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ABSTRACT

This report details the Hawaii State Department of Education's plan for the use of computers and computer-related technologies in instruction and instructional support. Four areas of implementation are identified: (1) computer literacy, which includes exploratory computer literacy, computer science, and vocational-technical education; (2) computer-assisted instruction; (3) computer-based information retrieval; and (4) computer-managed instruction. Descriptions of both current and emerging uses of computer technology in the Computers in Instruction Program are provided in this plan, along with goals and directions for each of the four areas of implementation and the three components of computer literacy. The text is supplemented with a glossary and nine appendices which make up more than two-thirds of the document. They include: information on program developments; equipment acquisition guidelines; educational specifications for a computer resource room; educational specifications for a career resource center; a framework for exploratory computer literacy for grades K-12; a secondary task force report; a rationale and specifications for computer-based information retrieval in school libraries; criteria for reviewing the effectiveness of computer-managed instruction; and a model for inservice training in computer literacy for teachers. A 20-item reference list for the plan and a 16-item bibliography for the inservice training model are provided. (EW)

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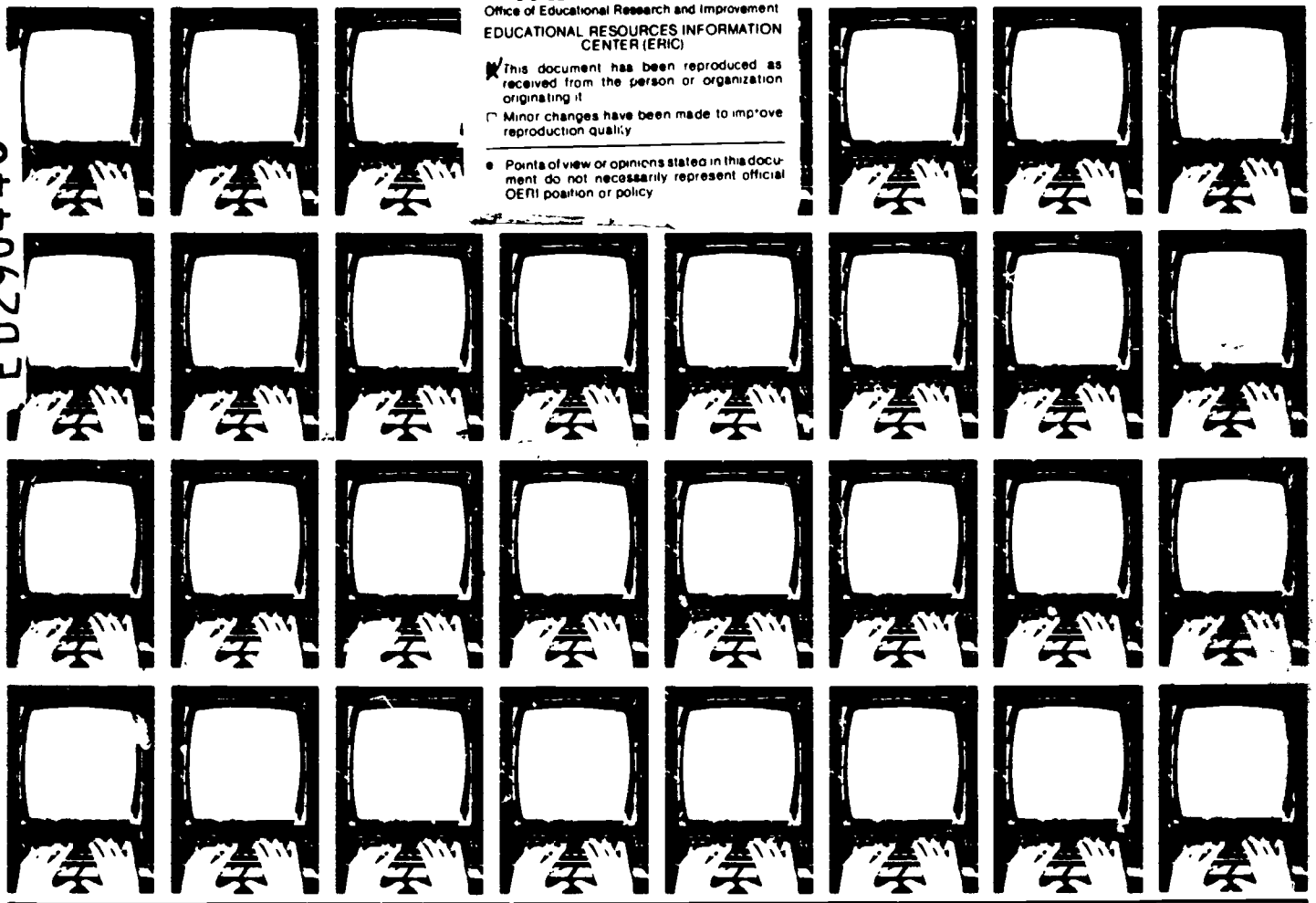

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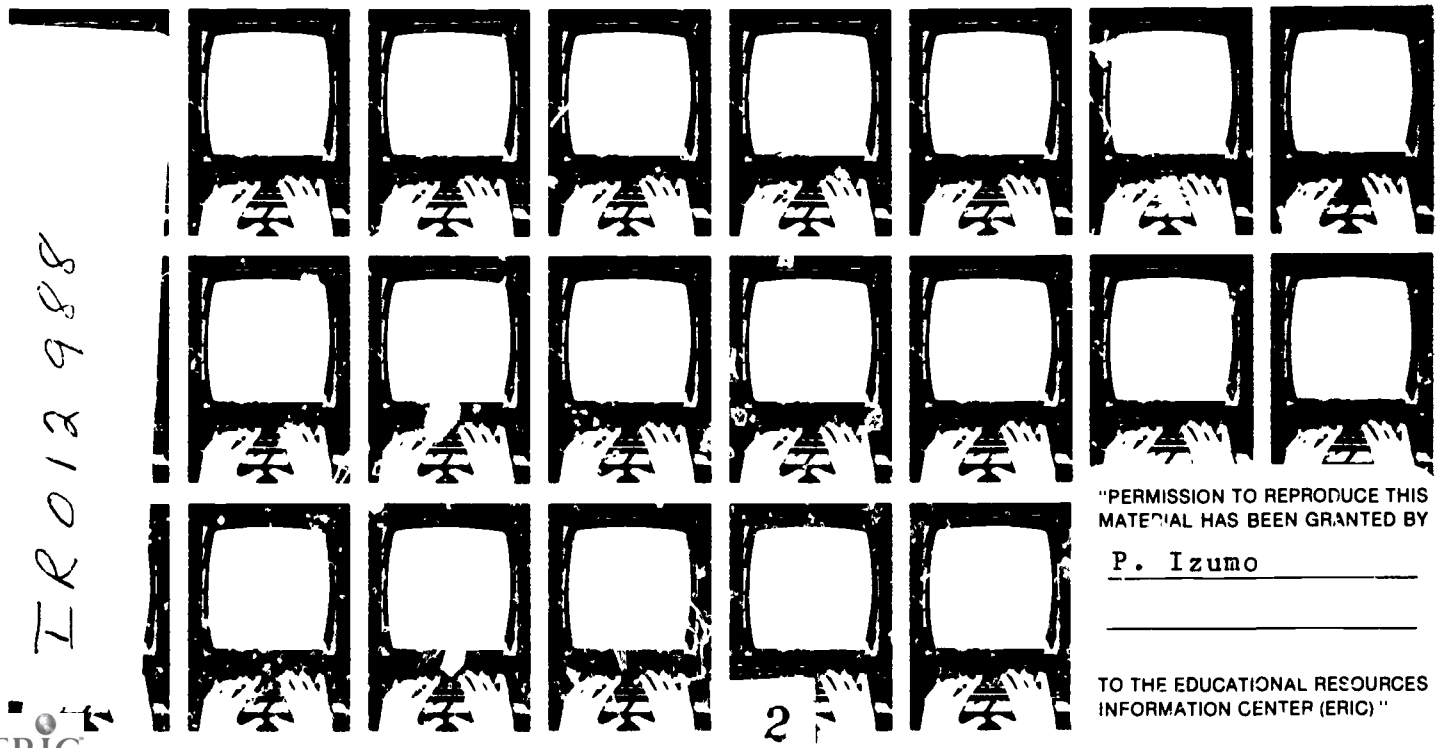

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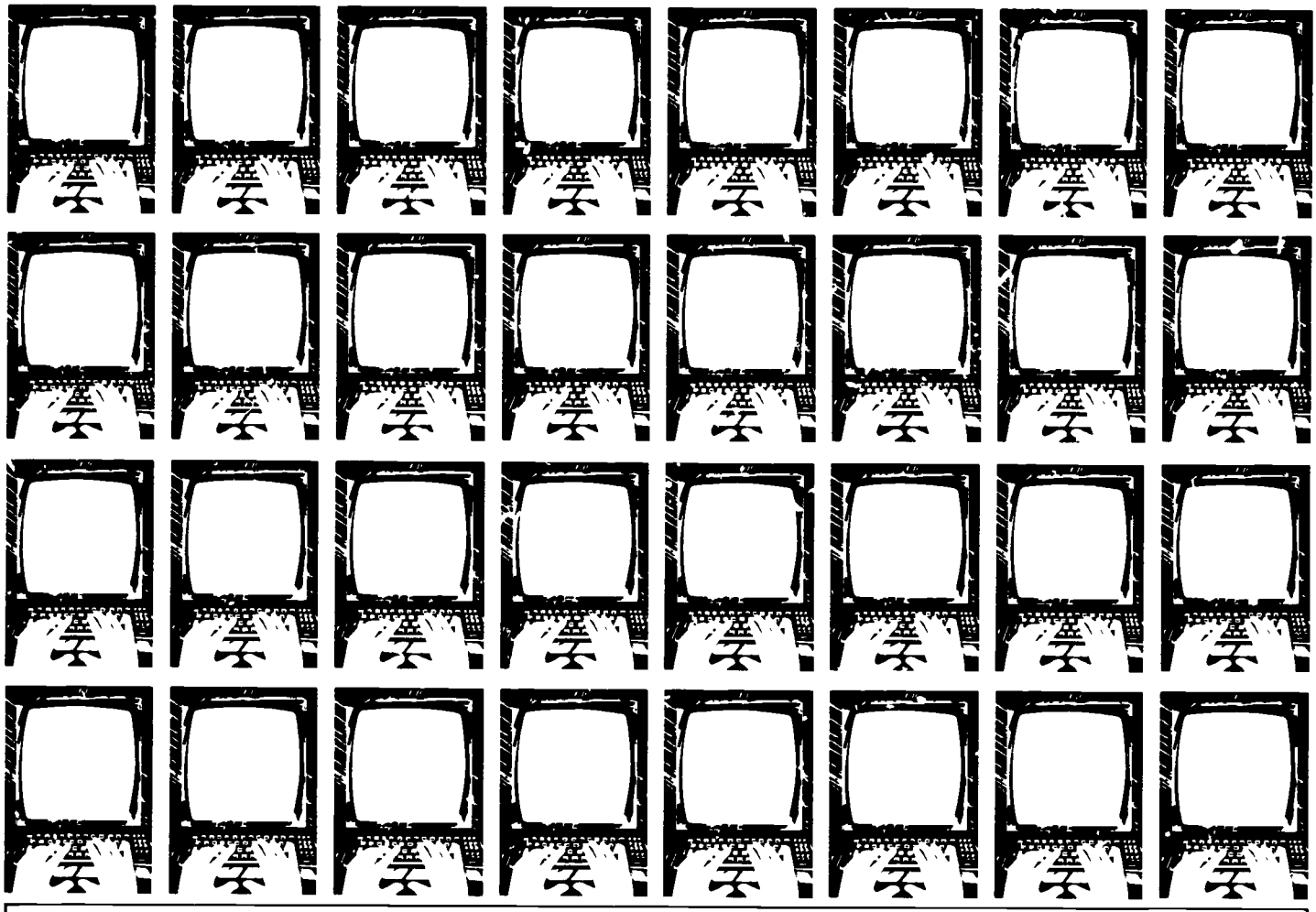

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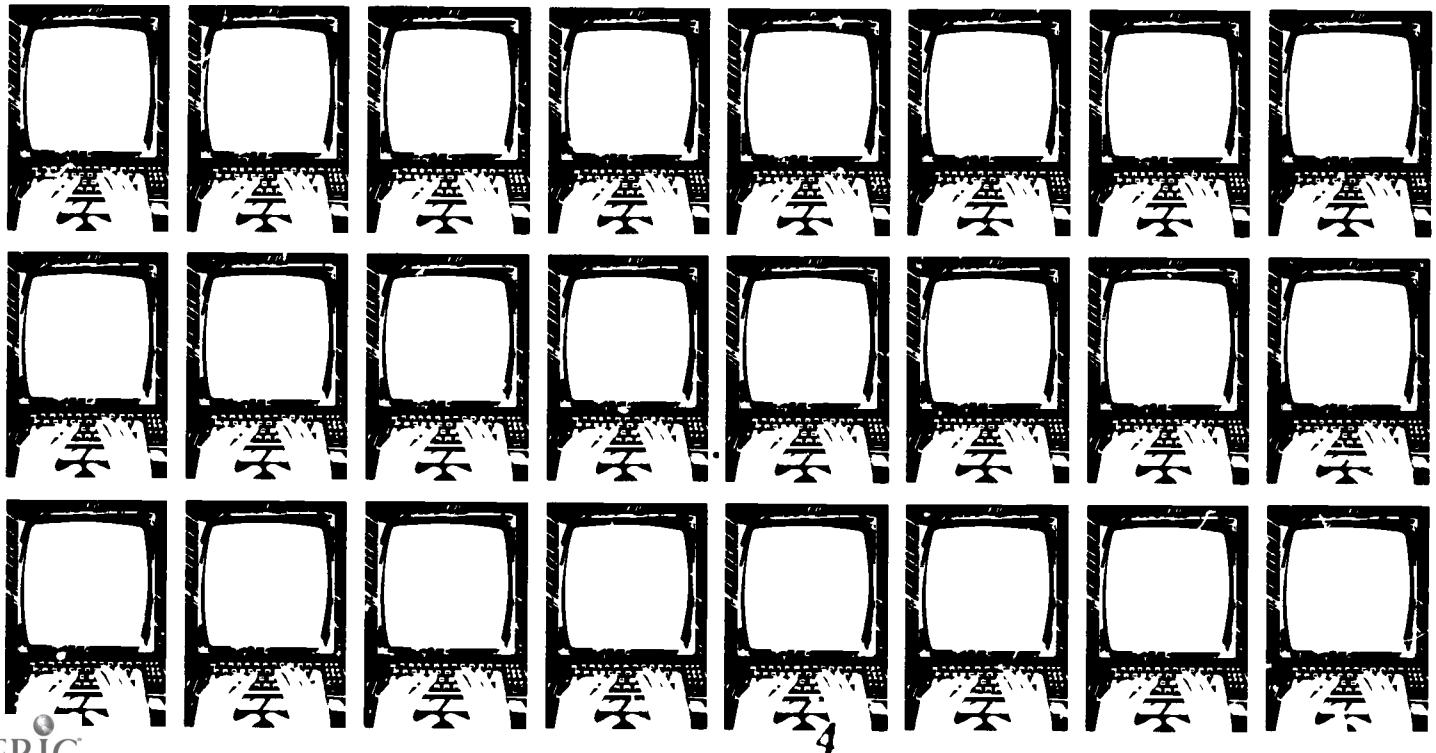

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FOREWORD

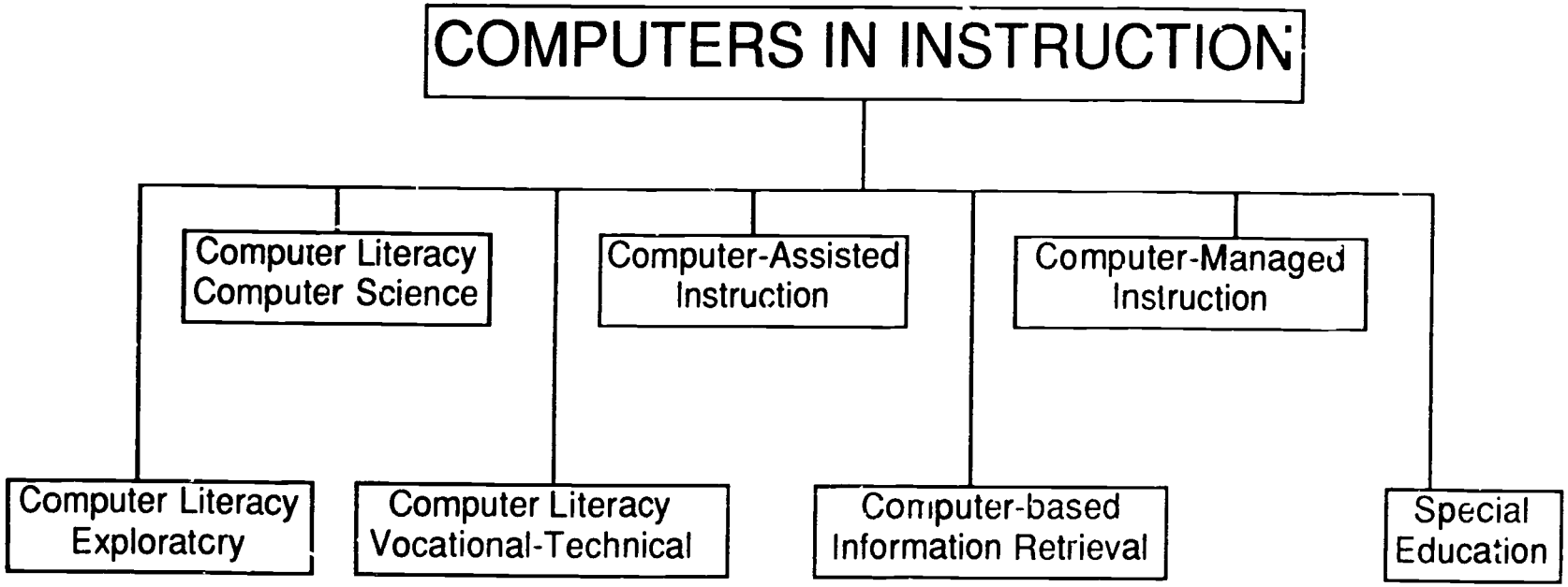
The Computers in Instruction Program has evolved within the context of the Department of Education **Plan for Computers in Education**. This document, **Computers in Instruction Plan,** supersedes the Computers in Instruction sections of the original **Plan for Computers in Education** and represents the framework within which the Department will continue to plan and develop the use of computers and computer-related technologies in instruction and instructional support.

