT NEEDS (LEVEL II):

Needed by 70 percent of state's educators	
Instructional positions, administrative and service personnel state-wide = 66,458	
46,520 Virginia educators need Level II staff development	
Level II staff development requires a minimum of 45 hours instruction	
Cost for delivery of 45 hours instruction	$ 1,500.00
1861 units (45 hour) of instruction needed (25 per class)	
Total for Level II Staff Development	$ 2,791,500.00

4. IMPROVE THE RELEVANCE OF LEARNING BY REFLECTING TECHNOLOGY-DRIVEN DEVELOPMENTS

RATIONALE: Experts agree that technology is changing our society from an industrial to a post-industrial or information-based society. A most significant impact of these changes on education will be the need to revise (some even use the term **transform**) curriculum content to prepare students to function effectively in such a society. Major changes in curricula will require parallel changes in evaluation criteria and methods.

FINDINGS: All curriculum content needs to be revised in light of our developing information-age society to include the development of higher order cognitive and affective skills such as reasoning, analysis, problem-solving, valuing and critical thinking. Standards of Learning Objectives should be revised appropriately and present testing and evaluation procedures should be made consistent with the new curricula.

RECOMMENDATION: It is recommended that short and long range plans be formulated to transform all areas of the K-12 curriculum to reflect skills and knowledge essential to participate effectively in an information-age society. It is further recommended that a restructuring of the evaluation of teaching/learning outcomes be effected to be consistent with the revised (transformed) information-age curricula.

ESTIMATED COSTS:

Curriculum revision will require extensive study and work at the local, state and higher education levels to include parents and representatives from business and industry. Resources will also be required to restructure the evaluation of the teaching/learning process.

The first step should be to create a plan to effectively bring about the curriculum revision (transformation) process.

Funds to start the planning process: $ 25,000.00

5. PLAN CAREFULLY FOR EDUCATIONAL TECHNOLOGY

RATIONALE: The effective use of technology in education requires careful planning at every level of the educational system. The needs of our rapidly changing society cannot be met, nor can available resources be optimally employed, if technology is allowed to percolate randomly through the school system. Technology should not be allowed to determine educational goals, but must be used to help achieve them.

Experts agree that planning for the implementation of instructional technology should be based on a "systems approach." A recent National School Boards Association paper on planning quotes Dr. Lewis Perelman, "A common and counterproductive error in discussions of 'technology in education' is the implication that 'technology' refers to computers or television, but not to schools, teachers, classrooms, textbooks, grades, diplomas, and the host of other paraphernalia and organizational arrangements that constitute an integrated education system. The technology **in** education is the technology **of** education - - productive innovation in any component almost invariably requires modification of the entire system. In fact, it is the common practice of simply **adding** technology to education while actively prohibiting transformation of the rest of the system infrastructure that has made much of the technological experimentation in education so apparently fruitless."

FINDINGS: Of 80 sampled school divisions, 51 have developed an instructional computing plan, and 32 of these divisions update their plan annually.

Only 12 of the 80 divisions reporting have a full-time professional to coordinate the planning and implementation of instructional computing. Sixty-eight divisions reported that a professional is coordinating instructional computing, but that they only spend an average of 17% of their time at the task.

There is no state coordinated planning process for the integration of instructional technology for Virginia's schools. State funding that is used for instructional computing is not tied to a stipulation that local school divisions have an **overall plan** for its integration into the K-12 curriculum.

RECOMMENDATION: It is recommended that every educational decision-making group participate in ongoing planning for the incorporation of technology into the educational system.

ESTIMATED COSTS:

Resources are needed to support and facilitate the planning process at all levels. Additional Department of Education Instructional Media and Technology Division staff are needed to provide field technical assistance to local school divisions related specifically to the planning process.

***Department of Education staffing to provide field technical assistance**			
Five Media and Technology Division staff positions	@ $	40,000.00	(per year)
Total annual cost for Media and Technology Division staff to facilitate statewide planning	$	200,000.00	

* These staff positions will also be heavily utilized in providing the sevices outlined in recommendation six.

6. DEVELOP FUNDING AND SUPPORT MECHANISMS

RATIONALE: Technology holds the promise of making public education more cost-effective while enhancing the quality of instruction. Technology will enable education to buy more learning per dollar and thus expand its benefits to society. Overall costs may be higher in the short term, but the costs of evaluating, planning, acquiring, disseminating, maintaining and replacing technology will have to be met if education is to serve the growing needs of an increasingly technical society.

