REPORT OF THE
JOINT SUBCOMMITTEE STUDYING

Initiatives to Advance Computer-Assisted Instruction

TO THE GOVERNOR AND
THE GENERAL ASSEMBLY OF VIRGINIA

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Report of the
Joint Subcommittee Studying Initiatives

to Advance Computer-Assisted Instruction
To
The Governor and the General Assembly of Virginia
Richmond, Virginia
January, 1984

To: The Honorable Charles S. Robb, Governor of Virginia
and

The General Assembly of Virginia

The Joint Subcommittee Studying the Initiatives to Advance Computer-Assisted Instruction was authorized to conduct its study by House Joint Resolution No. 61, agreed to during the 1983 Session of the General Assembly. The resolution may be found in the appendices of this report.

Appointed to serve on the Joint Subcommittee were Delegates John G. Dicks, III, of Chester, Benjamin J. Lambert, III, of Richmond, Chairman, and Marian Van Landingham of Alexandria; Senators Edward M. Holland of Arlington, Vice-Chairman, and Frank W. Nolen of New Hope.

INTRODUCTION

The national economy, having been plagued over the past several years by chronic and persistent recession, "is undergoing a fundamental, structural change. The nation, and Virginia with it, is experiencing an 'industrial evolution' which has major ramifications as to how the Commonwealth can best accomplish the critical functions of educating its citizenry to compete successfully and survive in a technological society and of assisting the private sector to create jobs".[1]

The recession in the national economy has resulted in thousands of dislocated workers because of plant closings. The most affected areas have been in the basic manufacturing industries, e.g., steel, autos, forest products, metals, mining (coal and special ore–copper, etc.), textiles, chemicals, and furniture. Though Virginia does not have a preponderance of steel and auto industries, some businesses in the state which supply materials to auto makers have been adversely affected. Occupational Employment Statistics data for Virginia show manufacturing as a declining percentage of total industry employment. Virginia is becoming more oriented to services, trades and white-collar workers, and moving away from blue-collar companies in the state. These companies will be located near the major research universities and in areas that can supply the technical work force.

This "industrial evolution" is said to be ushering in the "information age," which will create new careers that will demand that workers possess high technical skills and decision-making capabilities. One article predicts that "the action in technology for this decade will be biotechnology, silicon chips for micro-electronics, robots, computers, research, medical microscience equipment, research and development, geology (finding resources without drilling), and defense."[2] Aware of these directions, the Governor, in 1983, appointed a Task Force on Science and Technology to develop a plan and economic strategies for establishing Virginia as a leader in the technological age. As a result of the Task Force's study emphasis will be placed on attracting high-tech industries. Because this new age will require a highly trained workforce, we are faced with the task of re-educating dislocated workers and assisting our school children in obtaining marketable skills. To meet these goals, the direction of public education in Virginia must change.

Virginia is committed to national preeminence in education and to the goal of assisting every student in mastering certain basic skills necessary for success in school and for a productive adult life. Adherence to these priorities is vital to our economic well-being. 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.

Use of Computers in Instruction in Virginia

It has been estimated that nationally, the number of microcomputers in the schools more than doubled during an eighteen-month period, increasing from 52,000 to 300,000 computers and terminals. In Virginia, only six to eight school divisions have made a serious commitment to computer-assisted instruction. There are 176 schools with computer science programs and the majority of the computer labs are not well equipped.

Public schools in Virginia have begun to use computers to perform evaluation and data analysis, record-management, payroll and accounting and other administrative and clerical tasks. A number of schools now have computer literacy courses and/or units of instruction as well as basic computer programming courses.

In July 1983, the Board of Education approved revised Accreditation Standards for Schools. One new requirement of the recently revised Standards states that "by graduation each student shall be provided educational experience directed toward objectives outlined in Computer Literacy for Students in Virginia." Several committees have been appointed by the Department of Education to assist it in the development of objectives and priorities regarding computer hardware, software, staff development, and in-service programs for teachers.