Many aspects of the Computers in Instruction Program will continuously be under development. This evolution is inherent in the technology and its applications, and, hence, should be viewed as critical to progress and improvement.

Computers and related technologies are evolving rapidly. Hardware costs have dropped with an increase in power and capability. Computer literacy is being replaced by technology literacy as distinctions among computers, telecommunications and other information technologies blur. As applications of these technologies to education impact on the instructional process, the Department will review and update this document to reflect progress made, and changes resulting from technological advances, Departmental priorities and legislation.

Charles T. Toguchi

Charles T. Toguchi
Superintendent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Computer Science
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DEPARTMENT OF EDUCATION
COMPUTERS IN INSTRUCTION PLAN

EXECUTIVE SUMMARY

The Department of Education **Plan for Computers in Education** established the conceptual framework within which the administrative and instructional applications of computer technology was to be planned and developed. This document, **Computers in Instruction Plan**, supersedes "Chapter 3 - Computers in Instruction" of the **Plan for Computers in Education** and represents the Department's plan for the use of computers and computer-related technologies in instruction and instructional support.

Background

The original **Plan for Computers in Education** identified four major areas for the Computers in Instruction Program: 1) computer literacy, 2) computer-assisted instruction, 3) computer-based information retrieval and 4) computer-managed instruction. The area of computer literacy consisted of three components: exploratory computer literacy, computer science and vocational-technical education. Priority was given to the implementation of the three computer literacy components.

Since the development of the **Plan for Computers in Education**, computer use at the school level increased dramatically from a limited number of schools with computer-related programs to all schools throughout the state. The rapid expansion of computer programs has been supported by the acquisition of microcomputers, development of curriculum and course guides, provision of inservice training and the assignment of state, district and school personnel to plan and deliver computer education programs. Funding for these programs has included discretionary school priority and other general funds, federal funds and private donations.

Current Situation

Currently, all schools have acquired microcomputers to initiate and expand computer-related programs for their students. Schools are in a transition from teaching the same computer literacy unit to all students to a more sequential curriculum in which simple skills are taught in the early grades, followed by a progression of increasingly complex skills and knowledge. Emphasis is on integrating the use of computers into the regular curriculum areas and classroom activities.

Computer technology represents an array of tools that can be used to 1) deliver, 2) support and 3) manage instruction. Delivery of instruction through computer-assisted instruction provides an environment in which students learn in an interactive mode using drill and practice, tutorial, simulation and problem-solving software. Computer technology is being used to support instruction in a variety of applications which enhance the learning process, including the automation of routine tasks, the incorporation of problem-solving activities and the acquisition and analysis of data. The management of instruction through the use of computer technology will assist teachers, school administrators, district and state personnel in planning for more effective and individualized instruction.

Descriptions of the current and emerging uses of computer technology in the Computers in Instruction Program are provided in this plan. Goals and directions for each of the four areas, computer literacy, computer-assisted instruction, computer-based information retrieval and computer-managed instruction, as well as each of the three computer literacy components, exploratory, computer science and vocational-technical education, have been developed. Uses of computers for students with special needs are also described.

The expansion of computer use into the curriculum has created a need for increasing the number of microcomputers in schools and the provision of inservice training and assistance to teachers in using the computer as a tool for acquiring, displaying, analyzing, synthesizing and interpreting information.

Proposed Approach

Computers and related technologies are evolving rapidly. Hardware costs have dropped with an increase in power and capability. "Computer" literacy is being replaced by "technology" literacy as distinctions among computers, telecommunications and other information technologies blur. (**Uses of Computers in Education**, Educational Turnkey Systems, Inc., April 1985.)

Consequently, many aspects of the Computers in Instruction Program will continuously be under development. This evolution is inherent in the technology and should be viewed as critical to progress and improvement. This plan will be reviewed and updated periodically to reflect progress made, and changes resulting from technological advances, Departmental priorities and legislation.

The implementation requirements identified in the subsequent chapters all focus on the need for a **coordinated** effort on the part of the Department to:

1. Address the issue of instructional, not only computer, technology in improving student learning.

2. Work toward reducing the paperwork and regulatory procedures involved in the hardware acquisition process.

3. Encourage the pilot use of the application of new technologies to enhance the instructional process in all curricular areas.

4. Support the acquisition of equipment and provision of training for all areas of the computers in instruction program.

5. Provide ready access to assistance, both technical and curricular, to encourage the use of computer and related technologies to deliver, support and manage instruction.

6. Develop avenues for the systematic sharing and dissemination of information about the uses of computer and related technologies within the Department.

COMPUTERS IN INSTRUCTION OVERVIEW

INTRODUCTION

The original Department of Education **Plan for Computers in Education** was developed by a Task Force convened by the Office of Instructional Services in May 1980. This document has served as one of the most influential sources of guidance for the development of Hawaii's Computers in Instruction Program. The recommendations developed by the Task Force have provided a structure within which plans could be shaped, even in the absence of fiscal support.

The **Plan for Computers in Education** identified four major areas for the Computers in Instruction Program: 1) computer literacy, 2) computer-assisted instruction, 3) computer-based information retrieval and 4) computer-managed instruction. Each of these four areas contributed towards meeting student learning needs through the use of computers in the development and implementation of systematically planned, comprehensive programs. The state plan also described the staff development needs and technical support services required for program delivery.

Since the development of the **Plan for Computers in Education,** all schools have acquired microcomputers to initiate and expand computer-related programs for their students. Priority was given to implementation of computer literacy programs through the exploratory computer literacy, computer science and vocational-technical education components. In addition, pilot studies and expansion programs have been implemented in computer-assisted instruction, computer-based information retrieval and computer-managed instruction. The implementation of the Computers in Instruction Program has been supported by the development of curriculum and course guides, provision of inservice training and the assignment of state, district and school personnel to plan and deliver computer education programs. (See Appendix A.) Throughout the efforts, various Task Forces and committees were convened to insure the broadest input including teachers, University specialists and technological experts.

However, there are many aspects of the Computers in Instruction Program that will continuously be under development. This evolution is inherent in the technology and should be viewed as critical to progress and improvement.

The next steps in program planning include the expansion of microcomputer use in all instructional areas; the individualization of learning to meet student needs; the planning for applications of learning systems resulting from the convergence of microcomputer, telecommunication, interactive videodisc and networking technologies; and the development of strategies for increasing provision of assistance, both technical and curricular, to support instructional programs using these technologies.

ASSESSMENT

Schools are currently in a transition from teaching the same computer literacy unit to all students to a more sequential curriculum in which simple skills are taught in the early

grades, followed by a progression of increasingly complex skills and knowledge. Schools have also begun expansion of computer applications to include other components of the Computers in Instruction Program. This transition, however, will not be simply nor smoothly achieved. In addition, the emphasis on integrating the use of computers into the curriculum creates a need for increasing the number of microcomputers in schools and the provision of appropriate inservice training and assistance to teachers in using the computer as a tool for acquiring, displaying, analyzing, synthesizing and interpreting information.

Schools have identified the hardware acquisition process as a concern, citing the time involved in obtaining approval and the massive paperwork entailed due to regulatory procedures. Activity to streamline these procedures has been occurring to provide some relief to the schools. Equipment acquisition standards for each component have been developed based on current applications. A table displaying these program standards and their aggregate by schools is provided in Appendix B.

The local needs and trends described above are supported by recent national reports on computer education.

- Three factors which promote the expansion of computers in instruction have been identified as: 1) the availability of assistance to teachers in integrating computers into instruction, 2) increased numbers of microcomputers per teacher and 3) provision of staff development. The integration assistance is described as curricular assistance linked to achievement of pedagogical objectives, not the maintenance of machinery or advice in selecting and obtaining courseware. (**Administrative Policies for Increasing the Use of Microcomputers in Instruction**, report prepared for the National Institute of Education by The Rand Corporation, July 1986.)

- The National Task Force on Educational Technology has recommended a goal of one workstation for every ten students and the identification of at least one teacher to serve as a resource for other teachers and to organize and oversee computer programs for the school. (**Transforming American Education: Reducing the Risk to the Nation**, A Report to the Secretary of Education, United States Department of Education, April 1986.)

- The rate of change inherent in the world of computing and its impact on the instructional uses to which computers are put and on the specific skills required to use them are identified as difficulties facing the development of an orderly curriculum. Nevertheless, computer competence, the ability to discover and use information, is referred to as the fourth basic skill by the National Assessment of Educational Progress (NAEP), in its recent publication, **A Framework for Assessing Computer Competence: Defining Objectives.**

- In special education "training and assistance continues to be a major bottleneck constraining effective use of microcomputers and related technologies." In addition, "the greatest need for information, training and assistance are in the areas of communication aids and devices ranging from general information about products and how they can be used." (**Technology for Special Education: A National Strategy**, Education Turnkey Systems, February 1986.)

The delivery of the Computers in Instruction Program can no longer be limited to stand-alone microcomputers. The merging of communication and information technologies has the potential of making a significant impact on the mode and manner in which instruction is made available to students. Technological developments in networking, telecommunications, expert systems, and interactive videodiscs are being applied in the delivery, support and management of instruction. Integrating these technologies into the learning environment will require continuous planning which recognizes both the evolving technologies and the needs of a changing society.

Based on these assessments and findings, revisions to the Computers in Instruction program are incorporated in this document. The overall goals, specific objectives, program components and implementation requirements have been revised and updated to reflect linkages to computer-related technologies.

GOALS AND OBJECTIVES

The goals for the instructional use of computers are :

- To develop computer literate citizens who are aware of, appreciate, and understand the functions and impact of computers in daily life; feel confident about using computers; know how the computer can be used as a tool for problem solving and decision making; recognize the limitations as well as the usefulness of computer technology; recognize educational and career opportunities related to the specific and general uses of computer technologies.

- To provide for students, teachers, administrators and program planners some of the instructional support systems needed to facilitate effective instruction. These support systems include computer-assisted instruction for subject areas, computer-managed instruction for student record-keeping related to competency-based education, information retrieval from local, national and international databases and networks, and the provision of support for end users in the Department.

A critical component for both goals is provision of training and assistance in the selection of optimal ways to deliver computer-based instruction to students and coordination of computer activities with ongoing classroom activities.

The objectives of the Computers in Instruction Program are to provide opportunities for:

- Developing technological understanding and skills in order that all students may be better able to function in an information society.

- Developing proficiency in using computers and related technologies in school, society and the workplace.

- Improving the learning of concepts and processes in curricular areas through the application of computer and related technologies.

- Providing curricular assistance to link computer activities with ongoing instruction.

- Gaining proficiency in applying computer systems for problem solving and decision making.
- Using current and accurate career information in career planning activities for students.
- Using increased numbers of library resources in fulfilling instructional assignments for students.
- Developing the skills for accessing and retrieving information in fulfilling instructional assignments.
- Enabling handicapped students to interact with their environment in the process of learning and communicating.
- Accessing local, national and international databases to obtain current and comprehensive information needed by and school, district and state personnel for program planning and curriculum development.
- Assisting in the diagnosis and evaluation of individual student progress toward the desired outcomes and in the maintenance and reporting of student progress records for teachers.
- Training in the planning and implementation of the use of computers in instruction for teachers, as well as other appropriate school, district and state certificated and classified personnel.

Responsibility for the development and installation of the curriculum for computers in instruction is lodged with the Office of Instructional Services. Purchase of hardware and related products and the linkage to the Department's Distributed Information Processing and Information Resource Management (DIPIRM) Plan are coordinated between the Office of Instructional Services and the Information Systems Services Branch, Office of Business Services.

PROGRAM DESCRIPTION

Computer technology represents an array of tools that can be used to 1) deliver, 2) support and 3) manage instruction. Each of these three applications of computers consists of one or more components which are closely related to the others and together reflect the total program of instructional use of computers.

Delivery

Computer-Assisted Instruction (CAI)

Computer-assisted instruction is a learning environment in which the computer delivers instruction to the student in an interactive mode using drill and practice, tutorial, simulation and applications software. The goal of CAI is to improve student achievement

in curricular areas by delivering instruction through the computer for enrichment, reinforcement or remediation. CAI delivery interfaces with other technologies, such as telecommunications, and other components of the Computers in Instruction program, particularly computer-managed instruction.

Planning for delivery of CAI through distance learning has been initiated. The implementation of distance learning programs necessarily merge computer and communications technologies.

Support

Computer Literacy

The area of computer literacy consists of three components: Exploratory Computer Literacy, Computer Science and Vocational-Technical Education. Computer literacy instruction provides students with an understanding of the capabilities, limitations, applications and impact of computers and related technologies. More recent emphasis, both locally and nationally, is that of developing the ability to use computers as a tool to solve significant and interesting problems.

Based on the recommendations of the Task Force that developed the **Plan for Computers in Education**, priority was given to implementation of computer literacy programs through the exploratory computer literacy, computer science and vocational-technical education components.

In 1984-85 another task force was convened to address the problems and concerns related to the delivery of the computer literacy programs at the secondary level. The task force was composed of secondary school teachers and administrators, university personnel and district and state specialists. Three recommendations were made: 1) all students be provided computer experiences to meet the minimum requirements of exploratory computer literacy by the end of grade 8; 2) elective computer education courses be included in the **Authorized Courses and Code Numbers (ACCN)**; and 3) delivery of the three components of computer literacy be differentiated by the computer applications incorporated into the particular subject area unit or course. In addition, implementation guidelines and alternative models were developed to provide secondary schools with the flexibility in determining the delivery of their own computer literacy programs. These guidelines and models are provided in Appendix F.

A description of each of the the three components of computer literacy is provided below:

Exploratory Computer Literacy

Exploratory Computer Literacy is a thematic area of the curriculum, with its delivery in the classroom designed for interfacing with all regular subject areas. The use of computers in this component is based on four modes to support instruction. These modes are the use of the computer as a tutor, tutee, tool and topic. In the evolution of this component, the use of the computer as a tool has become increasingly significant in expanding computer applications in education. Moreover, specialized applications of computers have begun to impact on the way in which tasks are accomplished in areas such as newswriting and science labs.

Computer Science

Computer Science encompasses the collection of technical skills and scientific methodologies that can be brought to bear on the creation of computer-based solutions to real problems. The ability to write well-structured programs using a high-level language empowers users to make use of the computer as their ultimate tool for solving problems.

Vocational Technical

Vocational Technical Education is designed to develop the skills and knowledge necessary for using the microcomputer as a tool for end products and for accomplishing job tasks related to the specific career field.