Various support mechanisms and professional staff are necessary to ensure effective and equitable applications of technology. A broadly based research, development, evaluation and dissemination effort will also be required to transform education through applications of technology.

FINDINGS: Most school divisions are currently supporting their educational technology applications with supplemental funding. Few divisions include technology and associated staff development needs as a significant and regular line item in the annual budget.

As indicated earlier, only twelve school divisions have a full-time instructional computing coordinator. Sixty-eight report having a part-time coordinator, but these spend an average of only 17% of their time on this activity.

The Department of Education has only two staff members in the Division of Instructional Media and Technology to provide technical support, leadership and training in instructional computing to 140 school divisions. Most of their activities (Technology Examination Center, inservice classes, electronic bulletin board, ITV production, coordination of conferences and software distribution, etc.) are designed to be Richmond based to impact as many divisions as possible. Field work to assist divisions with planning, implementing, and training for technology applications is very limited. School divisions who are located considerable distances from Richmond frequently request on-site and/or regional training assistance. Fairfax County has seven full-time professionals who provide technical assistance in instructional computing to their educators.

RECOMMENDATION: It is recommended that funding and support mechanisms be established to assure appropriate financing and the effective implementation of technology in education.

ESTIMATED COSTS:

A cost effective and vital support mechanism for equitable instructional computing implementation would be state funding to aid school divisions in establishing a full-time professional to coordinate this area.

Matching funding to support a full-time instructional computing coordinator for each school division	@ $ 15,000.00	(per year)
Total annual cost for divisional computer coordinators (140 x $15,000 matching funds)	$ 2,100,000.00	

The Department of Education should have an annual budget to continue the support of the following ongoing instructional computing initiatives:

Software Acquisition and Distribution:

Software Communication Service Consortium Membership	$ 9,000.00
Minnesota Educational Computing Consortium Membership	$ 3,300.00

Technology Examination Center Support:

Acquisition of Current Software/Courseware Items	$	5,000.00
Purchase of Inservice Materials	$	5,000.00
Hardware Maintenance	$	2,700.00
Acquisition of Current Hardware Items	$	15,000.00

Conferences, Workshops, and Inservice Training:

Annual Instructional Computing Conference	$	15,000.00
Inservice Classes and Workshops for DOE and LEA Professional Staff (Richmond Based)	$	20,000.00
Special Regional Inservice Workshops	$	20,000.00

Virginia Network for Educational Technology (toll-free number)	$	5,000.00

Annual Budget for DOE Instructional Computing Initiatives: (per year)	**$**	**100,000.00**

The five Division of Media and Technology staff positions needed to provide planning assistance in recommendation five will also be utilized in providing the support mechanisms outlined in recommendation six to school divisions in their own environments.

Conclusions

Virginia has reason to be proud of those school divisions that have taken a leadership role in the application of computer technology. These localities have characteristically provided basic computer literacy training for all educators, have begun to train teachers in the application of the computer in specific subject areas and grade levels, and are following a comprehensive plan for the K-12 implementation and management of educational technology.

However, resources in most school divisions have only allowed computer applications in programs such as computer science/math, business computer applications, and computer literacy; very little support is available for the use of computers in other discipline areas. In addition, many Virginia educators still lack basic computer literacy skills, and most have received no formal inservice on teaching with the computer.

The average computer to students ratio is 41 to 1. While most high schools have a computer science and/or a business computer applications lab, these programs serve an average of only 150 students per school. Although school divisions offer computer literacy instructional units for all students, very few have the opportunity to use the computer as an instructional tool in subsequent classes and school assignments.

In addition, most educators do not have access to the necessary hardware/software and training to enable them to use instructional management and productivity software such as word processors, test generators, grade and database managers, and electronic spreadsheets.

This report's reference to the expression, "technology-based education," implies an environment where computers are not used as "add ons," but are an integral part of the educational system. This environment would certainly include schools equipped with multi-purpose computer labs to specifically support computer-assisted instruction, sufficient numbers of mobile computer units with large-screen monitors to encourage in-class group instruction, resource labs where multiple work stations are equipped with appropriate productivity software and courseware which can be accessed easily by students during the school day, and microcomputers for educators to access for instructional management and productivity use during the school day as well as for overnight loan.

To offer technology-based education, most Virginia schools will need many more computers, students and teachers will need much more access to them, and our educators will need more knowledge about how to use them effectively in the teaching/learning process.