In addition, the 1983 General Assembly passed legislation to provide aid to localities for the purchase of computer hardware and software for use in the classroom, (Chapter 622, Item 192.9(7), 1983 Acts of Assembly), and to provide tax incentives to industries and businesses that donate technical equipment, (Chapter 452, 1983 Acts of Assembly).

Notwithstanding all these efforts, there is not a comprehensive, uniform statewide computer-based curriculum in the public schools whereby students can acquire marketable skills, business and industry in the Commonwealth can have access to skilled workers, and classroom teachers can engage a proven medium to enhance instruction.

Findings of the Joint Subcommittee

During the course of the study, the Joint Subcommittee ascertained information concerning the instructional use of the computer, computer science programs and needs of local school divisions, technological advances in telecommunications, and perspectives of business and industry regarding their need for a skilled workforce. The Joint Subcommittee also viewed demonstrations of sophisticated technology used to deliver educational programs and it participated in demonstrations of the use of the computer as an instructional aid.

A. Lack of Information

The Joint Subcommittee found a dearth of information available regarding the instructional use of the computer in Virginia. This is due partly to the fact that the use of computers in instruction is relatively new in the Commonwealth and heretofore, such data have not been compiled. Information provided to the Joint Subcommittee indicates that many school divisions are purchasing computer hardware without clearly defined purposes and goals for the use of such equipment. Because school divisions are purchasing computer hardware before purchasing computer software, often they are placed in the position of having committed a tremendous investment in software that is not adaptable to the hardware. This represents a substantial financial commitment to technology that is underutilized or cannot be used at all.

Of the school divisions that have computer science programs, nearly all have computer literacy programs. Such programs are primarily included in the curriculum of the upper elementary (4-6) and intermediate grades (7-9). In the secondary grades (9-12), the emphasis is on computer science, and business applications of computers, e.g. programming and data processing.

Other educational uses of the computer include its use in instruction as:

° an instructor, e.g. tutorial, drill and practice

° a laboratory, e.g. data processing, problem solving, simulation

° an object of instruction, e.g. computer literacy, computer science, computer programming, data processing

° a calculator, e.g. mathematical calculations

° a management tool, e.g. financial, personnel and student information

° an instructor's aid, e.g. computer-managed instruction, generation of instructional materials, information storage and retrieval

B. Terminology

The Joint Subcommittee was advised that one major obstacle to effective use of the computer in instruction is the lack of uniformity and consistency in terminology throughout the Commonwealth, for example "what does computer based instruction/education really imply?" During in-depth discussions on this issue, the Joint Subcommittee determined that the technical language in the enabling legislation for the study (HJR 61) was an example of this problem in that the terminology did not adequately convey the purpose of the study.

C. Funding

Also examined was the issue of funding. In 1983, the legislature passed two measures, (1) to appropriate funds to local school divisions for the acquisition of computer hardware and software for classroom use, and (2) to provide tax incentives to business and industry that donate technological equipment. However, data provided by the Department of Education disclosed that this funding was insufficient given the need to provide quality computer science programs statewide.

D. Perspectives of Business and Industry

Much has been said nationally regarding education for a technological society: Stressed in these discussions is the importance of educating students to be self-sufficient in the coming technological age. It is acknowledged that states can no longer afford to educate students to meet the needs of the state only, but the need is for states to educate students to survive in a "global economy". The educational need being generated by the creation of new technologies is not a general computer literacy experience, but a general updating of curriculum and improvement in the acquisition of higher order skills. Because more and more jobs in the future will be skill-oriented, and more of the basic skills will be automated, students will need to be able to perform critical analysis and synthesize data. Therefore, emphasis should be on school improvement with additional components, not on adding new components to the school or the curriculum.