Computer-based Information Retrieval (CIR)

Computer-based information retrieval focuses on the use of computers as a tool to access information at remote sites to support student learning. Telecommunication capabilities and other evolving technological developments will enable students and educators, regardless of school location or size, to access and use resources available through local, national and international databases to meet the advanced as well as expanding informational needs of students and educators.

Special Education

Special education is designed to meet the individual educational and related service needs of handicapped children ages 3 to 20. Computers and adaptive devices are tools to enable handicapped students to more fully communicate and learn to achieve greater independence.

Management

Computer-Managed Instruction (CMI)

Computer-managed instruction is a computer-based information system used to support the management functions performed by the teacher. A CMI system should provide student progress information at the appropriate time and place to assist teachers, administrators, district and state personnel in planning for effective instruction. The database established should also be accessible for administrative decision making.

Computer-management systems facilitating on-line communication between classroom, district and state for learner objectives, student recordkeeping and monitoring have been proven to save time for more quality educational programs and provide equal opportunity to students, regardless of geographic location.

The Special Education/Special Services Data Management and Reporting System (DMRS), including computer-assisted development of Individualized Education Programs (IEP), is designed to facilitate student recordkeeping, instructional management and individualized instruction to meet federal regulations.

TARGET POPULATION

- Approximately 165,000 students, pre-K to adult, in Hawaii's public schools.
- Teachers of grades pre-K to 12, and other school personnel.
- School, district and state level managers responsible for planning and implementing programs affected by the components of computers in instruction program.

IMPLEMENTATION REQUIREMENTS

Critical to the implementation of the Computers in Instruction program is the need for extensive inservice training on both computer use and its integration into the curriculum, the availability of assistance and support for linking computer activities to ongoing classroom instruction, a sufficient number of microcomputers and the identification and acquisition of quality software.

An emerging need is the development of a clear, supportive communication system to unite all DOE efforts in the area of instructional technology. The merging of computer and communications technologies in this information age makes current delineations and multiple-layered review and regulations obsolete. The recent initiative in distance learning programs creates an immediate need to review and coordinate efforts in implementing instructional technology.

Curriculum Development

Curriculum development to support the computers in instruction program includes the development of curricular and instructional support materials for each of the components. Effective use of computers to deliver, support and manage instruction will require linkages to content area objectives, development of a database of instructional activities, strategies and resources to meet learner objectives and utilities to measure and analyze student performance toward specified objectives.

Inservice Training

Inservice training of teachers, other school personnel, administrators and program managers is recognized as a critical factor in the implementation of computers in instruction. The effective use of computers in instruction requires that educators be well versed in the knowledge, skills and processes relevant to using computers to deliver, support and manage instruction. The Department's Computer Literacy Teacher Inservice Training Model identifies goals and outcomes for the development of computer literate educators. (See Appendix I.)

Delivery of the Department's inservice training program consists of two avenues: services provided by each district and school, and statewide services provided to interested educators in specialty areas. The Department's Professional Development Center in the Office of Instructional Services provides specialty training including:

- Cadre training for newly developed components or guides.
- Content-specific training in relation to the integration of computers in instruction in the various general education curricula.
- Generic applications of computer packages for the assessment and improvement of instruction and curriculum.
- Computer applications for improving instructional and administrative decision making.

As emerging technologies are incorporated in the various areas of the computers in instruction program, training in their u · must also be provided.

Curricular Assistance

In addition to provision of inservice training, routine assistance to teachers in integrating computer applications into instruction is essential to facilitate the widespread use of computers in the instructional areas. This assistance must be readily available to help teachers plan and deliver computer activities that are linked to and coordinated with their instructional objectives as well as facilitate the instructional management functions necessary to monitor student progress. Expanded use of computers in curricular areas has the potential for exposing more students of all abilities to more advanced applications.

Avenues for provision of assistance to teachers in integrating computer applications into the curriculum include:

- A coordinator/resource at each school.
- A Teacher Information/Support Center in each district.
- A Teacher Information/Support Center at the state level.

Software

Assistance in identification of quality software to deliver and support instruction is available from a variety of sources. The Department's **Approved Instructional Materials (AIM)** document includes software approved for purchase by curricular areas. Evaluations of software provided in the **AIM** are included in a computerized database available at all district offices and the Professional Development Center.

The Department's Computer Review Center and Clearinghouse, situated in the Multimedia Services Branch of the Office of Instructional Services, provides software evaluations conducted locally via individual inquiries and its **Computer Software Reviews** document. The center also provides opportunities for teachers and administrators to preview software prior to purchase decisions and administers the Department's membership in the Minnesota Educational Computing Consortium (MECC).

Software evaluations and rankings are also provided by several nationally recognized institutions and consortia, through print and electronic media. Software evaluated as

excellent by several of these sources could serve as a mechanism for identifying and selecting packages for more careful evaluation and matching to learner objectives.

The use of computers to manage instruction will require some in-house software development where linkage to the Department's administrative applications is necessary or in specific applications for improving instructional and administrative decision making. Development of software for specific applications would be based on standardized, commercially available packages.

The rapid change in software development and the volume of new software require the coordination of these efforts and the dissemination of information to teachers on quality software that is consistent with the Department's curriculum. Developments in the delivery of software, such as through communications, videodisc or CD-ROM technology, will also impact on instructional computing.

Hardware

National studies consistently support the need for providing a sufficient number of microcomputers. The Rand Corporation report cites "making more microcomputers available to teachers is the single policy mechanism with the greatest value for increasing teachers' participation." The report of the National Task Force on Educational Technology recommends a goal of one workstation for every ten students.

The Department of Education has developed desirable standards for each of its computers in instruction components. As an aggregate these standards approximate the one to ten ratio recommended by the National Task Force on Educational Technology for both elementary and secondary schools. Schools should be allowed the flexibility of acquiring hardware with established ratios as a guide, not a limit, for delivering all components of the computers in instruction program. (See Appendix B.)

However, it should be noted that the National Task Force on Educational Technology specified workstations, not microcomputers, in its recommendation. Computers in instruction programs can no longer be restricted to stand-alone microcomputers, but should address the impact of developing technologies. Flexibility in permitting the pilot use and evaluation of developments in networking and telecommunications, for example, is necessary for accommodating the continually evolving technologies and their impact on schools, society and the workplace.

Moreover, the merging of communications and computer technologies to acquire, store and disseminate information has begun to revolutionize the world of work. Regulations for the acquisition of equipment must be made more flexible to allow the application of these emerging trends to enhance the instructional process.

As the inventory of microcomputers and related equipment increases, the repair, maintenance and replacement needs must be addressed systematically. These needs include funding and personnel resources necessary to maintain on-going programs.

Facilities

The use of a computer resource center is the proposed approach for program implementation, except in specialized applications. Educational specifications for the computer

resource center have been established and are included as Appendix C. If environmental conditions affect hardware operations and software maintenance, schools may justify the need for air conditioning the computer resource center. The number of centers will be determined by the size of the school, with each center functionally able to service multiple programs and strategically located on the campus to insure accessibility to students. These centers would also be used for inservice training. The resource center approach would provide for:

- optimum utilization of hardware through shared use.
- maximum security and control during and outside of school hours.
- appropriate supervision with increased accessibility to all students.
- favorable facility and environmental conditions for hardware and software maintenance.
- regular diagnostics and maintenance of equipment.

Specialized applications of computers in instruction may entail rearrangement and/or expansion of existing facilities. These applications include:

- Career resource centers, for which educational specifications have been established and are included as Appendix D.
- Computer-based information retrieval in school libraries.
- Microcomputer-based laboratories in the school science labs.
- Microcomputer applications in newswriting, journalism and yearbook classes.

As emerging technologies are incorporated in the various areas of the computers in instruction program, facility requirements for accommodating the necessary equipment must be developed prior to implementation.

EVALUATION PLAN

The evaluation of the Computers in Instruction Program will consist of both formative and summative evaluation.

Formative Evaluation

The formative evaluation will be conducted annually and provide information for necessary revisions in the plan as it is being implemented. This evaluation will focus on equipment, inservice training, staffing, curriculum, software and other support materials, budget and the plan itself. Considerations under each of these categories will include the following:

Equipment

- Is the capacity of the equipment sufficient for the intended purpose?
- Are there sufficient numbers of minicomputers, microcomputers and terminals for student and staff access?
- What is the average replacement cycle for in-place equipment?

Inservice Training

- Are the inservice training models for the various target groups effective? (Managers, clerks, instructors, content, schedule, etc.)
- Is participation among various target groups sufficient?

Staffing

- Are there sufficient staff at individual schools to accommodate student interest and enrollment in the various courses and services?
- Are qualified resource personnel available to individual schools and districts to provide curricular assistance to teachers when needed?
- Are qualified staff available to meet the needs for the various components of the Computers in Instruction Program?

Curriculum, Software and Other Support Materials

- Does the curriculum software contribute to the Foundation Program Objectives and/or other instructional objectives?
- To what extent do the software and supporting materials provide instructional activities not available by other means?
- To what extent do the software and supporting materials provide instructional activities better than by other means?

Budget

- Are cost projections realistic?
- Are there other budgetary needs that were not anticipated in the plan?
- Is lease or purchase of equipment more cost-effective?
- What is the most cost-effective way of providing equipment maintenance?

- What is the progress toward attainment of the goals and objectives for Computers in Instruction?
- Are there other alternatives that need to be considered?
- Are there sections of the plan that require revision based on experience or advances in technology?
- What problems are being encountered in implementation of the plan?

Summative Evaluation

The summative evaluation design will incorporate all changes made as a result of the formative evaluation. The goals, objectives and outcomes specified in the plan serve as the basis for the evaluation design. Other pertinent information obtained from program evaluations will also be incorporated. Consideration will be given to variances due to geographical location, equipment, grade levels, instructional delivery strategies, teacher preparation and other school related variables.

EXPLORATORY COMPUTER LITERACY

INTRODUCTION

In the original Department of Education **Plan for Computers in Education**, exploratory computer literacy is one of three components in the area of Computer Literacy. The other two components are computer science and vocational-technical education.

The intent of the exploratory computer literacy component is to develop computer-literate students who can function in a society where contact with computers is becoming a daily necessity. Development of this component has been based on the Exploratory Computer Literacy Framework for grades K-12, developed by a Task Force composed of educational specialists and teachers from elementary, secondary and college levels in the private and public sectors. (See Appendix E.)

Exploratory computer literacy is a thematic program for all students in grades K-12. As its delivery in the classroom is designed for interfacing with all regular subject areas, planning must identify delivery strategies to minimize duplication of effort and maximize concept development and reinforcement among teachers and grade levels.

Since the development of the **Plan for Computers in Education**, all schools have implemented exploratory computer literacy programs. The implementation of exploratory computer literacy has been supported by the development of curriculum and course guides, resource units and extensive inservice training based on the Department's four-phase inservice training model which takes teachers from initial hands-on experiences to classroom implementation. At the high school level, delivery of hands-on experiences to seniors was supported by the Exploratory Computer Awareness Interim Program (ECAIP), initiated in 1983.

Skills and knowledge required for computer literacy will continue to evolve as the technology and its application to school, the workplace and the home develop. Current trends indicate an increasing emphasis on being able to use the computer as a tool for acquiring, displaying, analyzing and interpreting data in the regular curriculum areas. In addition, the integration of related technologies such as telecommunications and interactive videodisc in the development of systems for training and learning will continue to impact on the evolving definition of computer literacy.

ASSESSMENT

The National Assessment of Education Progress (NAEP) booklet, **A Framework for Assessing Computer Competence: Defining Objectives**, describes the majority view of computer competence, for most students, as requiring "an exposure to computing that enables them both to experience the power of computing and to use that power to solve significant and interesting problems." Based on its assessment, NAEP developed objectives in three major categories: computer applications, computer science and knowledge and attitudes. The exploratory computer literacy program encompasses all of these areas, with greater emphasis on computer applications and knowledge and attitudes. Computer

science concepts are introduced, but are further developed through the specialized computer science component at the secondary level.

The emphasis on developing the ability to use computers for a variety of purposes is reflected in the **SchoolTechNews** article, "New View of 'Computer Literacy' Emerging." This December 1984 issue includes opinions of nationally recognized leaders in computer education. The view expressed by the experts in this article is that: "The emerging--and probably final--definition says computer literacy is knowing how to use the computer as a tool." That is, a computer literate student should know how to do something useful with computers. One way to develop the understanding and skills necessary is through the routine use of computers throughout a student's school experiences. Some experts feel that in three to five years, computer literacy will not be taught as a separate subject.

The description of the exploratory computer literacy program in this chapter reflects the emerging emphasis on using the computer as a tool. Exploratory computer literacy has been developed as a thematic program for all students in grades K-12. Since its delivery in the classroom is designed for interfacing with all regular subject areas, strategies for integrating the use of computers into the ongoing classroom activities for acquiring, displaying, analyzing, synthesizing and interpreting information must be provided. Moreover, specialized applications of computers as tools to enhance learning are emerging in areas such as art, music, journalism and laboratory science.

The **Exploratory Computer Literacy Curriculum Guides**, developed for grades K-6, 7-8 and 9-12, give direction while providing sufficient latitude for exploration, experimentation and individual growth. Resource units for each of the three levels, including guidelines for school planning, teacher-developed materials and examples of school implementation strategies, have been developed to further assist schools and districts.

At the secondary level, as recommended in the Secondary Task Force Report, two elective one-semester courses have been included in the **Authorized Courses and Code Numbers (ACCN)**. These courses provide one alternative for delivering exploratory computer literacy experiences to all secondary students. Four other implementation options are provided. (See Appendix F.)

GOALS AND OBJECTIVES

The goals of the Exploratory Computer Literacy component are:

- The student will feel confident about using computers.
- The student will know how the computer can be used as a tool for problem solving and decision making.
- The student will be aware of, appreciate and understand the functions and impact of computers in daily life.
- The student will recognize the limitations as well as the usefulness of computer technology.

- The student will recognize the educational and career opportunities related to the specific and general uses of computers.

The Exploratory Computer Literacy Framework (Appendix E) subdivides each of the goals into objectives which are further subdivided into student expectations. The student expectations are statements of competence that students are expected to attain at various benchmarks, in grades 3, 6, 8, and 12.

PROGRAM DESCRIPTION

Exploratory computer literacy is a thematic area of the curriculum. Thematic areas embrace subject matter that is appropriately embedded in more than one of the existing subjects of the school. The **Exploratory Computer Literacy Curriculum Guides** for all three levels, grades K-6, 7-8 and 9-12, provide examples and guidelines for integrating exploratory computer literacy concepts and activities into the language arts, mathematics, science and social studies programs. Exploratory computer literacy is also imbedded in other thematic areas such as career education and environmental education.

The **Exploratory Computer Literacy Curriculum Guides** also describe four instructional modes for developing computer literacy:

- The computer as a **tutor** uses the computer to deliver instruction to students through interaction with software programs such as drill and practice, tutorials, simulation and problem solving.
- The computer as a **tutee** enables students to write their own programs using a programming language to solve problems in various areas.
- The computer as a **tool** enables students and teachers to use the computer in a variety of applications in acquiring, displaying, analyzing, interpreting and presenting information.
- The computer as a **topic** deals with instruction in the mechanics of computers, how they function and, most importantly, the impact of computer use on self and society.

All four instructional modes can be used to provide students with the learning experience necessary for developing computer competence. Greater emphasis has been given to the use of the computer as a tool as software development in this area has evolved to support this application.

TARGET POPULATION

- All students (approximately 165,000 students) in grades pre-K to 12 in Hawaii's public schools.
- Teachers of grades pre-K to 12, and other school personnel.

- School, district and state level managers responsible for planning and implementing programs affected by computer applications.

IMPLEMENTATION REQUIREMENTS

Critical to the expansion of exploratory computer literacy programs in the schools is the need for extensive inservice training on both computer use and its integration into the curriculum, the availability of assistance and support for using computers to enhance ongoing classroom instruction, acquisition of a sufficient number of microcomputers for use by all teachers and the identification and acquisition of quality software. Commitment from school administrators, and district and state specialists is needed to support this expansion through articulation of plans for computer use and provision of technical support and readily available assistance.

Curriculum Development

As the emphasis in exploratory computer literacy becomes one of developing the ability to use computers as a tool, models for integrating computer activities across the curriculum areas must be developed. The initial developmental effort focused on the four content areas of language arts, mathematics, science and social studies. As computer applications in these areas evolve, instructional support materials must be developed and disseminated. Developmental efforts must also be initiated in coordination with specialists and teachers in other content areas to expand the use of computer technology and, hence, computer literacy experiences for all students.