Consequently, the recommendations contained in this report call for ongoing planning at all levels concerning the implementation of educational technology with adequate funding and support mechanisms to implement those plans, for a revision of existing curriculum to include the skills and knowledge required by an information-age society, for employment of computer technologies to improve the teaching/learning process and, where appropriate, to individualize learning experiences, and the massive training of educators to use technology both as a teaching and personal productivity tool.

APPENDIX A

REPORT OF THE
DEPARTMENT OF EDUCATION TASK FORCE
STUDYING INITIATIVES TO
ADVANCE COMPUTER-ASSISTED INSTRUCTION

IMPROVE THE DELIVERY OF INSTRUCTION THROUGH TECHNOLOGY

Historically, it has been recognized that instruction should be tailored to meet the individual learning styles and needs of students. For the first time, the computer provides a tool to effectively implement this mode of instruction. Technology-based education can make learning more active and interactive for each student. For the purpose of this report, "Technology-Based Education" will be used synonymously with computer-assisted instruction (CAI) and will refer to any system where the computer helps control the presentation of data.

It is recommended that emerging technology be employed to improve the teaching/learning process, and that schools use the capabilities of computers to individualize learning experiences where appropriate in all curriculum areas.

Schools should:

- Provide "foundation-level" hardware and software to implement a technology based curriculum.
- Provide inservice training for all educators on the integration of the computer into the curriculum relative to Level II competencies as identified in "Guidelines for Educational Computing in Virginia."
- Implement a technology-based curriculum.

The Department of Education should:

- Provide assistance to school divisions in defining the needed software for a technology-based curriculum.
- Define for the software industry the areas where software products are needed and the form they should take.
- Provide assistance to school divisions in the selection and evaluation of needed software.
- Participate in national consortiums and/or join organizations for the purpose of negotiating state usage rights for computer software and instructional materials.
- Establish "foundation-level" hardware and software minimums in order for schools to implement a technology-based curriculum.
- Provide assistance to school divisions in the planning, implementation, and evaluation of inservice training relating to the use of a technology-based curriculum.
- Support the implementation and evaluation of model programs for improving education through computer-based technology.

- Establish accreditation standards which require the implementation of a technology-based curriculum.

- Identify and distribute information regarding the effective use of the computer in the curriculum.

Higher education institutions should:

- Perform research on the emerging role of the teacher as diagnostician of student needs, designer of individual methods of instruction, and manager of technological resources and learning processes.

- Assemble teams of discipline experts, classroom teachers, instructional designers, and computer scientists to develop innovative, creative software and to improve existing, less sophisticated software to support improvements in current instructional practice.

- Provide continuing education programs for teachers on the integration of computers in the K-12 curriculum.

Impact statement:

- Significant financial support will be necessary to assist school divisions in acquiring hardware/software for a K-12 foundation level computer use.

- State level personnel resources will be required at the Department of Education and higher education levels to assist school divisions in identifying instructional practices involved in a technology-based curriculum, and in the selection and evaluation of the software/hardware necessary for implementation.

- Financial support will be necessary to assist school divisions in providing inservice programs for teachers on the implementation of a technology-based curriculum.

SUPPORT TEACHERS AND ADMINISTRATORS WITH TECHNOLOGY

Technology will not transform education to meet the needs of society if educators do not learn to use it as both an instructional and a management tool. Computer technology should be used to allow educators to spend more time on instructional tasks and supervision rather than on clerical and management tasks.

It is recommended that computer technology be used by all educators to accomplish administrative, instructional management, and clerical tasks.

Schools should:

- Provide the necessary hardware/software and training to enable teachers to use instructional management and productivity software such as word processors, test generators, grade managers, database and report generators, and electronic spreadsheets.

- Provide the necessary hardware/software and training to enable administrators to use administrative software (student and financial accounting, scheduling, attendance, etc.) as well as productivity tools such as word processors, databases, and spreadsheets.

The Department of Education should:

- Establish "foundation-level" hardware and software minimums in order for schools to provide access to computer technology for educators.

- Make certain administrative software (student accounting, attendance, etc.) available to all school divisions.

Higher education institutions should:

- Provide continuing education programs for educators on the use of instructional management and productivity tool software.

- Ensure that all college educators are fully competent in applying technology to administrative and instructional management tasks.

Impact statement:

- Significant financial support will be necessary to assist school divisions in acquiring foundation level computer access for educators, and basic administrative software for all school divisions.