High technology companies are looking for superbly trained individuals with keen minds, not computer literacy. Computer literacy for the sake of computer literacy is an empty process because it is less important than literacy. Likewise, there is no need for every student to be a computer programmer. Industry has no need for this. It is counterproductive to have a programming course in every school. What industry does not need are "computer junkies," persons able to spew forth technical jargon who are wedded to the computer to the exclusion of the humanities and the social sciences. The skills which industry requires are (1) the ability to speak lucidly, (2) the ability to think logically and analytically, (3) the ability learn, and (4) the ability to marshal, transfer and apply technical knowledge to the humanities and social sciences to achieve a better quality of life for society.

Therefore, the focus of the curriculum in the public schools should be "can the computer be useful in achieving stated academic goals," and not "how can we use the computer." Education must use technology to improve scholastic outcomes, reduce costs, maintain services, and determine and recognize the appropriate and inappropriate ways to use technology in education. Teachers must be taught how to use the computer and to integrate it effectively in the

curriculum to assist students in achieving specific educational objectives, and then to teach other teachers to do likewise.

To reach these goals, it is imperative that school divisions link technology carefully to instructional objectives and recognize the constraints on the use of technology in education, e.g. tradition, market size and legal constraints. School divisions should make use of research and evaluation already available to reduce duplicative efforts and eliminate unnecessary expenditures in deciding which computer software to purchase. A mechanism to procure software should be developed, such as negotiating the purchase, as is done in the textbook adoption process, or states could initiate new and creative ways to acquire needed computer software. Some efforts could be to lobby jointly for good software standards, investigate and negotiate licensing agreements to prevent pirating, seek more intelligent pricing policies and consider royalty for reproduction. Schools should be encouraged to use technology which they have left basically unexplored, i.e. cable, interactive television, and other telecommunications capabilities. These means are particularly beneficial in providing requisite services in small schools or in isolated geographic areas.

Funding priorities should be on the acquisition of quality software, in-service technological demonstration centers and financing capital outlay for poorer school divisions. Raising teacher salaries to compete with or to try to outbid industry is unsuccessful because school divisions will never be able to compete financially with business. Establishing differentiated pay for teachers would result in the richer school divisions siphoning off teachers from poorer school divisions, thereby creating an equity problem. Rather, schools should devise means to supplement subject areas marked by a shortage of teachers. Establishing differentiated programs, such as those used in higher education, would permit school divisions to use resource teachers, graduate or advanced students as teaching assistants or to employ retired professors in advanced high school classes for which a teacher is unavailable. This might be a temporary solution to teacher shortage, but it may pose a problem in those states which have teacher certification requirements.

E. Linkages

David Matthews, President of the Charles T. Kettering Foundation, asserts that "economic productivity is impossible without educational productivity. We educate for more than vocational skill, yet there is no skill of the sort our economy requires that is possible without a good basic education." [3]

Therefore, the development and cultivation of cooperative programs between schools and industry that address both vocational/career education and basic academic skills are essential to the maintenance of an effective and relevant curriculum and to the delivery of skilled and productive citizens. Such ventures would also be cost effective because duplicative efforts would be minimized. In addition, as technology changes, schools would be able to adjust the curriculum and replace equipment more expediently to obtain a more appropriate match between industry needs, educational objectives, and prospective employees.

The Joint Subcommittee was informed that the U.S. Department of Defense has developed a new computer language, "ADA," which will be implemented in 1985. It is projected that the language will become an industrial standard for defense contractors and commercial industry. Given Virginia's proximity to defense installations, and given the fact that many graduates in the Commonwealth enlist in the armed forces or are employed by them in civilian capacities, it is essential that Virginia's public colleges and universities begin to prepare students to use the language. It is expected that the Defense Department's computer language will have a "trickle-down effect" on public education.

Several of the nation's largest schools of education now include units in computer science in admissions and graduation requirements. The Joint Subcommittee was informed that some colleges and universities in Virginia have similar proposals, many of which will become effective within the next two or three years. Because of this new development, the Joint Subcommittee recommends that the Board of Education advise local school divisions of such changes in college admissions policies so that students may be so apprised and changes in curricula may be made accordingly.