Inservice Training

Inservice training of teachers, administrators and program managers is identified as an essential factor in the expansion of computer literacy programs. A July 1986 report prepared for the National Institute of Education by the Rand Corporation. **Administrative Policies for Increasing the Use of Microcomputers in Instruction**, cites the need for extensive inservice training to expand the instructional use of microcomputers by more teachers for more subjects in more grade levels.

The Department's Computer Literacy Teacher Inservice Training Model for the development of computer literate educators is included as Appendix I, as well as Appendix E in **Computers in Instruction: Framework for Administrators**. In addition, specialty training in relation to the integration of computers in instruction in the various general education curricula is being provided.

Curricular Assistance

The provision of curricular assistance to teachers in determining ways to link computer activities with ongoing instruction is critical to the use of computers by more teachers in more content areas in all grade levels. This assistance must be readily available to teachers to encourage and support the integration of computers.

Currently, resources for this type of assistance are extremely limited. Statewide efforts must be made to develop resources, including the provision of follow-up assistance to

schools and teachers, in the integration of the exploratory computer literacy component into the curriculum.

While inservice training workshops and courses provide opportunities to address teacher needs, the provision of assistance in a timely manner has not been possible within current resources and staffing. Expansion of exploratory computer literacy programs to all students will require provision of support to teachers who feel apprehensive about initiating new programs. Resources to provide the necessary on-site support must be available at the school, district and state levels. The assignment of a computer coordinator/resource to each school is also a critical factor identified in studies of successful and effective implementations of computer programs. As the Exploratory Computer Awareness Interim Program (ECAIP) is phased out, the ECAIP district resource teachers currently providing direct services to students will begin to provide some of the support and assistance being requested by teachers and principals.

Software

Assistance in identification of quality software is available from a variety of sources. Software evaluations and rankings provided by several nationally recognized institutions and consortia have been and will continue to be provided to each district office. The **Approved Instructional Materials** includes software recommended by content areas. A computerized database of software evaluated for inclusion in the **AIM** is available at all district offices and the Professional Development Center. The Department's Computer Review Center and Clearinghouse provides information on software evaluations conducted locally via individual inquiries and the **Computer Software Reviews** document.

Curriculum guides and resource units provide a recommended list of software as well as guidelines and sample lessons for linking the use of available software packages into the regular curriculum. Software development has not been required for this component.

Hardware

The Rand Corporation report states that its "results show clearly that technology is used more widely as it becomes more available." The increased availability of hardware reflects administrative commitment and simplifies the use of microcomputers for instruction for teachers.

A Pepperdine University study of the $8 million IBM Model Schools Program also identified the accessibility of computers to teachers and students as one of ten "critical success factors" in effective implementations. The study also found that successful schools kept at least 15 machines in one lab. This configuration enables a typical class of 30 to use the equipment with a minimum of two students per computer, or half the class to be scheduled at one time, with a machine for each student. In addition, the study found that an open access policy to computers and locating computers adjacent to classrooms promote effective implementation.

In a survey conducted by Quality Education Data (QED), the student-to-computer ratio in public schools, grades K-12, is 38 to 1 for the 1986-87 school year. According to this survey, Hawaii had the highest state ratio of 86 students to 1, while Alaska had the lowest with 17 to 1. The national student-to-computer ratio has been reduced over the years with QED surveys indicating a 51 to 1 ratio in 1985-86 and a 125 to 1 ratio in 1984-85.

Based on these studies and surveys, each school is projected to be equipped with at least one lab of 16 microcomputers to facilitate scheduling and instruction. Schools with larger enrollments incorporating the use of computers throughout its curriculum will require additional equipment according to established ratios. (See Appendix B.)

While current applications use stand-alone microcomputers, developments in networking and telecommunications indicate the need for flexibility in accommodating the applications of these evolving technologies and their impact on schools, society and the workplace.

Facilities

The computer resource center is the proposed approach for program implementation, except for specialized applications. Educational specifications for the computer resource center have been established and are included as Appendix C. The number of centers will be determined by the size of the school, with each center functionally able to service multiple programs and strategically located on the campus to ensure accessiblity to students and teachers.

Specialized applications of computers in instruction may entail rearrangement and/or expansion of existing facilities. These applications include microcomputer-based laboratories for science and desktop publishing in journalism classes.

EVALUATION PLAN

Evaluation of the exploratory computer literacy component will include annual review and analysis of data available from:

- Collection of ACCN and Master Scheduling information and computer projects implemented through special programs such as Instructional Resource Augmentation (IRA) and Primary Instructional Needs of Intermediate Schools (PIN).

  How many schools offer computer literacy programs and courses? How many students are serviced? How many students successfully complete these courses and programs?

  Are there sufficient trained staff at individual schools to accommodate student interest and provide computer experiences for all students?

- Evaluations of inservice training courses and workshops.

  Are inservice training courses effective? Is teacher participation in these workshops and courses sufficient?

- Feedback from receiving schools and post-high school institutions.

  Are students adequately prepared to meet expectations of receiving schools? How successful are high school graduates enrolled in post-high school courses in which computer use is a prerequisite?

COMPUTER SCIENCE

INTRODUCTION

Computer science is one of three components in the area of Computer Literacy. The other two components are exploratory computer literacy and vocational-technical education. The computer science component is an elective program primarily for grades 9-12 with instructional delivery primarily through mathematics and science programs.

Computer Science encompasses the collection of technical skills and scientific methodologies that can be brought to bear on the creation of computer-based solutions to real problems. A particular programming language is used as a vehicle for implementing computer-based solutions to particular problems, but the language is not the focal point of the course. Emphasis in computer science is to provide students with a conceptual background in computing and computer sciences to enable students to apply the concepts in solving problems.

Since the development of the **Plan for Computers in Education**, the majority of high schools have implemented elective courses in computer science. Several high schools offer the Advanced Placement Computer Science course. The implementation of the computer science program has been supported by the development of three course guides and extensive inservice training in the teaching of computer science concepts using BASIC and Pascal.

The discipline of computer science has been evolving over the past several years and will continue to change. Consequently, computer science courses must reflect these changes as new concepts and machine capabilities evolve and are made appropriate parts of these courses. The growing interest in logic programming and its role in artificial intelligence developments, for example, will impact greatly on the need for continual curriculum development, inservice training and curricular assistance to teachers. Program planning must also address the acquisition of sufficient hardware with the capabilities necessary to support these new applications.

ASSESSMENT

Efforts in computer science have focused on provision of inservice training and curriculum development. Extensive training on the teaching of computer science concepts using BASIC and Pascal has been provided. The need for training in Pascal was especially critical when Pascal was selected as the language for the Advanced Placement Computer Science Examination. Training activities have been coordinated with university personnel, and public and private school teachers. Course guides for computer science courses have been developed with input from classroom teachers as well as faculty in the Information and Computer Sciences Department, University of Hawaii.

Currently, courses which focus on the academic discipline of computer science are described in the **Authorized Courses and Code Numbers (ACCN)** of the Foundation Program. These include elective courses offered through Computer Education. The use of computers as tools for designing and implementing computer-based solutions in mathematics are offered through Mathematics Education courses.

The majority of high schools offer one or more of these computer science courses. Several schools have initiated the Advanced Placement Computer Science course, which requires the ability to program in Pascal.

A program for selected students, Summer Program for the Enhancement of Basic Education (SPEBE), has included a computer science center since its initial year in 1985. The SPEBE Computer Science Center, primarily for students who have completed their junior year, has been coordinated with the Department of Information and Computer Sciences and the Early Admissions Program at the University of Hawaii at Manoa. The focus of the SPEBE Computer Science Program will be on developing concepts in artificial intelligence and expert systems, graphics and communications beginning in the Summer of 1987.

As the discipline of computer science evolves, there will be a continuing need to support computer science teachers through inservice training, curriculum development, curricular assistance and provision of equipment to support instruction.

GOALS AND OBJECTIVES

The goals of the computer science program and related learner objectives are listed below.

1. The student will demonstrate competence in using computers.

   - Interacts with prepackaged computer programs.
   - Processes information according to a set of pre-defined computer rules: organized, coded, given meaning and transmitted.
   - Develops good programming style in a higher level language such as Pascal. Good programming style includes logical structure, documentation (readability), efficiency, elegance.

2. The student will use the computer as a tool for problem solving and decision making.

   - Selects and uses appropriate data structures to solve problems.
   - Creates and implements algorithms to solve problems.
   - Uses a computation/information system (computer or computer system) to solve challenging problems and make decisions.
   - Uses the computer for information storage and retrieval, simulation and modeling, quality or process control and decision making, computation, data processing.

3. The student will recognize the impact of computers in daily life.

   - Recognizes ethical and social implications of computer use.
   - Demonstrates responsible use of computer systems.

4. The student will investigate educational and career opportunities in computer-related professions.

PROGRAM DESCRIPTION

The computer science component of computer education is primarily for grades 9-12. Its major focus is on developing the knowledge and skills necessary to design and implement computer-based solutions to problems in several areas. Computer science is not intended as vocational training for students seeking entry-level jobs related to computing.

The ability to write well-structured programs using a high-level language empowers users to make use of the computer as their ultimate tool for solving problems. Computer science courses serve as a basis for students to build their own special applications of computers for problem solving and decision making in a variety of circumstances. Programs, however, are not solely a means of communication between the programmer and the computer. For programs to communicate well, they must contain and be accompanied by documentation, describing their purpose, how they are constructed, how they are to be used and any other facets of the program that would aid a reader's understanding.

For students interested in the academic discipline of computer science with focus on programming methodology, algorithms and data structures, elective courses in Computer Education are described in the **Authorized Courses and Code Numbers (ACCN)**. The **ACCN** also includes elective courses through Mathematics Education which focus on designing and developing computer-based solutions to problems in mathematics. In all of these courses, a particular programming language is used as a vehicle for implementing computer-based solutions to particular problems, but the language is not the focal point of the course.

In computer science courses students learn the basic ideas of structured programming to solve problems in a high-level programming language with appropriate algorithms, data structures and control structures. Topics include problem solving, programming methodology, programming languages, computer environments and areas of applications. The minimum laboratory hands-on time required in computer science courses is two hours per week per student to code, test and debug programs.

TARGET POPULATION

The target population is high school students, in grades 9-12, pursuing elective programs in computer science.

IMPLEMENTATION REQUIREMENTS

Resources required for instruction in computer science are extensive. The need for adequately trained teachers in computer science is a national concern. The Association for Computing Machinery (ACM) cites the preparation of computer science teachers as a "critical, immediate goal for teacher training institutions." Facilities must be accessible to students outside of formal class hours to enable students to work alone at a computer coding, testing and debugging programs.

Curriculum Development

As the discipline of computer science evolves, appropriate elements must be incorporated into the curriculum for secondary students. These elements may include new languages, concepts and applications.

Input from university faculty and classroom teachers and emerging national trends as reflected in journals will continue to impact on program planning and delivery in computer science. Continual development of teacher guides, instructional materials and accompanying training and support models will be an integral part of program planning and delivery.

Inservice Training

Well-trained teachers are the cornerstone of effective instruction in a discipline that has been and will continue to evolve. Based on the efforts of the Association of Computing Machinery (ACM), competencies for computer science teachers were identified. These competences include the ability to write and document well-structured programs in several languages and to understand the range of computing topics that are suitable to be taught at the secondary level as well as the justification for teaching these topics.

Development of these competencies involves a tremendous investment of time and resources. The ACM recommendations for a program of study for certification in computer science include the equivalent of 18 semester hours of required courses with an additional 12 semester hours of elective courses. The ACM guidelines also recommend that computer science teachers be competent in three programming languages: BASIC, Logo and Pascal.

Currently, no local teacher training institution offers a pre-service program based on the ACM recommendations. Consequently, the provision of training for inservice teachers who are interested in teaching computer science courses is an immediate and continuing need.

Curricular Assistance

Based on teacher feedback from pilot studies and inservice training courses, assistance in identifying appropriate instructional materials, alternatives for organizing classroom and laboratory activities and technical support in configuring appropriate hardware components to support new applications are essential. The need for assistance is especially urgent for teachers initiating new courses or applications.

While inservice training workshops and courses provide opportunities to address teacher needs, the provision of assistance in a timely manner has not been possible within current resources and staffing. Expansion of computer science courses to all schools will require provision of support to teachers who feel apprehensive about initiating new courses. Resources to provide the necessary on-site support must be developed at the district level. As the Exploratory Computer Awareness Interim Program (ECAIP) is phased out, the ECAIP district resource teachers currently providing direct services to students will begin to provide to computer science teachers some of the essential support and assistance.

Software

The software components of the total programming environment must perform in conjunction with each other to support computer science courses. Utility programs, such as screen editors, are an integral part of the support components needed to provide effective instruction. Access to utilities within the operating system environment to manage mundane tasks permits the student to be more productive. Testing and evaluation of these utility programs on the computer system are necessary to determine response time and interactions within the integrated unit.

Hardware

Hardware needs for computer science courses are extensive. Students will frequently need time for computer use outside of formal class hours, so sufficient machines and flexible access must be provided. Minimum recommended time equivalent is two hours a week per student, alone on the computer. The hands-on time alone on the computer is in addition to instructional time on the computer under the direction of the teacher.

Equipment for computer science courses will require great r capability than those used for exploratory computer literacy programs. The ACM recommendations for computer science courses at the secondary level specify the necessity of microcomputers or a networked system with convenient storage for data and program files and high speed printers. The capability of storing files that can be accessed both by the student and the student's programs is identified as a necessary feature for the Advanced Placement Computer Science Course.

Facilities

Based on the extensive hands-on time required by students in computer science courses, flexible scheduling and access to computers must be provided, preferably in a lab setting. The Advanced Placement Computer Science Course description, as an example, suggests that schools that do not allow computer facilities to be used outside of normal school hours reevaluate this policy. Extending use of computer facilities will impact on staffing for security and supervision.

EVALUATION PLAN

Evaluation of the computer science component will include annual review and analysis of data available from:

- Collection of ACCN and Master Scheduling information.

  How many schools offer computer science courses? How many students are enrolled in these courses? How many students successfully complete computer science courses?

  Are there other courses that need to be offered? Should any existing courses be modified or deleted?

Are there sufficient trained staff at individual schools to accommodate student interest and enrollment in computer science courses?

- Evaluations of inservice training courses and workshops.

  Are inservice training courses effective? Is participation among computer science teachers sufficient?

- Feedback from post-high school institutions.

  Are students adequately prepared to meet expectations of receiving institutions? How successful are students enrolled in computer science and related courses?

- Results of the Advanced Placement Examination.

  What percentage of students enrolled in the Advanced Placement Computer Science Course elect to take the test? Of students who participate in the Advanced Placement Examination, what is the distribution of scores?

  How many schools and districts have students participating in the Advanced Placement Computer Science Examination?

VOCATIONAL-TECHNICAL EDUCATION

INTRODUCTION

Vocational-Technical Education is one of three components in the area of Computer Literacy given priority in the original Department of Education Plan for Computers in Education. The other two components are computer science and exploratory computer literacy. Comprehensive vocational-technical computer literacy instruction is delivered primarily through appropriate courses in Business Education and Industrial Education, reflecting changes in the world of work and the advances made by computer technologies on job training needs.

Computer technology developments, however, will have instructional implications in virtually every vocational-technical course, indicating the pervasiveness of the computer in the workplace.

Program planning must address these implications for curriculum development, inservice training, curricular assistance, and hardware needs.

ASSESSMENT

Computer literacy efforts in vocational-technical education have addressed inservice training, curriculum development, and special projects. Inservice training has been conducted through cooperative efforts of the Department, the University of Hawaii, and educational specialists from industry.

A course guide for computer applications in home economics was developed through a project sponsored by the Office of the State Director for Vocational Education and materials developed have been distributed to the field for evaluation.

Courses which concentrate on computer programming, data entry and processing, and computer repair and maintenance are described in the Foundation Program's **Authorized Courses and Code Numbers (ACCN)**. Computer literacy training has also been offered in cases where there was access to computers and where federal vocational education monies were targeted for exemplary program development projects.

In 1985, the Area Vocational Center for advanced computer programming was established at McKinley High School. The objectives of this center are to:

1. provide students with an opportunity to gain advanced knowledge and skills relevant to the needs of the labor market as well as those requirements articulated with post-secondary institutions;

2. improve the cost-effectiveness in view of the limited resources available; and

3. retain the concept of the comprehensive high school and its equality of educational opportunities.

Indications are that the center concept is viable. A recommendation made in the formative evaluation was to "further develop the area vocational center concept so that it will serve the educational needs of a broader range of students." Based on this recommendation, efforts are currently underway to expand the offerings to include desktop publishing and other current applications.