TRAIN EDUCATORS TO USE TECHNOLOGY TO IMPROVE EDUCATION

An effective school must employ teachers who can incorporate instructional technology in their teaching/learning process. A well planned and executed staff development program must not only offer initial training, but provide continuing experience within the classroom environment. Such staff development should also provide for the sharing of experiences throughout the education profession. An opportunity to utilize technology for both instructional and personal productivity purposes is critical for achieving mastery of these skills.

It is recommended that all educational agencies share the responsibility for developing this technology-based competency with the professional educators. There needs to be a coordinated planning effort for both initial teacher preparation and professional staff development of current educators to assure optimal effectiveness.

Schools should:

- Provide adequate incentives, time and resources for teachers to learn, develop and apply technology based competencies and implementation strategies.

- Select and train teachers who can become models and facilitators in the application of technology in specific subject areas and grade levels.

- Work cooperatively with colleges and universities in the development of courses and workshops to meet local staff development needs for educational technology.

- Obtain and use current technology in school-based management and teacher inservice education activities as a model of an information-age school.

The Department of Education should:

- Require state certification of teachers to include Level II competencies as identified in "Guidelines for Educational Computing in Virginia," a 1983 Department of Education publication.

- Review the Standards of Learning objectives for each curriculum area to identify those which could best be achieved via instructional technology as well as those which need to be revised in light of an information-age society.

- Plan, implement, and evaluate staff development for the integration of technology in all curriculum areas. Innovative uses of the current ITV delivery system should be made as well as using new technologies such as laser videodisk, slow-scan television and satellite dissemination of teleconferences and instruction.

- Serve as a clearing-house for staff development resources and training personnel.

- Initiate a study of the appropriate requirements for a state endorsement in computer-related teaching.

Higher education institutions should:

- Revise current teacher preparation programs to ensure the integration of technology into their delivery.
- Ensure that all college educators are fully competent in applying technology to education.
- Support the research and development of innovative uses of technology for educating students.
- Encourage cooperation among higher education institutions and private industry to explore and promote applications of existing and emerging educational technologies.

Impact statement:

- Significant annual state aid should be available to encourage local school divisions and institutions of higher education to offer on-going educational computing inservice programs.

IMPROVE THE RELEVANCE OF LEARNING BY REFLECTING TECHNOLOGY-DRIVEN DEVELOPMENTS

Technology has changed our society from an industrial to an information-based society. The most significant impact on education of these changes will be the need to transform the curriculum to prepare students to function effectively in such a society. In addition, present testing and evaluation procedures are based on and promote outdated curricula. Major changes in curricula will require parallel changes in evaluation criteria and methods.

It is recommended that long and short range plans be formulated to transform all areas of the K-12 curriculum to reflect skills and knowledge essential to participate effectively in an information-age society. It is further recommended that a restructuring of the evaluation of teaching/learning outcomes be effected to be consistent with the revised (transformed) information-age curricula.

Schools should:

- Plan for curriculum revision and implementation by establishing standing committees to analyze the impact of technology in each subject area and to recommend appropriate changes.
- Develop new curricula reflecting knowledge and skills required by an information-age society to include the development of higher order cognitive and affective skills such as reasoning, analysis, problem solving, valuing and critical thinking.
- Investigate and adopt evaluative tools that address emerging changes in curricula.
- Inform parents/community of changes in curricula and evaluative methods being employed.

The Department of Education should:

- Establish standards for graduation to ensure that all students will acquire both new and traditional basic skills, as well as higher-order reasoning skills in a number of fields that allow the graduate to function effectively in today's complex information-age society.
- Revise the Standards of Learning objectives to reflect curricular changes necessitated by new skills and knowledge brought about by the information-age society.
- Take a pro-active role with institutions of higher education in order to effect curricular change.
- Develop and select testing/evaluation policies, guidelines and instruments that promote required change.

Higher education institutions should:

- Assist schools to undertake the massive task of curriculum revision by conducting research and development related to the K-12 technology-based curriculum.
- Transform teacher preparation programs to be consistent with the K-12 technology-based curriculum.
- Provide continuing education programs which help teachers meet the demands of a changing technology-based curriculum.
- Conduct research and development in testing and evaluation.

Impact statement:

Significant state resources must be allocated to support the transformation of the curriculum and to restructure the evaluation of teaching/learning outcomes.