CONCLUSIONS

The advent of a rapidly changing technological society and the corresponding changes in the technical needs of Virginia business and industry demand a highly skilled work force. Even personal responsibilities and activities will dictate a need for computer awareness, if nothing more. Public schools must respond to these needs by producing graduates who have not only basic skills and life-coping skills, but marketable technical skills. Despite these directions, a computer-based instruction curriculum is not available statewide.

It is the Joint Subcommittee's belief that such a curriculum is necessary, and that a viable and adequately funded mechanism to implement this curriculum without adversely affecting the present basic school aid formula must be developed. Many states have proceeded to mandate computer literacy programs without a sound method for financing the programs. As a result of poor planning, many of them are now struggling to maintain their programs. The Joint Subcommittee strongly believes that Virginia should not pursue a policy contrary to its tradition of wise planning, sound investment and conservative spending. Given the lack of information regarding the use of computers by local school divisions and considering the computer initiatives of the Defense Department and the possibility of new college admissions and graduation requirements in this area, the Joint Subcommittee determined that additional information was needed. It has requested its staff and the Department of Education to survey local school divisions, business and industry, and colleges and universities in Virginia to ascertain the data essential to its study. In addition, due to the increased attention on computers, technology and telecommunications, several organizations, state agencies, businesses and industries have expressed a keen interest in the work of the Joint Subcommittee. Because many of these persons sought to solicit information from the Joint Subcommittee that it was too attempting to compile, as many questions as possible from each group have been included in a single survey instrument to each school division. Surveying the local school divisions in this manner would eliminate duplicative efforts and prevent local school divisions from being deluged with questionnaires. A separate survey will be sent to each college and university in Virginia to obtain current and proposed admissions and graduation requirements.

While acknowledging the need for a viable and comprehensive computer-based curriculum, the Joint Subcommittee believes that resolution of the following issues should be reached prior to mandating or recommending the implementation of the curriculum.

Issues

1. Focus of curriculum. Where should emphasis be placed: computer literacy (awareness), computer-assisted instruction (computer as a tool to assist and/or manage instruction), and computer programming (high skill level)?

2. Sequence of curriculum. In what grade should computers and computer literacy be introduced? Should the program begin in kindergarten and progress sequentially through grade 12? Should computer literacy be considered a basic, such as math, reading, etc.?

3. Comprehensiveness. How comprehensive should the program be? How much should a prospective high school graduate know about or be able to perform on a computer? Should all students take advanced computer courses (computer programming)? Should computer specialization include computer science or applications?

4. Linkage. Is there a need to require that high school computer courses be the foundation for college level courses? Should successful completion of some type of computer course be a requirement for high school graduation?

5. Terminology. What is computer literacy, computer-assisted instruction and computer-managed instruction? What relationship should these terms have to the K-12 curriculum?

6. Teacher training. Is there a need for adequately trained and competent teachers who can integrate the computer in instruction, instruct students in the use of the computer, and teach advanced computer science courses? How should teachers, in force, be retrained? How can in-service best be used to retrain teachers? Should computer education become a requirement

for teacher certification and certificate renewal?

7. Administration. What administrative applications and support should computers provide schools?

8. Funding: What kind of mechanism is needed to fund a comprehensive computer-based curriculum?

9. Procurement of hardware and software: Should the state, via the Department of Education, provide technical assistance to local school divisions in acquiring hardware and software that meet the division's needs? To what extent should technical assistance be provided, i.e., response to a local request, or action initiated by the Department?

10. State leadership: What is the proper role of the Commonwealth in this area? Should the use of computers in instruction be mandated? Should computer-based education be permitted as a local option? Should implementation of the program be immediate or phased-in? Should funding for the program be shared with the localities or completely funded by the state?