Another 1985 federally funded project "The Microcomputer in Agriculture" explored various computer applications in the vocational-technical agriculture classroom and laboratory. This effort demonstrated the cost-effectiveness of using inexpensive home computers as processors and controllers of mechanical devices, security and atmospheric sensors, and irrigation and electrically controlled production systems.

Currently, the new Carl D. Perkins Vocational Education Act (P.L. 98-524) Part B. "Uses of Funds", sec. 251(a) mandates the use of federal vocational funds only for program improvement and that which stresses the use and implementation of high technology into the curriculum. This restrictive regulation not only precludes the replacement of standard equipment but makes it compulsory for the Department to use the larger amount of federal funds to purchase and implement computer and computer-related equipment in its vocational programs.

GOALS AND OBJECTIVES

The goals of the vocational-technical computer literacy program and related learner objectives are listed below.

1. The student will demonstrate entry-level competence in using computers.

   - Interacts with prepackaged computer programs.
   - Develops fluency in the use of business applications tools to include word processing, spreadsheet projecting, and database management.

2. The student will demonstrate entry-level competence in computer maintenance and repair.

   - Develops skills necessary to maintain and service computers.
   - Develops skills necessary to perform basic trouble-shooting and repair of computers and peripherals.

3. The students will use the computer as a tool for product design, development, and/or manufacturing, and instrument monitoring and/or control.

   - Interacts with prepackaged computer-assisted design (CAD) and computer-aided manufacturing (CAM) programs.
   - Uses the computer to control and manage industrial processes.
   - Uses the computer to produce drawings and designs relevant to industrial standards and practices.

4. The student will investigate educational and career opportunities in computer-related vocations.

PROGRAM DESCRIPTION

The vocational-technical component of computer literacy is primarily for grades 10-12. Its major focus is on developing the knowledge and skills necessary for entry and progression in the labor market or post-secondary job training institutions.

The ability to apply computer technology through the various occupational clusters enables students to extend their productivity and enhance their employment capabilities. Topics covered through the vocational-technical computer education curriculum include word processing, spreadsheet projecting, and database management in the business cluster; repair and maintenance, composite printing, and CAD/CAM in the industrial-technical cluster; remote farm control and management in the agriculture cluster; and nutritional analysis in the food service cluster.

TARGET POPULATION

The target population is high school vocational education students primarily in grades 10-12 pursuing training for chosen occupations in vocational-technical education.

IMPLEMENTATION REQUIREMENTS

The program requires sufficient numbers of computers and related peripheral devices with support services for computer use and curriculum development. Recent research identified computer requirements for the vocational-technical classroom. A January 1987 study by Dr. H Dean Sutphin of Cornell University, "Report on Phase II of a Preservice and Inservice Model for Instructional Applications of Microcomputers," concluded that when a centralized general use computer lab is available, a ratio of one computer per ten students is acceptable in the vocational area classrooms.

Curriculum Development

Technical and occupational change necessitates frequent and continual upgrading and restructuring of the vocational-technical computer education program to provide relevant job training. Program planning will continue to be shaped by input from post-secondary vocational training institutions and from the business and industrial sectors.

Inservice Training

Support to teachers is essential for the delivery of computer literacy instruction. As teacher skill levels move beyond basic literacy, inservice activities will emphasize needs drawn from the business and industrial sectors, as these sources best identify employment training needs. For example, as consumer electronics expands into computers and computer-based appliances, the National Electronics Industry Association provides free workshops for industrial technicians and electronics teachers.

The specialized nature of vocational-technical computer applications makes inservice training a pressing and continuing need.

Curricular Assistance

Meaningful implementation of vocational-technical computer literacy instruction requires assistance delivered from the state and district levels to the school and classroom. Continuing assistance in coordinating software and specialized hardware with curriculum is essential for effective instruction.

Software

Unique to the vocational-technical computer literacy program is the need for software designed specifically for custom applications ranging from remote farm control to routines for drawing architectural plans. Programs of this nature permit the student to work in school environments that replicate the conditions and demands of the business and industrial sectors. Software that enables users from remote work stations to work on programs operating on local work stations will network students, teachers, and administrators on an interactive basis.

Hardware

Equipment acquisition, maintenance and replacement will require a continuing investment of time and money.

Equipment for vocational-technical computer education must be of industry or near-industry standards. Specialized applications like CAD/CAM, composite printing, instrument control and diagnosis, robotics, and computer maintenance and repair require on-site dedicated machines or simulator kits for proper instruction. Peripherals will include plotters, diagnostic sensors, specialized relay boards, and processor and memory upgrades to keep up with advances in software.

The merging of databases and artificial intelligence (AI) systems with localized industrial applications through telecommunications and networking will also result in specialized hardware needs for the vocational-technical laboratory. Modems and phone links will be needed to make this possible.

Facilities

The specialized applications of the vocational-technical laboratory will require linkages with traditional industrial and manufacturing equipment and more current databases. Computers and related peripherals in these instances may require expansion of existing facilites to provide for safe and proper installation and usage.

EVALUATION PLAN

Evaluation of the vocational-technical component will be based on the following data:

1. Results of the Graduate Follow-up Survey and Vocational Education Data Survey (VEDS).

2. Annual vocational program and ACCN monitoring (review of program objectives, specifications, methodologies, and compliance with federal and state laws).

3. Evaluation of inservice activities (kinds of workshops and numbers of participants, input received from the inservice training advisory committees).

COMPUTER-ASSISTED INSTRUCTION

INTRODUCTION

Computer-assisted instruction (CAI) is defined as a learning environment in which the computer presents instructional material to the student in an interactive mode using drill and practice, tutorial and simulation programs. In the original Department of Education **Plan for Computers in Education,** the Task Force recommended that full implementation of CAI be deferred until a study was conducted.

The study was to determine the effectiveness of CAI, with consideration given to cost and the evolving technologies related to delivering instruction through CAI. The CAI study was conducted over two years, 1984-1986, and entailed three areas of review: research literature, field study and local practices. Findings and recommendations are discussed in the CAI Study Report, which was accepted by the Computers in Education Committee in October 1986. Implementation guidelines, sample activities and an initial recommended software list, based on the CAI study, are under development. Recommended software by curricular areas will be included in the **Approved Instructional Materials (AIM)** document.

As schools develop and implement CAI programs, the experience gained is expected to validate or contribute to revisions of the guidelines. Another factor contributing to the need to revise implementation guidelines is the continually evolving technology that supports courseware development. Developments in artificial intelligence techniques, computing environments and interfaces to videodisc and CD-ROM technologies will impact on the manner and mode in which instruction will be delivered in the CAI mode.

ASSESSMENT

The Department's CAI study was based on a review of research literature, a two-year field study and input from local practices in CAI. The major finding from these reviews is that careful prior planning to any implementation of CAI is essential. Specific findings identified in the CAI Study Report are:

- Extensive inservice training on both computer use and software integration must precede implementation. Follow-up support for teachers must also be available. School administrators must be trained to provide curriculum leadership in this area.

- Identification of quality software, and planning for acquisition of sufficient copies of selected software and integration into the regular curriculum must be completed prior to implementation. Use of effective CAI software provides opportunities for students to control the learning process, provides interaction and feedback, and allows students and teachers to establish and attain clearly specified objectives.

- A sufficient number of microcomputers for appropriate hands-on time must be available. Computer time needed for achievement results, according to research

literature, ranges from 12 to 20 minutes per session for 5 days out of 10 in a given subject. Planning for acquisition of microcomputers should also include provisions for equipment set-up and maintenance.

- CAI should supplement, not replace, regular instruction. Integration with regular instruction has proved most effective when used as a supplement. In addition, CAI study results indicate higher or equally positive attitudes towards school.

- Most popularly cited studies indicate that CAI is most effective with elementary students. In the DOE field study, elementary students were the most enthusiastic with virtually no gender differences. In addition, high and low achievers tend to show more gain than average students when CAI is used.

GOALS AND OBJECTIVES

The goal of computer-assisted instruction is to improve student achievement in subject areas by delivering instruction through the computer. The objectives are therefore program objectives for each of the subject areas.

PROGRAM DESCRIPTION

Computer-assisted instruction is a learning environment in which the computer delivers instruction to the student in an interactive mode using courseware developed by others. The original definition of CAI specified the use of drill and practice, tutorial and simulation software. Based on findings from the CAI study the definition of CAI was expanded to include the use of applications software that is integrated into the curriculum. Examples include use of word processing in writing, database management in social studies and graphics in art.

Research results support the use of CAI as a supplement, not replacement, to regular instruction. CAI activities can be used to replace some of the supplemental materials already used by the teacher to provide some of the reinforcement, drill and practice, as well as to provide motivational and challenging simulation and problem-solving situations uniquely suited to computer presentation. Integration with regular instruction has proved most effective. Eventually, the CAI component will be incorporated in each curricular area, along with textbooks and other instructional materials.

CAI delivery interfaces with other technologies and components of the Computers in Instruction program. For example, CAI courseware often includes a computer-managed instruction component to monitor student achievement. Developments in videodisc and CD-ROM technologies are being integrated into CAI courseware. The integration of telecommunications technology with CAI courseware, such as in distance learning, has enabled school districts to provide equal opportunity to students, regardless of geographic isolation.

TARGET POPULATION

The potential target population for computer-assisted instruction is all students in grades pre-K to 12.

IMPLEMENTATION REQUIREMENTS

Effective implementation of computer-assisted instruction will require careful planning at every level of the Department. Efforts at the state, district and school levels should be coordinated to support delivery of CAI to students who can benefit from this learning mode. The Department's CAI Study Report cautions that careful planning prior to any implementation of CAI is essential. This report makes the following recommendations for CAI implementation:

- Inservice training on the proper evaluation, selection and use of software be conducted prior to implementation of CAI. Follow-up support on a timely basis should be made available.
- CAI should be used to augment services provided through special programs, such as Special Education, Chapter 1, Comprehensive School Alienation Program (CSAP), Gifted/Talented (G/T) and Program for Students of Limited English Proficiency (SLEP).
- CAI be used to support basic skills instruction in mathematics and the language arts areas of reading and writing.
- Controlled use of CAI be permitted in other areas, including the use of applications software, such as word processing in writing, database management in social studies and graphics in art.

It should be noted that the examples provided above do not encompass all possible areas for CAI implementation. Moreover, as advances in software development and the technology to support these advances occur, controlled use of CAI using these emerging technologies should be initiated. The Department has initiated planning for a pilot of distance learning as an alternative in its efforts to provide equal educational opportunities for all students.

Curriculum Development

The urgent need in computer-assisted instruction is the need to develop models for integrating software programs into the content areas. Several efforts, notably the California Department of Education's Technology in the Curriculum (TIC) Project, have produced resource materials and teacher training models that could be adapted for use in Hawaii in the areas of language arts, mathematics, science and social studies. Development must be expanded to other areas, such as art and music, as the technology begins to support realistic color, graphics and sound. Planning for curriculum development must also address areas which are becoming increasingly important in our information age.

As technological innovations such as distance learning and networking technologies provide avenues for meeting the needs of individual students, curriculum to support

individualization through these new media must be developed in coordination with program managers.

Inservice Training

Primary among the findings of the CAI study was the need for more teacher training prior to implementation. In-depth training preceding implementation and follow-up training on a timely basis are identified as critical to effective CAI programs. Training should help teachers feel confident about working with computers. In addition, training and assistance in integrating software into the regular curriculum are essential as the goal of CAI is to improve student achievement in all curricular areas.

Training to help teachers develop confidence in working with computers is provided through the Department's Computer Literacy Teacher Inservice Training Model. (See Appendix I.)

Training in the integration of software into the general education curriculum is provided through workshops and courses offered through curricular areas, as well as through coordination between computer education and the various curricular areas.

As emerging technologies are used in delivering CAI through telecommunication, CD-ROM or videodisc technologies, training in their use must be provided.

Curricular Assistance

Experience with efforts to implement computer-assisted instruction, both locally and nationally, identifies the need for the availability of follow-up assistance. Teacher feedback in the Department's field study of CAI indicated that lesson planning to incorporate software demanded a considerable amount of time. Assistance in linking courseware to the curriculum to meet specific objectives is essential for effective CAI delivery.

Currently, resources for this type of assistance is extremely limited. Statewide efforts must be made to develop resources, including the provision of follow-up assistance to schools and teachers, in the integration of CAI into the curriculum. This assistance can be provided by district resource teachers trained to provide appropriate support.

Software

Identification of quality software, and planning for acquisition of sufficient copies of selected software and integration into the regular curriculum must be completed prior to implementation. Use of effective CAI software provides opportunities for students to control the learning process, provides interaction and feedback, and allows students and teachers to establish and attain clearly specified objectives.

Recommended CAI software for language arts, mathematics, science and social studies has been incorporated into the **Approved Instructional Materials (AIM)**. Evaluations of software provided in the **AIM** are included in a computerized database available at all district offices and the Professional Development Center. Additions and updates to the **AIM** will be incorporated annually and expanded to include other areas. The Department's Computer Review Center and Clearinghouse publishes evaluations of locally previewed software through its annual **Computer Software Reviews** document.

The continually changing technology which supports courseware development and the delivery of software, such as communications or CD-ROM technology, will also impact on instructional computing.

Hardware

The equipment aspect of CAI requires a major, on-going investment of time, money and attention. Hardware related concerns include the acquisition of sufficient equipment, the monitoring of setup and maintenance support and slow turnaround of repaired equipment.

Based on research literature, recommended optimum computer time for achievement effects is from 12 to 20 minutes for five days in a ten-day period in a given subject. Extrapolating from this ratio, a school lab could handle ten 30-minute classes per day; thus, 20 classes could be accommodated in any ten-day period.

In addition, the interfacing of CAI delivery with computer-managed instruction to monitor student achievement and telecommunications technology require that the Department evaluate hardware requirements for these and other emerging applications. These include the use of local-area networks, satellite programming and applications of cable television and fiber optic technologies.

Facilities

Computer-assisted instruction can be delivered effectively in a computer lab. The lab approach is recommended, particularly in implementations involving interfaces with other technologies, such as networking and communications, and other components of the Computers in Instruction program, particularly computer-managed instruction.

Integrated programs with a CAI component, such as The Voyage of the Mimi or Writing to Read, involve the use of small numbers of microcomputers in a classroom. In these instances microcomputers are used as one of several workstations or in a demonstration mode.

CAI for Career Education and Foundation Guidance implementation can also be used in the career resource centers, established in the secondary schools. Library/study skills CAI programs involve the use of small numbers of microcomputers in the school library to accommodate individual students or small groups.

As emerging technologies, such as those being implemented in distance learning programs, are applied to CAI delivery, facilities requirements for telecommunications equipment must be developed.

EVALUATION PLAN

The evaluation of computer-assisted instruction will focus on student outcomes addressed. Evaluation instruments include criterion-referenced tests measuring student performance related to learning objectives, attitudinal surveys and observational data.

In addition CAI programs will be monitored by district and state specialists with attention to content covered, instructional methods used, student engagement time, and the amount and type of interactions among students, teachers, other adults and computers to identify successful practices.

COMPUTER-BASED INFORMATION RETRIEVAL

INTRODUCTION

In the original Department of Education **Plan for Computers in Education**, computer-based information retrieval (CIR) is one of the four major areas of the Computers in Instruction Program. CIR consists of using computer-based technology as a tool for accessing and retrieving current, comprehensive information from local, national and international databases and networks.

The Task Force that developed the plan recommended that career education be the initial implementation focus for CIR and that a study be made regarding the inclusion of computer use in school libraries within a year after the **Plan for Computers in Education** was completed.

Initially, career information was provided to high school students through Career Kokua, the state's computer-based career information system. Since then, Career Kokua services have been expanded to elementary and intermediate schools.

The study regarding computer use in school libraries for information retrieval included two surveys, two pilot projects and research into similar projects being implemented in other districts and states. The study was designed to determine the following: a) user needs, b) the feasibility and benefits of shared resources and c) the technical and cost requirements of converting a school library's holding to a computer database.

In addition, CIR is being implemented by various programs, such as Special Education, Vocational-Technical Education and the Hawaii Educational Dissemination Diffusion System (HEDDS). CIR applications will be expanded to access the additional specialized databases and networks as they become available.

While current applications of CIR are based primarily on the use of microcomputers and modems, developments in the traditional communications areas of cable television, satellite and fiber optic technologies will begin to impact on the way in which CIR is implemented in the near future, for example, to establish networks of shared resources or provide for resource management. Recent developments in CD-ROM systems and videodisc technologies have also begun to facilitate efforts in building, accessing and managing databases.