PLAN CAREFULLY FOR EDUCATIONAL TECHNOLOGY

The effective use of technology in education requires careful planning at every level of the educational system. The needs of our rapidly changing society cannot be met, nor can available resources be optimally employed, if technology is allowed to percolate randomly through the school system. It is not intended that the technology be allowed to determine educational goals, but must be used to help achieve them.

It is recommended that every educational decision-making group participate in ongoing planning for the incorporation of technology into the educational system.

Schools should:

- Develop a plan for the implementation and management of educational technology that is updated every two years. Plans should account for the orderly acquisition of both hardware and software, and the educator inservice needed to accomplish educational goals.

- Develop strategic plans for educational improvement that recognize the needs of a changing society and that provide for continuing planning that anticipates future changes.

- Involve parents and business/industry in the planning process from the outset.

- Set policies for planning at the district and school levels to ensure that decisions to purchase and use technology are made within the context of overall school improvement strategies.

The Department of Education should:

- Establish guidelines for the development of school division plans for technology integration and evaluation.

- Link financial assistance for educational technology to school divisions with the requirement that a plan for the implementation and management of educational technology be developed and updated every two years, according to Department of Education guidelines.

- Ensure that local school division plans and their implementation provide equity of access to educational technology.

- Encourage and support local division planning by providing technical assistance to help schools plan. Good planning at the division level should be rewarded with financial support, including seed money for well-planned development efforts. Department of Education staff should be added to help provide this technical assistance.

Higher education institutions should:

- Develop a plan for the implementation and management of educational technology in colleges of education and/or departments of education that provides a model for teacher training and an environment in which research and development can prosper.

- Assist the Department of Education in the provision of technical assistance to school divisions for the implementation, management, and evaluation of educational technology.

Impact statement:

- Funding will be required to assist and encourage school divisions and higher education in the planning process. Adequate staff positions will be required for the State to provide leadership and technical assistance to school divisions in the implementation and managment of technology in the K-12 curriculum.

DEVELOP FUNDING AND SUPPORT MECHANISMS

Education can enhance its quality and cost effectiveness through technology-based education. Technology should enable education, in the long term, to buy more learning per dollar and thus expand its benefits to society. Overall costs may be higher in the short term, but the costs of evaluating, planning, acquiring, disseminating, maintaining and replacing technology will have to be met if education is to serve the growing needs of an increasingly technical society.

Various support mechanisms are also necessary to ensure effective and equitable applications of educational technology. A broadly-based research, development, evaluation, and dissemination effort is required to transform education through applications of technology.

It is recommended that funding and support mechanisms be established to assure appropriate financing and the effective implementation of technology in education.

Schools should:

- Include technology, especially computer hardware, as a regular line item in the annual budget of each school division. This budget line item should provide for the phased acquisition, maintenance and replacement of computers and other increasingly sophisticated instructional technology devices as appropriate to meet the curricular/instructional needs of each school.

- Include the acquisition and replacement of software as a regular line item in school division budgets.

- Provide a leadership position at the district level in the area of instructional technology.

- Create an instructional technology specialist position in each school.

- Provide, as a regular line item in the annual budget, funding to support inservice training for all educators in educational technology as outlined in "Guidelines for Educational Computing in Virginia."

- Encourage and provide local support for the involvement of selected schools and/or educators in pilot programs and/or collaborative research and development via State matching grant programs.

- Use all sources of available information to select the most cost effective and efficient technology on the market. This should include collaboration of schools and teachers with higher education institutions, state departments of education, and appropriate segments of business and industry.

- Provide incentive programs to all education faculty to access or own personal computers at minimal cost to faculty members.

The Department of Education should:

- Establish standards for hardware and software which will provide a foundation level of support for the use of technology in education.

- Establish an advisory committee to consider funding formulas and proposals.

- Develop funding formulas for implementation of foundation level hardware/software standards in all schools.

- Establish policies which facilitate favorable prices and cost containment for all education agencies.

- Create incentives for education agencies to employ technology which has been shown through research or experience to be effective.

- Implement on-going hardware and software evaluation with specific assistance to school divisions in courseware evaluation and selection.

- Provide software to schools in the most cost effective manner.

- Establish adequate staff positions for the Department of Education to provide necessary leadership and training in instructional technology for schools.

- Promote the creation of positions necessary to place instructional technology at the level commensurate with the plans and expectations of the State's leadership.

- Establish support programs for research and development in instructional technology through creative funding such as matching grants, competitive grants, regional centers/programs, and target population programs.