11. High technology: What is high technology? What are the labor needs of such industries? How does high technology apply to vocational education? How can schools and industry, together, best meet the technological needs of the state and the nation and assist students in obtaining marketable skills?

12. Implementation time-table: Should Virginia mandate or recommend the implementation of a computer-based curriculum without a funding mechanism fully in place due to the pressing need for the program or only when the funding is in place? How long can the State delay implementation of a program without impeding the goals set by the Governor to launch Virginia as a leader in the technological age?

13. Equity: How can Virginia best assure equal access for all school children, especially if computer-based education is mandated and implemented in the State?

Alternative.

Is there an alternative to computer-based education whereby students can obtain comparable skills?

Because the Joint Subcommittee did not have sufficient time in which to resolve the aforementioned issues, it recommends that the study be continued. Legislation to this effect is appended to this report.

The Joint Subcommittee thanks the Department of Education, local school divisions, business and industry, and all other persons who assisted it in the study.

Respectfully submitted,

Benjamin J. Lambert, III, Chairman

Edward M. Holland, Vice-Chairman

John G. Dicks, III

Frank W. Nolen

Marian Van Landingham

Footnotes

1. Eubanks, Scott. Virginia's Economic Development Strategies for the Future: Establishing a New Standard of Leadership in an Evolving Technological Age. (Virginia: Virginia Division of Industrial Development, 1983).

2. Virginia. "Dislocated Workers." (Virginia: Bureau of Labor Statistics, 1983).

3. David Mathews, President, Charles F. Kettering Foundation, in Henry, James F. and Susan Ueber Raymond. Basic Skills in the U.S. Work Force: The Contrasting Perceptions of Business, Labor and Public Education. (New York: Center for Public Resources), 1982.

Appendices

A. Proposed Legislation

B. Computer Literacy Requirement of the Standards for Accrediting Schools in Virginia

C. Computer Literacy for Students in Virginia

D. House Joint Resolution No. 61, 1983

Appendix A

HOUSE JOINT RESOLUTION NO.....

Continuing the work of the Joint Subcommittee Studying the Use of Computers in Instruction.

WHEREAS, the National Commission on Excellence in Education has recommended that all students receive at least one semester of instruction in the use of the computer; and

WHEREAS, at present there is no mechanism for evaluating the use of computers in the classroom or funding for such programs in this Commonwealth; and

WHEREAS, such an evaluation must be based on data which are credible; and

WHEREAS, comprehensive surveys of the school divisions and the institutions of higher education are necessary to collect the required data for such an evaluation; and

WHEREAS, such surveys require careful preparation and wide participation in order to provide valid data; and

WHEREAS, these surveys have been developed and distributed in cooperation with the Department of Education; and

WHEREAS, it will not be possible to collect and analyze these data before the 1984 Session of the General Assembly; now, therefore, be it

RESOLVED by the House of Delegates, the Senate concurring, That the work of the Joint Subcommittee studying the initiatives to advance computer-assisted instruction shall be continued in order to complete the comprehensive study, which was begun in 1983, of the use of computers in instruction in this Commonwealth and to accomplish the following:

1. Evaluate the data collected from the local school divisions and the institutions of higher education on the use of computers in instruction;

2. Examine the Commonwealth's role in assuring that appropriate computer skills are acquired by public school students;

3. Determine the appropriate policy for Virginia concerning the use of computers in public education; and

4. Analyze funding methods to determine an equitable, viable and balanced approach.

The membership of the Joint Subcommittee shall consist of the present five members in addition to two members of the House Appropriations Committee who shall be appointed by the Chairman thereof and one member of the Senate Finance Committee who shall be appointed by the Senate Privileges and Elections Committee.

The Joint Subcommittee shall complete its work in time to submit its recommendations to the 1985 Session of the General Assembly.

The cost of this study shall not exceed $15,610.