ASSESSMENT

Information is becoming available from a greater variety of sources and media. Obtaining the most current and accurate information has become an increasingly essential learning skill in this information age.

Research literature and local practices have shown that accessing information via local, national and international databases and networks is a realistic, attainable and increasingly important skill for all students. Telecommunication capabilities and other evolving technological developments will enable students to access current and

comprehensive information, regardless of school size or geographic location. For example, a student in Hana should be able to electronically research a paper using library resources available to students on Oahu or the mainland.

Advancements in communications technologies have already begun to revolutionize the way in which information in the form of text, data, image and voice are stored, accessed and retrieved. An entire encyclopedia is already available on a single CD-ROM disk. Videodiscs containing art collections of entire museums are available. The University of Hawaii library system has converted its catalog information to computer database, thus making remote access feasible. The maintenance and continuous updating of locally developed databases are essential in ensuring the accuracy and validity of information.

Currently, the CIR applications within the DOE have developed separately for individual program needs and functions. As computer and communications technologies are employed for delivering information to support instructional applications, the DOE must coordinate the access to available information systems within the DOE as well as establish the gateways or interconnections to databases and networks external to the DOE. There is a critical need to coordinate efforts in CIR to develop the infrastructure for establishing effective linkages among the various systems being implemented or accessed.

GOALS AND OBJECTIVES

The goal of computer-based information retrieval is to provide access to the expanding availability of resources that support the information needs of students and educators.

The objectives of CIR are:

- To provide the opportunity for students to use a variety of information resources and systems in fulfilling instructional assignments, with equal access for all students.
- To develop the skills for accessing and retrieving information in lifelong learning pursuits.
- To develop a coordinated network within the Department of Education with linkages to other systems locally, nationally and internationally.
- To maintain and continually update local databases.
- To access local, national and international databases and networks to meet the information needs of school, district and state personnel responsible for program planning and curriculum development.

PROGRAM DESCRIPTION

Computer-based information retrieval (CIR) consists of using the computer as a tool for accessing and retrieving current, comprehensive information from local, national and international databases and networks. Current applications of CIR in the Department of

Education (DOE) include provision of career information through Career Kokua, pilot studies regarding computer use in school libraries for information retrieval (See Appendix G), and access to specialized national databases through Special Education, Vocational-Technical Education and the Hawaii Educational Dissemination Diffusion System (HEDDS).

While current applications of CIR are based on the use of microcomputers and modems, developments in the traditional communications areas of cable television, satellite and fiber optic technologies will begin to impact on the way in which CIR is implemented in the near future. Recent developments in CD-ROM systems and videodisc technologies have also begun to facilitate efforts in building, accessing and managing databases. As additional databases and information services become accessible, CIR will be expanded to accommodate these applications.

The systematic implementation of CIR will require coordinated planning at the state level with involvement and input from potential end users of the variety of systems and networks developed or accessed. CIR developments have the potential of impacting on all other areas of the computers in instruction program.

TARGET POPULATION

The potential target population for CIR is all students in grades pre-K to 12; and school, district and state personnel.

IMPLEMENTATION REQUIREMENTS

Currently, the CIR applications within the DOE have developed separately for individual program needs and functions. As computer and communications technologies are employed for delivering information to support instructional applications, the establishment of an infrastructure to provide effective linkages among the various systems being implemented or accessed will be critical.

Technical assistance and inservice training on the use of CIR systems and networks will be essential, as the technologies being implemented are relatively new. Based on evaluations and feedback from current users of CIR applications, timely follow-up assistance on any implementation problems is needed for continued use of the system. A critical support function that must be addressed in the planning and development of local databases is the need for continual maintenance and updating of information.

Curriculum Development

Expansion of CIR to more content areas will require making the use of the technologies as easy as possible, especially for the novice end user. Student as well as teacher handbooks must be developed to help users feel confident and become competent in using CIR systems.

Models which incorporate effective search strategies in the process of retrieving information using a computer-based system must be developed to assist teachers in all content

areas. Development will include identification of locally and nationally developed activities and units for use in traditional content areas.

Inservice Training

CIR requires the use of various technologies in its implementation. Inservice training must address a number of areas: step by step instructions on accessing and using a particular system for novice users, strategies for conducting on-line searches, organizational structure of the database being accessed and other capabilities of the system, such as electronic mail. For teachers, training in incorporating these information retrieval skills into their classroom activities will be essential.

Evaluation data from the Career Kokua workshops, which represent the initial implementation of CIR, indicate the importance of conducting annual update training sessions at the beginning of the school year to introduce changes in the information da abase as well as telecommunications advances and applications. Training packages for initial, as well as follow-up, training sessions must be developed for each system implemented.

Curricular Assistance

Implementation of CIR involves careful coordination between the expanded network of available information and the instructional activity for which the information is sought. Experience with CIR applications indicate that follow up support on the effective use of the technology will be required. Assistance in planning programs and instructional activities that integrate information skills with learning in the various content areas is also essential for effective use of any CIR system.

Software

A survey among current CIR users must be conducted to determine how best to support the various CIR applications. Issues related to use of gateways versus individual, local access in terms of cost, ease of use, coordination and support requirements must be addressed.

Based on results of the survey, appropriate software will be evaluated and selected. A list of recommended software will be disseminated to schools, districts and state offices.

Hardware

Current applications of CIR are based on the use of microcomputers and modems. Microcomputer to school ratios for CIR applications in career education and library information retrieval have been developed. (See Appendix B.)

As CIR applications are expanded, gateways or bridges must be designed and implemented in consultation with experts in this field to facilitate and coordinate user access to multiple systems.

Developments in the traditional communications areas of cable television, satellite and fiber optic technologies, however, have begun to impact on the way in which CIR is being implemented in the private sector. Recent developments in CD-ROM systems and

videodisc technology have also begun to provide alternatives for storing and accessing information. Application of these evolving technologies to the managment of information have the potential of impacting on other areas of the computers in instruction program, including CAI and CMI. Flexibility and support for controlled experimentation with innovative ways of applying these technologies in an integrated manner should be encouraged.

Facilities

CIR activities may be conducted through one or more of a school's computer resource centers, where communications capabilities are available. Specialized applications of CIR may entail further rearrangement and/or expansion of existing facilities, such as in school libraries or career resource centers. Educational specifications have been established for career resource centers in high schools for delivery of career information. (See Appendix D.)

EVALUATION PLAN

The evaluation of CIR will focus on effectiveness relating to user needs and uses of each system. The extent to which CIR learner objectives are being met will be measured by evaluation instruments such as user satisfaction surveys and logs kept by school staff.

The implementation of CIR systems will also be evaluated by state and district specialists with special attention to equipment and software needs, inservice training requirements, and staffing and budgetary concerns. Successful, as well as unsuccessful, practices in the use of CIR in the schools will be identified and shared.

COMPUTER-MANAGED INSTRUCTION

INTRODUCTION

As described in the Department of Education's **Plan for Computers in Education**, computer-managed instruction (CMI) is a computer-based information system used to support the management functions performed by the teacher. CMI encompasses the educational goals, the curriculum, the instructional model, the teacher and a management information system. CMI seeks to facilitate information processing, by providing the information at the **appropriate** time and place so it can be applied directly to instructional decision making. A CMI system includes the collection, consolidation and retrieval of information in the schools and administrative offices.

CMI is instruction-related in that the mundane recordkeeping and paperwork tasks are handled through the computer. Elements of the system design include the following:

- incorporation of student learning objectives and means for evaluating student achievement of specified objectives;
- provision for establishing a comprehensive student data base with report writing capabilities;
- storage and accessibility of student progress information by classroom teachers, school administrators, and district and state staffs; and
- identification of interfaces with computer-assisted instruction programs and other learning activities.

Since the development of the **Plan for Computers in Education**, the department has not been able to begin systematic development of a statewide CMI system due to limited resources and availability of appropriate systems. As software and hardware requirements are considerable for implementing CMI, trial use has been limited to those systems and packages provided on loan or donated by vendors.

Two developments have the potential of greatly impacting on CMI implementation: 1) recent advances in technology have the potential of facilitating the systematic development of a statewide CMI system and 2) textbook publishers have begun to market computerized instructional management programs linked to their objectives.

While individual schools may choose to implement computerized instructional management programs, there is still a need for the development of a statewide CMI system to support the Department's Competency-Based Education program. The Department must commit the necessary resources to begin the necessary preliminary planning and developmental efforts to incorporate the technological advances for linking microcomputers to mainframes and using sophisticated database management and reporting programs on microcomputers at the school level.

ASSESSMENT

A pilot study of computer-managed instruction is being conducted in Honolulu District. The pilot involves the use of CMI systems to provide teachers with information on student achievement toward the performance expectations related to Foundation Program Objective I: Develop basic skills for learning and effective communication with others.

Evaluation of this CMI pilot cites the need for adequate staffing to support developmental and implementation efforts. Extraordinary efforts were expended by personnel involved in the pilot to overcome hardware and software limitations.

Feedback from personnel involved in this initial CMI pilot indicates the need for extensive preliminary planning and the development of the necessary components to support CMI. These developmental needs include the specification of learning objectives that are measurable, the development of evaluation instruments for measuring student performance related to learning objectives and a utility for data analysis which facilitates input, processing and retrieval of student data. Other needs include the development of a computerized library of available instructional materials and activities to meet learning objectives; utilities to maintain, update and produce reports on student, class, school, district and state data; and the capability of sharing and transfering data across applications that need them, whether at the school, district or state level.

Advances in technology have the potential of facilitating the development of CMI applications. These advances include:

- an increased availability of databases that can be adapted, merged and/or enhanced to simplify the problem of data entry, and
- the increasing availability of powerful personal computers, providing the possibility of using sophisticated database management and reporting programs on personal computers.

The General Education Branch has initiated efforts in investigating the CMI applications of these technologies to some of the annual statewide data collection and program analysis functions on a limited scale. Demonstrations include computer support for instructional management functions through the transfer of data files from magnetic tapes in a VAX format to an IBM personal computer and the development of databases on a personal computer for the analysis of data and the generation of reports and summaries.

That is, technology now provides the tools for implementing a CMI system. Developmental efforts towards linking the statewide performance expectations (PEs) of the eight Foundation Program Objectives and corresponding Competency-Based Measures (CBM) to learner objectives at the classroom are necessary to support computerization. Input from classroom teachers, school administrators and other end users of the CMI system will also be incorporated during this developmental phase.

GOALS AND OBJECTIVES

The goal of computer-managed instruction is to provide teachers, administrators and program planners an instructional support system to assist in the diagnosis, evaluation, recording and reporting of student progress.

The objectives of computer-managed instruction are to:

- Assist in the diagnosis and evaluation of individual student progress toward the desired outcomes.
- Assist in the maintenance and reporting of student progress records to improve instruction.
- Provide accessibility to student achievement information on a timely basis for administrative decision making.
- Develop proficiency in using the technological components of CMI to improve instruction.

PROGRAM DESCRIPTION

Computer-managed instruction is a computer-based information system used to support the management functions performed by the teacher. While instructional management programs produced to support a publisher's basal textbook series are referred to as CMI, the distinction between a CMI **program** and a CMI **system** is critical.

While commercial **programs** for computerizing instructional management functions related to a particular basal series are useful for monitoring the learning of concepts and skills for which the program was developed, most cannot be modified or expanded. The problems related to modifying commercial CMI programs limit their applicability to supporting instructional programs for individual schools. Schools may choose to implement these programs as a supplement to the statewide CMI system, just as schools can elect to administer student achievement tests to supplement the statewide testing program.

An effective instructional management **system** must have the capability to deal with a number of elements in the instructional environment. These elements encompass: 1) the educational goals and objectives, 2) instruments and utilities to evaluate and analyze student performance data, 3) a library of learning activities linked to instructional objectives and 4) computer utilities that maintain and update the student database as well as produce desired reports, charts and graphs.

The CMI system must provide student progress information at the appropriate time and place to assist teachers, administrators, and district and state personnel in planning for effective instruction. An effective computerized management system should be able to manage large student populations, be expandable to accommodate changes as they arise, be capable of sharing and transferring data across applications that need access and be supported by other computer utilities such as wordprocessors, database managers and programs that generate learning/teaching aids. In addition, the database established, must be accessible for administrative decision making.

Development of a CMI system requires a considerable commitment of resources, both human and fiscal. The CMI system developed for the Department will begin with monitoring student achievement toward the Performance Expectations of the Foundation Program Objectives for which corresponding evaluation instruments have been developed. The CMI system design will provide for expandability to accommodate additions and changes. Modifications, additions and deletions to the databases established for curriculum support and student information will be designed for efficiency and ease of use.

Essential to effective computerization of instructional management is the automatic sharing and transferring of information across applications that need to use it. There is no savings in time unless data, once entered into the computer, can be used for several applications by various user.

Implementation of a statewide CMI system, therefore, is highly dependent upon networking and telecommunications support and must be linked to databases available through the Deparment's administrative applications of computers. CMI systems being used at the school level must be compatible with CMI systems installed at the district and state level for the efficient sharing of data files. For example, since student information is available through the Department's VAX minicomputer, this information should be electronically accessible to CMI systems at the school. Conversely, student information collected at the school level must be accessible for developing district and state summary reports.

Hardware and software technologies now permit communication between IBM personal computers and both the VAX minicomputer and IBM mainframe. The identification of priorities, resource allocations and timelines is necessary for the development of the DOE's CMI system.

While technology now provides the tools for implementing a CMI system, the Department must commit the necessary resources to begin the preliminary planning and developmental efforts. These efforts include incorporating the technological advances for linking microcomputers to mainframes and using sophisticated database management and reporting programs on microcomputers at the school level. Efforts in developing the curricular support components will be coordinated with content area specialists, the DOE Test Development Section and the Information Systems Services Branch.

TARGET POPULATION

The target population is all end-users of the CMI system: teachers, school administrators, district and state level personnel responsible for reporting on student progress and/or program planning.

IMPLEMENTATION REQUIREMENTS

Development and implementation of a statewide CMI system will require the full commitment of the Department. The computer components provide a skeletal tool for CMI applications, but successful implementation of a system will require extensive preparation and commitment of resources. Preliminary planning and development of the necessary

components to support a CMI system will require coordination with content area specialists and the Test Development Section, with input from classroom teachers, school administrators and other potential end users.

Moreover, as technology now supports file transfers among various systems, policies and procedures for accessing available databases must be developed. Developmental efforts must be initiated to identify personnel requirements and expertise necessary to support implementation. These efforts will require coordination between the Information Systems Services Branch and the Office of Instructional Services for linkages to databases and files, such as student demographic and statewide test data.

The CMI pilot in Honolulu District was one of nine computer pilot studies evaluated by the Social Science Research Institute (SSRI), University of Hawaii at Manoa. The evaluation report cites the need for building an infrastructure to support the application of computers in education as an important requirement for successful implementation. Specific reference is made to adequate commitment of personnel and fiscal resources for developmental efforts and implementation support to efficiently apply computerized systems.

Curriculum Development

The development of measurable learning objectives and an associated bank of test items for schools to access is an essential component of any CMI system. The SSRI evaluation report recommends standardized formats for the test banks for incremental development and phasing into the system. This developmental effort will require close coordination among state program managers, the Test Development Section and teachers in the field.

Implementation of a statewide CMI system with computerized recordkeeping will enable teachers to individualize learning. Development of a library of learning activities will provide assistance to teachers in meeting the needs of individual students.

Inservice Training

The SSRI evaluation report recommends a "heavy commitment" to inservice training. The evaluation findings identify the lack of enough sufficiently trained personnel as a major drawback in the pilot projects.

Training for both resource personnel to support the CMI system as well as for end users of the CMI system is essential. The SSRI evaluation report cites the training and preparation of principals and teachers to use the CMI system to the benefit of their schools as a critical step. The need for continuation of training after the system is installed is necessary for successful implementation. Problems with equipment and telecommunication linkages need to be addressed on a timely basis for continued utilization of the system.

Inservice training models for the various CMI applications must be developed for each of the target groups at the school, district and state levels.

Curricular Assistance

Experiences with CMI installations, both nationally and locally, provide evidence that on-site support for users of a CMI system is necessary for successful implementation. The

human resource commitment required for installation of CMI is high. However, the SSRI evaluation notes that personnel needs were underestimated in the pilot projects. In the Honolulu District CMI pilot, one resource teacher supported the installation in five pilot schools.

On-site support includes both technical assistance with the equipment and telecommunications components, and also assistance in using the CMI system to improve instruction and administrative decision making. For example, two of the pilot school principals noted that the computer-generated student performance results proved to be an effective mechanism for communicating with parents.