- Encourage, create, and support industry and non-school agencies in the development, evaluation, and dissemination of software and special programs employing newer technologies.

- Create financing alternatives in cooperation with the private sector to support the education needs of special target school populations.

- Provide incentive programs to professional and support staff to access or own personal computers at minimal cost.

Higher education institutions should:

- Include technology, especially computer hardware, as a regular line item in the annual budget of colleges of education and/or departments of education. This budget line item should provide for acquisition, maintenance and replacement of computers and other increasingly sophisticated instructional technology devices which can provide a model for teacher training and an environment in which research and development can prosper.

- Include budget items to support inservice for teacher educators to ensure that they are fully competent to utilize computers and other technology in all areas of the professional education curriculum.

- Engage in the development of software which embodies new and/or improved approaches to accomplishing educational goals.

- Provide support for staff to engage in regular evaluation and dissemination of curriculum relevant educational software, and to assist schools with curricular needs assessments which identify software for effective instruction to meet school division educational goals.

- Encourage and support education/computer science collaborative programs for preparing teachers and leadership personnel to meet school staffing needs.

- Provide incentive programs to all education faculty to access or own personal computers at minimal cost to faculty members.

- Develop new programs to prepare educational technology specialists for employment in Virginia's schools.

- Implement and/or collaborate in the implementation of pilot programs undertaken via competitive or matching state grant programs.

- Provide support for basic and applied research which has promise for contributing to the improvement of technology utilization.

Impact statement:

- A major state funding effort will be necessary to ensure the equitable and cost effective implementation of educational technology in K-12 and higher education in Virginia.

APPENDIX B

"FOUNDATION LEVEL COMPUTER USE K-12"

RECOMMENDED BY

THE DEPARTMENT OF EDUCATION

FOUNDATION LEVEL COMPUTER USE K-12

Introduction

Enclosed is a chart showing the **minimum** recommended educational computing utilization for the K-12 curriculum (**Foundation Level Computer Use K-12**). **Minimum** hardware/software configurations are shown with projected costs and the student population affected. The chart outlines the instructional or teacher support benefits derived from each computer utilization as well as including a basic school division impact statement. The following explanations are offered for the various recommended computer labs and hardware/software configurations:

Grade Level Mobile Units (K-8)

A mobile microcomputer for every two classrooms is recommended for each grade level (K-8) for group presentations with an adequate large screen projection system (25 inch monitor). A growing quantity of instructional courseware suitable for group presentation (simulations, problem solving, productivity tools, etc.) is available to provide the instructor with an interactive instructional tool with graphics and animation capability. This capability would complement the use of a multi-purpose lab for student hands-on.

Subject Area Mobile Units (9-12)

A mobile microcomputer with large screen projection capability is recommended for all curriculum areas normally offered in grade levels 9-12. Much CAI (Computer Assisted Instruction) courseware normally used for individual student use is also suited for large group instruction. In addition, spreadsheet, database, simulation, and problem solving software can be used to present problem solving and critical thinking situations. This capability would complement the use of a multi-purpose lab for student hands-on.

Multi-Purpose Lab (4-12)

A twenty station multi-purpose lab per 15 classrooms is recommended for schools with grade levels 4-12. This facility could be scheduled by instructors from all curriculum areas for computer assisted instruction, writing exercises using word processing software as well as providing support for computer literacy instruction focusing on the state mandated computer literacy competencies. The lab would also provide support for the increasing demand for instruction in basic keyboarding skills.

Student Resource Lab

A student resource lab for each school with grades 8-12 is recommended to support the need for student access to microcomputers to complete writing projects, assignments requiring the use of CAI courseware, and keyboarding practice. This lab could also support electronic data retrieval utilizing career and college information software.

Business Education Lab

A twenty station lab is recommended for all high schools to support business education classes requiring computer supported instructional activities. Students entering the job market should be given hands-on exposure to popular business applications such as the use of word processing, spreadsheet, database, graphics, and communications software.

Computer Science and/or Computer Math Lab

A twenty station lab is recommended for all high schools to support computer programming and/or computer math classes. Students who will continue their education beyond high school will use the computer in most courses of study. Programming experiences utilizing the computer to solve mathematical problems will be particularly helpful to students who major in computer science and information processing.