Appendix B

Computer Literacy Requirement

By graduation each student shall be provided educational experiences directed toward objectives outlined in Computer Literacy for Students in Virginia by the Department of Education.

Source: Standards for Accrediting Schools in Virginia, Adopted by the Board of Education, July, 1983.

COMPUTER LITERACY FOR STUDENTS IN VIRGINIA

DEFINITION

We believe that students in Virginia should develop the ability to understand the capabilities, applications and implications of computer technology and use this knowledge to function effectively in society.

INTRODUCTION

The following objectives have been developed to provide a framework for teaching computer literacy. The objectives represent competencies which students should achieve by graduation from high school. Computer literacy instruction can be integrated into the various subject areas or taught in separate computer literacy courses. No specific grade level or curriculum placement is indicated to allow each school maximum flexibility in developing its own curriculum.

HOUSE JOINT RESOLUTION NO. 61

Requesting the House Committee on Education and the Senate Committee on Education and Health to establish a joint subcommittee to study initiatives to advance computer-assisted instruction.

Agreed to by the House of Delegates, February 11, 1983
Agreed to by the Senate, February 23, 1983

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, personal computers are now being used in homes throughout the United States; 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 for all involved in preparing students for the future; now, therefore, be it

RESOLVED by the House of Delegates, the Senate concurring, That the House Committee on Education and the Senate Committee on Education and Health are hereby requested to establish a joint subcommittee to study initiatives to advance computer-assisted instruction.

The joint subcommittee shall be composed of five members. Three members shall be appointed from the House Committee on Education by the chairman thereof. Two members shall be appointed from the Senate Committee on Education and Health by the Senate Committee on Privileges and Elections.

The joint subcommittee is hereby requested to complete its study in time to submit recommendations to the 1984 Session of the General Assembly.

The cost of this study shall not exceed $3,200.

1. **The student will define selected computer terminology.**
   Descriptive Statement: Such terminology will include the proper names of computer components and terms which indicate procedures and functions, e.g. byte, menu, load, interface, RAM, ROM.

2. **The student will identify the basic components of a computer and describe the function of each.**
   Descriptive Statement: Emphasis will be on the functional component systems, e.g. central processing unit, input/output devices, memory.

3. **The student will load and run a prepared program.**
   Descriptive Statement: Skills emphasized are turning on the computer and appropriate peripherals, inserting the appropriate software and following instructions to complete the program.

4. **The student will use the keyboard to interact with the computer.**
   Descriptive Statement: These skills will include the use of special function and alphanumeric keys.

5. **The student will select and use an appropriate program to accomplish a given task.**
   Descriptive Statement: This involves task analysis, selection and use of compatible software packages.

6. **The student will describe a computer program.**
   Descriptive Statement: Emphasis will be on understanding that a program is a series of logical, sequential statements which instruct the computer to perform the operations necessary to solve a problem or complete a task.

7. **The student will analyze a simple problem and describe procedures to solve that problem.**
   Descriptive Statement: Emphasis is on the use of logical thinking and problem-solving skills. This does not require, but may include the use of a computer and the writing of a simple program.

8. **The student will describe the recent development of computer technology and its applications in daily living.**
   Descriptive Statement: Emphasis will be on computer applications in the home, school and community. This may include the history of computer technology.

9. **The student will describe the potential and limitations of the computer.**
   Descriptive Statement: Emphasis will be on understanding the current and possible future capabilities of computers.

10. **The student will identify and evaluate major ethical, social and economic issues which relate to the use of computers.**
    Descriptive Statement: Emphasis will be on the broad influence of computers upon the many facets of society and resultant changes in patterns of thought and action.

11. **The student will explore computer-related careers and recognize the value of computer skills for future education and employment.**
    Descriptive Statement: Emphasis will be on the future use of computers in a variety of occupations and prerequisite skills needed for career planning.

12. **The student will describe electronic databases as information sources.**
    Descriptive Statement: Emphasis is on information found in databases and methods of information retrieval.