Software

Software for CMI applications on microcomputers require the capability of importing data downloaded from a minicomputer and manipulating the data to meet CMI needs. While the most popular database management, spreadsheet and wordprocessing software packages have the capability of importing data files and manipulating the data for CMI, specialized packages, such as the IMS+ software used in the CMI pilot project, may not. In addition, specialized packages may not have the capability of uploading information on student progress collected at the school level for district aggregation.

Development or modification of software to support linkages for efficient file transfer may be required for the Department's particular hardware and software configuration. However, as file and data transfer is also essential in business applications, computer manufacturers have developed software to facilitate communication between and among computer systems. Software developments already support communication between the IBM personal computer and both the VAX minicomputer and IBM mainframe. Applicability and adaptability of these technologies to meeting CMI needs must be studied.

Hardware

Equipment necessary to support CMI include at least one microcomputer system with a hard disk, a high-speed printer and a scanner. Larger schools will require more than one microcomputer to support CMI functions. The hard disk must have the capacity to store files downloaded to the site. Scanners and high speed printers facilitate data entry and report generation. A study funded by the National School Boards Association identified inadequate printers as a common problem.

Critical to effective CMI is telecommunication and networking technology. The hardware and software must have the capability of sharing data among the systems and sites using CMI. The need to establish equipment requirements for efficient means of transmission is identified as a need in the SSRI evaluation report.

In specialized situations, the use of portable laptop computers for data collection or access to the CMI system may be required. Criteria for applications of laptop computers will need to be established through controlled use and evaluation.

Facilities

Since sensitive student data will be stored or accessible on the CMI system, security to assure privacy is essential. The CMI microcomputer system should therefore be housed in the school office. Telecommunication links and other methods of electronic transfer will need to be established.

EVALUATION PLAN

Evaluation of CMI will focus on improvement in data access and utility, staff productivity and support of management functions. Criteria for reviewing CMI programs are provided in Appendix H.

SPECIAL EDUCATION

INTRODUCTION

Most handicapped students will be able to access and benefit from CAI, CMI, CIR and Computer Literacy programs that are available to all public school students and described in other chapters of the Computers in Instruction Plan.

Some handicapped students with special needs will require modifications in teaching style and hardware and software adaptations in order to derive maximum benefit from using the computer as a tool for learning and management.

This chapter will reflect the additional specialized equipment and training needs required to ensure equal and appropriate educational opportunities for handicapped children.

The Department of Education's State Plan For Special Education outlines the Department's plan for expansion of the use of technology and computers for assistance in data-based management, computer-assisted instruction, student planning, recordkeeping and student accounting.

Significant advances have been and continue to be made in the computer industry which enable special education students both to compensate for learning handicaps and to remediate certain learning problems with significantly greater ease. Special education technology, when properly applied, represents by far the major instructional development to enable handicapped students to function to the greatest degree in less restrictive environments. Computer-adaptive instructional devices enable students with motor and sensory handicaps to access microcomputers through alternative keyboards, special switches, scanners, Braille writers, encoders, decoders, voice synthesizers.

ASSESSMENT

Recent research studies indicate the importance of computers in the special education classroom to assist teachers and students.

- A May 1986 experimental study conducted by Marcia J. Jakins at the University of Hawaii, entitled "Comparison of Time Saving and Quality of a Computerized Individualized Education Program (IEP) Writing Method," investigated the amount of time taken to write IEP's manually and on the computer. Results showed that the computer method took significantly less time at a significance level of 0.0005 with a mean of 30 minutes. The quality of the computer generated IEP was significantly higher than handwritten IEPs at a significance level of 0.0215.

- A July 1986 report prepared by the Special Education Technology Users Project, "A Study of Time Saving and Quality of a Computerized Individual Education Program (IEP) Writing Method" investigated the amount of time 134 special education teachers in Hawaii saved by writing IEP's on the computer.

Results showed that computerizing IEPs saved an average of 89 minutes. The majority of the teachers used the time saved for instructional planning.

- A July 1986 study implemented by The Special Education Technology Users Project, "SETUP Classroom Instruction Component," investigated whether district workshops and onsite training would result in measureable gains in self-assessed teacher abilities and time/week increases on the computer. Results of the study showed improvement in time and quality of student use of computers, increased teacher awareness of computer programs and adaptation possibilities, and measureable increases in pre-post student in reading scores.

Surveys of teachers indicate that the increased paperwork required of them by P.L. 94-142 and Chapter 36 is taking away instructional and planning time. Inservice training on the full range of microcomputer applications in special education settings to reduce administrative time and increase instructional time is a recommended solution. Areas of focus would include utilization of specially designed software for writing Individualized Education Programs (IEPs), maintenance of student records, and other computer-managed instruction (CMI) applications.

The surveys also indicate that there is a need for training to implement CAI with current cost-effective educational hardware and software designed to meet the individual remedial/compensatory needs of students.

The fact that utilizing computers for management purposes will save time and the time saved will most probably contribute to more quality special education programs provides a rationale for ongoing development, evaluation and training in this area. With the advancement of special tool applications of the microcomputer for the handicapped, training and assessment of the most updated equipment will enable the handicapped to become more capable and independent members of the community.

GOALS & OBJECTIVES

The goals for management and instructional uses of the microcomputer are:

- To develop computer awareness and literacy among the handicapped so that they will confidently utilize computers in their daily lives as a tool for communication, problem solving and decision making.

- To provide training to teachers, administrators, program planners, and parents in the use of updated computer software and hardware support systems for handicapped students that will assist them in their classroom and community environments to become more independent members of society.

- To train teachers and administrators on the most updated computer support systems needed to facilitate effective instruction. These support systems include on-line computer-managed instruction for student recordkeeping related to student's Individualized Education Programs (IEPs), student planning, student accounting, information from local and national databases, and the provision of support for computer users in the Department.

A critical component for the three goals is the provision of training, assistance and ongoing user support in a) the selection of optimal ways to deliver computer-based instruction to students and b) keeping informed of the most updated computer methods and materials developed for use with the handicapped.

The objectives of the Special Education Plan for Computers In Instruction are to provide:

- Hands-on inservice training with follow-up support to all special education teachers on updated methods for computer-assisted instruction (CAI) and computer-managed instruction.
- On-line bulletin board/mailing system for information exchange and communication between those special education classrooms with modems and a state resource person knowledgeable in special education computer applications.
- Piloting and evaluation of the Data Management and Reporting System (DMRS) software to facilitate computer-assisted development of Individualized Education Programs, student recordkeeping, instructional management and individualized instruction.
- Necessary equipment, software, and training to all districts and schools for statewide implementation of the DMRS software.
- Assistance in the implementation of the special education subsystem of the Student Information System to provide the capability to access special education academic and administrative data to facilitate compliance monitoring, evaluation research, planning and review of programs.
- Training in the planning and implementation of the use of computers by teachers, as well as appropriate school, district, and state certificated and classified personnel who are responsible for the education of the handicapped.
- Curricular assistance to link computer activities with IEP goals and objectives and ongoing instruction.
- Assistance to special education teachers regarding the maintenance of computerized records on student progress, program planning, parent communications, behavioral data, scheduling of meetings, etc.

Computer-adaptive devices can be seen as a major support to enable special needs students to gain access to previously unavailable educational experiences. Alternative keyboards, switches, scanners, Braille writers, and encoders are devices which bring about greater educational opportunities for this population.

PROGRAM DESCRIPTION

The use of computers in special education provides for computer-assisted instruction to special needs students as a remedial technique. This assistance may include drill and

practice of basic skills, simulations of situational experiences which require problem solving, tutorials for additional exposure to academic instruction, or the application of computer/adaptive devices which can enlarge print, manipulate environmental controls, produce expressive speech, or otherwise facilitate communication.

In addition, computer-adaptive devices and telecommunications will be employed to enhance communication and enable greater access to the environment for the physically or sensory limited.

Computer management systems facilitating on-line communication between classroom, district and state offices regarding student IEP's, recordkeeping, planning, accounting will a) save time for more quality educational programs and b) provide equal opportunity to students, regardless of geographic isolation.

TARGET POPULATION

- Approximately 12,000 students, Pre-school to grade 12/age 20 in Hawaii's public school certified as special education students.
- Special needs students who are certified handicapped requiring specialized computer applications.
- Special education teachers of grades Pre-school to 12.
- School, district, and state level managers responsible for planning and implementing programs affected by the Special Education Computers in Instruction Plan.

IMPLEMENTATION REQUIREMENTS

Critical to the implementation of the Special Education Computers in Instruction Plan are: a) the development of extensive inservice training on both computer use and its integration into the curriculum, b) the availability of assistance and support for linking computer activities to IEP goals and objectives, classroom instructional activities, c) a sufficient number of microcomputers, and d) the identification and acquisition of quality software and adaptive devices.

Ongoing evaluation and training of new updated hardware and software must take place in order to assist teachers in utilizing the computer as a tool for instruction and management.

Curriculum Development

Curriculum development to support the Special Education Plan for Computers in Instruction includes the development of curricular and instructional support materials for all training modules. Effective implementation of computers delivering, supporting and managing instruction will require linkages to IEP goals and objectives developed for individual student needs, development of a database of instructional activities, resources to meet individual learner objectives and utilities to measure and analyze student performance toward specified objectives.

Inservice Training

Effective inservice training of teachers, parents, administrators, and program planners is essential to ensure successful implementation of the Special Education Plan for Computers in Instruction. Educators must be well versed in the specialized knowledge, skills, and processes relevant to utilizing computers and adaptive devices to deliver, support, and manage instruction.

Delivery of the Department's special education computer inservice training will consist of:

- Service and support provided to state, district, and school personnel working with the special needs population by a qualified person knowledgeable in Special Education and use of computers with the handicapped.
- Contracting of outside sources who have specialized skills in computer applications for the handicapped.
- Establishing and maintaining an on-line information exchange and user support system at the State Special Education Section to enable communication between special education classrooms and a state resource teacher knowledgeable in special education and computer applications.
- Training and support in the Hawaii State Special Education DMRS software to state, district, and school level personnel responsible for the maintenance of the system.

Curricular Assistance

In addition to provision of inservice training, ongoing support and assistance in hardware and software troubleshooting and application are essential for effective and successful computer instructional plans.

Provisions for assistance in integrating computer into the curriculum include:

- Establishment of a State Special Education Information/Support Center and a State Special Education Computer Coordinator/Resource/Trainer position.
- Identification of a special education computer coordinator/resource at each district.

Software

Assistance and identification of quality software to deliver and support instruction and management for special education are available from:

- The Special Education Section, where programs and software evaluations from several nationally recognized institutions are housed. A State Special Education Technology Resource Teacher will conduct and coordinate sessions.

- The Computer Review Center and Clearinghouse.

Custom designed software reflecting the special education requirements of Chapter 36 and linking schools, districts, and the state office is essential for management purposes.

Because software programs are constantly being developed and modified, the coordination of effort and the dissemination of information on quality software which can fit into the Department's special education curriculum will be essential.

Hardware

In order to accommodate the special ways that microcomputers can aid the handicapped student in learning and communication, a ratio of at least one computer to every six special education students must be provided. In some specialized cases of students with specialized needs, a ratio of 1:1 would be necessary.

For the ever increasing student recordkeeping and reporting that are necessary for the special education student population, the hardware provided for special education students must also be accessible to teachers for management purposes. Compliance with federal and state laws relating to the education of the handicapped requires a high degree of documentation to ensure appropriate identification, evaluation, programming and placement of students.

Modems and phone links to computers are necessary for district, state and school levels for the successful implementation of a statewide data management and reporting system.

Specialized computer-adaptive devices are needed as a major support to enable special needs students to gain access to educational experiences previously unavailable to them due to various limitations. Support on evaluating these hardware devices will be available through the State Special Education Information/Support Center at the State Special Education Section. Adaptive devices presently available and necessary include: adaptive firmware cards, single switches, power pads, touch windows, unicorn keyboards, key guards, joy sticks, mouses, Koala pads, V-TEK large print processors, voice synthesizers, embossed printers, versabraille, large print printers, refreshable braille keyboards, braille display processors, and large print displays. With the rapidly improving and developing computer technology for the handicapped, new or improved adaptive devices and equipment requirements will be continuously reviewed and additional funding will be pursued through standard budgeting procedures.

Facilities

Placement of microcomputers and appropriate peripherals in special education classrooms allowing maximum accessibility is essential to facilitate instruction, communication and management.

Computer labs in schools for teacher training and for use by handicapped students must be programmatically and physically accessible and be able to accommodate students in wheelchairs.

EVALUATION PLAN

Evaluation of Special Education Plan for Computers in Instruction will be in accordance with the evaluation plan described in the Computers in Instruction chapter of this document. In addition, evaluations will be conducted following each training session to provide information for necessary revisions in the plan as it is being implemented. Evaluation of the DMRS pilot software will focus on determining its usefulness and effectiveness.

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DEPARTMENT OF EDUCATION
COMPUTERS IN INSTRUCTION PLAN

GLOSSARY

GLOSSARY

adaptive firmware card	card designed to provide transparent access to the Apple IIe computer for people who cannot use the standard keyboard, or who find a special input arrangement faster, easier, or simpler to use than the standard keyboard.
algorithm	step-by-step procedure, often expressed in mathematical terms for solving a problem or obtaining a particular result.
artificial intelligence (AI)	branch of computer science dealing with the development of computer systems capable of carrying out the functions normally associated with human intelligence such as interacting in a natural language or adapting performance based on past actions.
BASIC	acronym for Beginners' All-Purpose Symbolic Instruction Code. A programming language widely used in programming instruction and personal computing.
braille display processor	"braille output" monitor for the Apple or IBM. Paperless braille out-put device.
bridge	device used to interconnect identical communication systems or networks.
CD ROM	acronym for Compact Disk Read-Only Memory. 5-inch plastic disk, with capacity of 550 megabytes, capable of storing text, graphics, sound and video for fast retrieval.
communications	flow of information from one point (the source) to another (the receiver); act of transmitting or making known.
communications network	interconnected set of transmitting and receiving devices that allow files or messages to be sent between both large information systems and individual stations.

compiler	program that converts one computer language into another, in order to store it for later use; usually refers to a program that translates a higher-level language into a computer's machine language.
computer	electronic device that manipulates symbolic information according to a list of precise instructions called a program.
computer-adaptive device	device that allows the handicapped to access a computer.
computer-assisted design and/or drafting (CAD)	use of computers to design products.
computer-assisted instruction (CAI)	use of interactive computer systems to present instruction to the student using drill and practice, problem solving, tutorial, and simulation programs.
computer-assisted manufacturing (CAM)	use of computers to control the manufacturing of products.
computer-based information retrieval	use of computer-based technology for accessing and retrieving information from databases and networks.
computer language	an artificial language that was designed to allow communication between human beings and computer systems.
computer literacy	term referring to the general range of skills and understanding needed to function effectively in a society that is increasingly more dependent on computer and information technology.
computer-managed instruction (CMI)	use of computers to support management and recordkeeping function performed by teachers and administrators
courseware	computer program used for instruction, along with manuals, workbooks and other supporting materials.

database	collection of related data, usually in several files, that are stored in a computer for easy and quick retrieval.
diagnostic sensor	any of a family of sensors that converts physical or mechanical stimuli, such as light or heat into electrical information that can be processed by computers.
disk or diskette	circular magnetic coated device on which data and programs are stored.
DMRS	Data Management and Reporting System developed for Special Education.
embossed printer	a printer that prints in braille and provides a hard copy of braille.
expert system	software package designed to capture and use the rules followed by experts in a given discipline.
fiber optic	glass or plastic fibers that carry data as pulses of laser light.
gateway	device which connects two distinctly different communications networks. The gateway may perform the protocol conversions necessary to transmit between the networks; for example, a gateway could connect a local area network to a national or foreign network.
graphics	creating visual images such as normal letters, numbers, special symbols and pictures, incorporating color and animation.
hard disk	magnetic disk made of rigid material with large storage capability.
hardware	more properly called computer hardware, a collection of physical devices which make up a computer system.
individualized educational program (IEP)	a plan that must be developed yearly on all students that are handicapped.

information retrieval	process used to recover specific information from stored data.
instrument control	use of computers to control laboratory or industrial instruments or equipment through relay boards.
interface	electronic and physical connection between various devices that allows the different devices to communicate with each other.
interpreter	computer language that translates and executes programs from a high-level language into a machine language, one line at a time.
keyguard	plastic overlay that fits on the keyboard.
koala pad	computer touch sensitive pad that allows access to computer programs and graphics drawings.
mainframe or mainframe computer	designation for large scale computers.
memory	integrated circuits of a computer which store information that is directly accessible to the CPU.
microcomputer	microprocessor-based small computing system introduced in the early 1970's.
minicomputer	designation for smaller (than mainframe) computers introduced in the mid 1960's.
modem	abbreviation for modulator/ demodulator; device that allows communication between computers over phone lines. It translates the computer's digital signals into audio signals and then back again for the receiving computer.
network or networking	interconnected system of transmitting and receiving devices for sharing resources or communications.