Teacher Resource Lab/Loaner Units

A teacher resource lab for each school (1 microcomputer and printer for every 10 teachers) is recommended to support the need for teachers to electronically manage grades and student information. The preparation of tests, worksheets, lesson plans and other instructional materials could be greatly assisted by the use of word processing and desk top publishing software. These units would also be available for overnight loan to teachers.

Minimum Software Support

Software usage rights for all public school divisions for products which are available from the Minnesota Educational Computing Corporation **(MECC)** would provide basic (foundation level) support for all microcomputer labs and hardware configurations. The state membership fee of $300 per 5,000 students ($57,600 for 960,000 students) would gain usage rights to all MECC software/courseware items including permission to duplicate as needed.

FOUNDATION LEVEL COMPUTER USE K-12

GRADE LEVEL	LAB OR RESOURCE AREA	HARDWARE CONFIGURATION	PROGRAMATIC USAGE	SPECIFIC UTILIZATION	STUDENTS AFFECTED	SOFTWARE USED	SOFTWARE COST	HARDWARE COST	LEA IMPACT
4-12	4-12 MULTI-PURPOSE LAB	20 MICROS, 10 PRINTERS, 10 PRINTER SWITCHES FOR EVERY 15 CLASSROOMS	COMPUTER LITERACY	DEVELOP MINIMUM COMPETENCIES	ALL	DEMONSTRATION		$28,500.00	ASSISTANCE IN MEETING STATE ACCREDITATION STANDARDS IN COMPUTER LITERACY
	4-12 MULTI-PURPOSE LAB		USE OF PRODUCTIVITY TOOL SOFTWARE (WORD PROCESSING, DATABASE, SPREADSHEET)	USE OF TOOL SOFTWARE FOR APPLICATIONS IN PROBLEM SOLVING AND CRITICAL THINKING	ALL	WORD PROCESSING, SPREADSHEET, DATABASE			DEVELOPMENT OF PROBLEM SOLVING AND CRITICAL THINKING SKILLS
	4-12 MULTI-PURPOSE LAB		KEYBOARDING	DEVELOP KEYBOARDING SKILLS	ELECTIVE	TYPING TUTOR			STUDENTS USE COMPUTER AS A LEARNING TOOL MORE EFFECTIVELY
	4-12 MULTI-PURPOSE LAB		WRITING INSTRUCTION	DEVELOP WRITING SKILLS USING WORD PROCESSING SOFTWARE	ALL	WORD PROCESSING			IMPROVE LANGUAGE ARTS ABILITY

FOUNDATION LEVEL COMPUTER USE K-12

GRADE LEVEL	LAB OR RESOURCE AREA	HARDWARE CONFIGURATION	PROGRAMATIC USAGE	SPECIFIC UTILIZATION	STUDENTS AFFECTED	SOFTWARE USED	SOFTWARE COST	HARDWARE COST	LEA IMPACT
4-12	4-12 MULTI-PURPOSE LAB		DRILL AND PRACTICE WITH CAI COURSEWARE	REINFORCEMENT OF BASIC SKILLS IN ALL SUBJECT AREAS	ALL	DRILL AND PRACTICE COURSEWARE			IMPROVEMENT IN BASIC SKILLS
6-12	6-12 STUDENT RESOURCE LAB	10 MICROS, 5 WP PRINTERS, 5 PRINTER SWITCHES FOR EACH SCHOOL	ACCESSIBLE TO STUDENTS FOR USE OF DRILL AND PRACTICE, KEYBOARDING, AND WORD PROCESSING SOFTWARE	USE DRILL AND PRACTICE COURSEWARE TO REINFORCE INSTRUCTION IN ALL CURRICULUM AREAS. USE OF WORD PROCESSING SOFTWARE FOR WRITING ASSIGNMENTS. TYPING TUTOR TO DEVELOP KEYBOARDING SKILL. CAREER AND/OR COLLEGE INFORMATION RETRIEVAL	ALL	WORD PROCESSING, RELATED CAI COURSEWARE, CAREER/COLLEGE INFO. RETRIEVAL SOFTWARE		$14,750.00	REINFORCEMENT OF BASIC INSTRUCTION AND DEVELOPMENT OF LANGUAGE ARTS SKILLS. INFORMATION REGARDING COLLEGE/CAREER CHOICES.
9-12	9-12 SUBJECT AREA MOBILE UNITS	15 MICROS WITH RGB CARD, 15 (25 INCH) MONITORS, 15 MOBILE CARTS FOR EACH SCHOOL	GROUP PRESENTATION OF INSTRUCTIONAL SOFTWARE FOR ALL CURRICULUM AREAS FOUND IN GRADE LEVELS 9-12 (ONE UNIT FOR EACH CURRICULUM AREA)	USE OF CAI COURSEWARE TO DELIVER INSTRUCTION (SIMULATIONS, PROBLEM SOLVING, DRILL & PRACTICE, AND PRODUCTIVITY TOOL SOFTWARE)	ALL	SIMULATION, PROBLEM SOLVING, DRILL & PRACTICE AND PRODUCTIVITY TOOL SOFTWARE		$34,500.00	ENHANCE INSTRUCTION BY PROVIDING AN INTERACTIVE DELIVERY TOOL WITH BIG SCREEN PROJECTION
10-12	10-12 BUSINESS EDUCATION LAB	20 MICROS, 10 WP PRINTERS, 5 PRINTER SWITCH BOXES FOR EACH SCHOOL	BUSINESS EDUCATION CLASSES: BUS. COMPUTER APPLICATIONS, WORD PROCESSING, OFFICE TECHNOLOGY, ACCOUNTING, AND KEYBOARDING	USE OF DATABASE, SPREADSHEET, WORDPROCESSING, AND APPLICATION SOFTWARE TO SIMULATE BUSINESS ACTIVITIES	ELECTIVE	SPREADSHEET, WORD PROCESSING, DATABASE, PAYROLL, AND ACCOUNTING APPLICATIONS	$8,000.00	$29,500.00	PROVIDES VOCATIONAL TRAINING IN BUSINESS COMPUTER APPLICATIONS

FOUNDATION LEVEL COMPUTER USE K-12

GRADE LEVEL	LAB OR RESOURCE AREA	HARDWARE CONFIGURATION	PROGRAMATIC USAGE	SPECIFIC UTILIZATION	STUDENTS AFFECTED	SOFTWARE USED	SOFTWARE COST	HARDWARE COST	LEA IMPACT
10-12	10-12 COMPUTER SCIENCE LAB	20 MICROS, 10 PRINTERS, 10 PRINTER SWITCHES FOR EACH SCHOOL	COMPUTER MATH AND/OR COMPUTER SCIENCE	PROGRAMMING INSTRUCTION IN BASIC, AND/OR LOGO AND/OR PASCAL	ELECTIVE	BASIC, PASCAL, LOGO	$2,000.00	$26,500.00	STUDENTS BETTER PREPARED FOR COLLEGE LEVEL STUDY IN COMPUTER SCIENCE OR DATA PROCESSING
K-12	K-12 TEACHER RESOURCE LAB/LOANER UNITS	1 MICRO, 1 WP PRINTER PER 10 TEACHERS	TEACHER SUPPORT: STUDENT INFORMATION AND GRADE MANAGEMENT, WORD PROCESSING, DESK TOP PUBLISHING.	ELECTRONIC MANAGEMENT OF GRADES, BUDGETS, AND STUDENT INFORMATION. PRODUCTION OF INSTRUCTIONAL MATERIALS USING WORD PROCESSING AND DESK TOP PUBLISHING SOFTWARE.	ALL INDIRECTLY	WORD PROCESSING, DESK TOP PUBLISHING, GRADE MANAGEMENT, DATABASE, SPREADSHEET		$1,700.00	INCREASE IN TEACHER PRODUCTIVITY SHOULD ALLOW MORE TIME FOR INSTRUCTIONAL PLANNING AND MANAGEMENT
K-8	K-8 GRADE LEVEL MOBILE UNITS	1 MICRO WITH RGB CARD, 1 (25 INCH) MONITOR, 1 MOBILE CART FOR EVERY TWO CLASSROOMS	GROUP PRESENTATION OF INSTRUCTIONAL SOFTWARE AT ANY GRADE LEVEL	USE OF CAI COURSEWARE TO DELIVER INSTRUCTION (SIMULATIONS, DRILL & PRACTICE, PROBLEM SOLVING AND TOOL COURSEWARE)	ALL	SIMULATION, PROBLEM SOLVING, DRILL & PRACTICE, AND TOOL SOFTWARE		$2,300.00	ENHANCE INSTRUCTION BY PROVIDING AN INTERACTIVE DELIVERY TOOL WITH LARGE SCREEN PROJECTION

APPENDIX C

LIST OF TASK FORCE MEMBERS

** EDUCATIONAL COMPUTING TASK FORCE MEMBERS **

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