on-line	devices, databases and/or information that are accessible directly by a computer.
operating system	systems software (usually created by the manufacturer) that manages the computer and its peripheral devices, allowing the user to run programs and to control the flow of information to and from the computer memory and peripheral devices.
Pascal	computer language invented by computer scientist Niklaus Wirth (circa 1970) which as initially intended as an aid to teaching computer languages.
peripheral device	accessory device, such as a printer, that is connected to a computer and controlled by it.
plotter	output device that converts graphic displays to architectural - quality drawings.
power pad	touch sensitive board which allows access to a computer without the keyboard.
program	list of instructions that tells a computer to perform a given task or tasks.
programmer	person who designs and writes a set of instructions for the computer.
programming	process of designing, writing, coding, documenting and testing of a computer program.
relay board	any of a family of interfaces used in connecting computers to electrically switched instruments or equipments.
robotics	use of computers to control devices and equipment; large-scale use of CAD/CAM techniques.
scanner	optical device which can recognize a specific set of visual symbols and input information into a computer.

simulations	CAI programs which provide representations of real-life situations.
software	computer programs consisting of instructions that tell a computer to perform a given task or tasks. There are two basic types of software. Systems software enables the computer to carry out its basic operations. Applications software consists of programs that instruct the computer to perform various real-world tasks such as writing checks, playing chess or testing students.
storage	device or medium that can accept, keep and deliver data on demand at a later time.
tape	inexpensive mass storage medium which is convenient for large files or archival storage. Data are retrieved sequentially rather than randomly.
telecommunications	use of computer and communication technology to transmit messages between computers or to centralized information services at remote sites.
terminal	input/output device that is attached to a host computer, consisting of a keyboard and display, but without built-in processing capability.
touch panel	touch-sensitive device attached to the front of the display screen, used to input information at a particular screen location.
touch window	touch-sensitive device that fits over the monitor allowing touch access to programs.
tutorial	CAI program which provides instruction. The computer "tells and asks" the student facts and questions, and the teacher takes on the role of consultant or resource person.
unicorn keyboard	touch sensitive membrane keyboard used as a large external keyboard for the

	visually impaired, which can also be programmed as a communication board.
upgrade	procedure to improve and update the performance of hardware.
utility program	systems software used to perform certain basic functions required in the operation of a computer system; eg., sorting.
V-TEK	large print processor used as an adaptive device on the Apple computer enabling large screen print for the blind.
versabraille	paperless brailler which may be used as a word processor and interfaced with a computer, printer, and embossor.
videodisc	use of phonograph-like disks to store video, sound and computer information. Stored information is read by a laser, allowing random access under computer control.
voice synthesizer	device to enable voice output from a computer program.
word processing	computer-based system for creating, editing, formatting and printing letters or other documents.
workstations	computer or terminal attached to a host computer for processing and data storage functions.

DEPARTMENT OF EDUCATION
COMPUTERS IN INSTRUCTION PLAN

APPENDICES

APPENDIX A

Program Developments

COMPUTERS IN INSTRUCTION
PROGRAM DEVELOPMENTS

Computers in Instruction Program

Computers in Instruction: Framework for Administrators

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BASIC Programming II Course Guide

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Computer-Managed Instruction

Honolulu District Pilot Study

Hawaii Data Management and Referral System Pilot Study

APPENDIX B

Equipment Acquisition Guidelines

EQUIPMENT ACQUISITION GUIDELINES

The equipment standards provided in this appendix were developed based on applications currently available. As computer applications in instruction change, however, these program standards will be adjusted accordingly.

Based on the equipment standards developed for each application, an overall school ratio was computed. This overall ratio is provided in the last column of the attached tables. As an aggregate these ratios approximate the recommendation of one workstation for every ten students made by the National Task Force on Educational Technology.

To facilitate implementation at the school level, it is recommended that until program standards are changed, *schools be allowed the flexibility of acquiring hardware within the overall school ratio of 1 microcomputer per 10 students* for delivering all components of the computers in instruction program.

COMPUTERS IN INSTRUCTION
EQUIPMENT STANDARDS

AREA	CURRENT APPROVED RATIO	DESIRED RATIO	BASE	LOCATION	EXPLANATION
Exploratory	1:60	1:40	Students	Computer RR	All students
Computer Science-AP	1:12	1:6	Students	Computer RR	2% of 9-12 enrollment
Computer Science-other	1:12	1:10	Students	Computer RR	8% of 9-12 enrollment
CAI REGULAR	1:33	1:10	Students	Computer RR	46% of K-12 enrollment
Career Resource Rm	4:1	4:1	Career RR	Career RR	Intermediate/High Schools
CMI-All Elementary	1:1	1:1	School	Sch Office	1 per school office for data security
CMI-Sec. up to 500	1:1	1:1	School	Sch Office	
CMI-Sec. 500-1500	2:1	2:1	School	Sch Office	
CMI-Sec. 1500+	3:1	3:1	School	Sch Office	
CIR - RETRIEVAL	1:1	5:1	School	Library	For schools with enrollments through 500
		8:1	School	Library	For schools with enrollments from 501 through 1000
		12:1	School	Library	For schools with enrollments greater than 1000
CIR - LIBRARY MANAGEMENT		1:1	School	Library	For all school libraries. In addition, a CD-ROM system will be needed for library management.
VT - CLASSROOM	1:10	1:10	Students	Classroom	6% of grades 10-12 enrollment
CAI - SPECIAL ED		1:6	Students	Classroom	For special education students in sp ed classes; but in specialized cases a ratio of 1:1 may be necessary. At least 1 per school with sp ed students.
Newswriting	n/a	4:1	School	Newswriting Classroom	Replace electric typewriters & commercial typesetting
Science Lab	n/a	3:1	Sci Lab	Science Lab	3 micros per lab [#lab/sch = enrollment/2/(26 Students)/(6 periods)

COMPUTERS IN INSTRUCTION
EQUIPMENT STANDARDS

AREA	CURRENT APPROVED RATIO	DESIRED RATIO	BASE	LOCATION	EXPLANATION
Vocational-Technical Labs:					Specialized equipment for vocational-technical education
Drafting	n/a	15:1	VT Lab	VT Lab	
Electronics	3:1	7:1	VT Lab	VT Lab	
Graphic Arts, Food Service, Agriculture	n/a	3:1	VT Lab	VT Lab	
Power Auto, Child Care	n/a	1:1	VT Lab	VT Lab	

COMPUTER EDUCATION: STANDARDS FOR MICROCOMPUTERS (1986-87)

DISTRICT	REG ENR	INT ENR	9-12 ENR	10-12 ENR	SE ENR	EXPL	COMPSCI	CAI-REG	CAREER	CMI	CIR	VTLAB	VTCLASS	CAI-SE	SCI LAB	NEWSWRT	TOTAL	OVERALL SCH RATIO
Honolulu District	34,271	5,746	10,099	8,513	2,007	857	112	1,5.5	60	70	430	140	53	335	152	24	3,810	10
Central District	31,954	4,287	8,955	6,584	1,915	799	100	1,470	40	55	[illegible]	108	40	319	127	24	3,436	10
Leeward District	27,412	4,035	8,230	5,929	1,819	685	91	1,261	36	47	2[illegible]	128	36	306	118	20	3,023	10
Windward District	17,936	2,271	5,259	3,998	1,389	448	58	825	28	35	232	63	24	232	72	16	2,035	9
Hawaii District	20,645	3,071	5,661	4,232	1,092	516	63	950	76	40	260	65	25	193	84	32	2,294	9
Maui District	14,766	2,118	4,286	3,174	7[illegible]	369	48	679	48	27	200	39	19	124	62	20	1,634	9
Kauai District	8,238	1,093	2,519	1,881	444	206	28	379	16	15	106	37	11	76	[illegible]5	12	921	9
Special Schools	99	0	0	0	162	2	0	5	0	0	0	4	0	27	0	0	38	7
State Total	154,136	21,363	46,919	[illegible]198	9,650	3,883	500	7,145	304	289	1,878	584	208	1,602	650	148	17,191	10

COMPUTER EDUCATION: STANDARDS FOR MICROCOMPUTERS (1986-87)

DISTRICT SCHOOL	REG ENR	INT ENR	9-12 ENR	10-12 ENR	ST ENR	EXPL	COMPSCI	CAI	REG CAREER	CMI	CIR	VTLAB	VTCLASS	CAI-SE	SCI LAB	NEWSWRT	TOTAL	OVERALL SCH RATIO
Honolulu District	34,271	5,746	10,099	8,513	2,007	857	112	1,576	60	70	430	140	53	335	152	24	3,810	10
Honolulu Aina Haina	390				52	10	0	18		1	6	0	0	9	0		43	10
Honolulu Ala Wai	753				33	19	0	35		1	9	0	0	6	0		69	11
Honolulu Aliiolani	4 2				17	11	0	20		1	6	0	0	3	0		41	11
Honolulu Anuenue	110				10	3	0	5		1	6	0	0	2	0		16	7
Honolulu Central	389	389			46	10	0	18	4	1	6	0	0	8	4		50	9
Honolulu Dole	864	864			70	22	0	40	4	2	9	0	0	12	8		96	10
Honolulu Farrington	2.275		2,275	2,275	185	57	25	105	4	3	13	30	14	31	22	4	307	8
Honolulu Fern	555				25	14	0	26		1	9	0	0	4	0		54	11
Honolulu Hahaione	438				17	11	0	20		1	6	0	0	3	0		41	11
Honolulu Hokulani	370				9	9	0	17		1	6	0	0	2	0		35	11
Honolulu Jarrett	187	187			32	5	0	9	4	1	6	0	0	5	2		31	7
Honolulu Jefferson	502				50	13	0	25		1	9	0	0	8	0		54	10
Honolulu Kaahumanu	792				17	13	0	36		1	9	0	0	3	0		69	12
Honolulu Kaewai	376				54	9	0	17		1	6	0	0	9	0		43	10
Honolulu Kahala	489				7	12	0	22		1	6	0	0	1	0		43	12
Honolulu Kaimuki H	1,508		1,508	1,121	129	38	17	69	4	3	13	30	7	22	15	4	221	7
Honolulu Kaimuki Int	422	422			58	11	0	19	4	1	6	0	0	10	4		55	9
Honolulu Kaiser	1,66		1,664	1,373	46	42	18	77	4	3	13	12	8	8	16	4	205	9
Honolulu Kaiulani	378				27	9	0	17		1	6	0	0	5	0		38	11
Honolulu Kalakaua	1,243	1,243			124	31	0	57	4	2	13	0	0	21	12		140	10
Honolulu Kalani	1,054		1,054	807	52	26	12	48	4	2	13	9	5	9	10	4	142	8
Honolulu Kalihi	417				17	10	0	19		1	6	0	0	3	0		39	11
Honolulu Kalihi-kai	868				32	22	0	40		1	9	0	0	5	0		77	12
Honolulu Kalihi-uka	349				19	9	0	16		1	6	0	0	3	0		35	11
Honolulu Kalihi-waena	561				46	14	0	26		1	9	0	0	8	0		57	11
Honolulu Kamiloiki	625				21	16	0	29		1	9	0	0	4	0		58	11
Honolulu Kapalama	786				21	20	0	36		1	9	0	0	4	0		69	11
Honolulu Kauluwela	586				18	15	0	27		1	9	0	0	3	0		55	11
Honolulu Kawananakoa	863	863			71	22	0	40	4	2	9	0	0	12	8		96	10
Honolulu Koko Head	536				0	8	0	15		1	6	0	0	0	0		31	11
Honolulu Kuhio	453				9	11	0	21		1	6	0	0	2	0		41	11
Honolulu Lanakila	401				16	10	0	13		1	6	0	0	3	0		38	11
Honolulu Lincoln	312				28	8	0	14		1	6	0	0	5	0		34	10

COMPUTER EDUCATION: STANDARDS FOR MICROCOMPUTERS (1986-87)

DISTRICT	SCHOOL	REG ENR	INT ENR	9-12 ENR	10-12 ENR	SE ENR	EXPL	COMPSCI	CAI-REG	CAREER	CMI	CIR	VTLAB	VTCLASS	CAI-SE	SCI LAB	NEWSWRT	TOTAL	OVERALL SCH RATIO
Honolulu	Likelike	522				47	13	0	24		1	9	0	0	8	0		55	10
Honolulu	Liliuokalani	204				38	5	0	9		1	6	0	0	6	0		28	9
Honolulu	Linapuni	237				1	6	0	11		1	6	0	0	1	0		25	10
Honolulu	Lincoln	573				52	14	0	26		1	9	0	0	9	0		59	11
Honolulu	Lunalilo	776				22	19	0	36		1	9	0	0	4	0		69	12
Honolulu	Maemae	842				17	21	0	39		1	9	0	0	3	0		73	12
Honolulu	Manoa	490				16	12	0	23		1	6	0	0	3	0		44	11
Honolulu	McKinley	2,225		2,225	1,829	117	56	25	102	4	3	13	33	11	20	21	4	292	8
Honolulu	Niu	556	556			24	14	0	26	4	2	9	0	0	4	5		64	9
Honolulu	Noelani	37				1	11	0	20		1	6	0	1	0	0		39	11
Honolulu	Nuuanu	377				1	9	0	17		1	6	0	1	0	1		35	11
Honolulu	Palolo	347				24	9	0	16		1	6	0	0	4	0		36	10
Honolulu	Pauoa	434				41	11	0	20		1	6	0	0	7	0		45	11
Honolulu	Puuhale	353				8	9	0	16		1	6	0	0	1	0		33	11
Honolulu	Roosevelt	1,373		1,373	1,108	73	34	15	63	4	2	13	26	7	12	13	4	194	7
Honolulu	Royal	387				12	10	0	18		1	6	0	0	2	0		36	11
Honolulu	Stevenson	422	422			33	11	0	19	4	1	6	0	0	6	4		51	9
Honolulu	Waialae	398				17	10	0	18		1	6	0	0	3	0		38	11
Honolulu	Waikiki	197				18	5	0	9			6	0	0	3	0		24	9
Honolulu	Wallupe	158				0	4	0	7		1	6	0	0	0	0		18	9
Honolulu	Washington	800	800			57	20	0	37	4	2	9	0	0	10	8		89	10
Honolulu	Wilson	405				30	10	0	19		1	6	0	0	5	0		41	11

COMPUTER EDUCATION: STANDARDS FOR MICROCOMPUTERS (1986-87)

DISTRICT	SCHOOL	REG ENR	INT ENR	9-12 ENR	10-12 ENR	SE ENR	EXPL	COMPSCI	CAI-REG	CAREER	CMI	CIR	VTLAB	VTCLASS	CAI-SE	SCI LAB	NEWSWRT	TOTAL	OVERALL SCH RATIO
Central	District	31,954	4,287	8,955	6,584	1,915	799	100	1,470	40	55	355	108	40	319	127	24	3,436	10
Central	Aiea E	375				14	9	0	17		1	6	0	0	2	0		36	11
Central	Aiea H	1,572		1,572	1,172	100	39	17	72	4	3	13	4	7	17	15	4	196	8
Central	Aiea I	675	675			71	17	0	31	4	2	9	0	0	12	6		81	9
Central	Aliamanu E	897				31	22	0	41		1	9	0	0	5	0		79	12
Central	Aliamanu I	989	989			70	25	0	45	4	2	9	0	0	12	10		106	10
Central	Hale Kula	950				28	24	0	44		1	9	0	0	5	0		82	12
Central	Haleiwa	494				67	12	0	23		1	6	0	0	11	0		53	11
Central	Helemano	366				22	9	0	17		1	6	0	0	4	0		37	11
Central	Hickam	802				4	20	0	37		1	9	0	0	1	0		68	12
Central	Iliahi	298				37	7	0	14		1	6	0	0	3	0		34	10
Central	Kaala	500				44	13	0	23		1	6	0	0	7	0		50	11
Central	Kipapa	952				26	24	0	44		1	9	0	0	4	0		82	12
Central	Leilehua	1,475		1,475	1,080	120	37	16	68	4	3	13	22	6	20	14	4	208	8
Central	Makalapa	616				12	15	0	28		1	9	0	0	2	0		56	11
Central	Mililani H	1,717		1,717	1,273	108	43	19	79	4	3	13	8	8	18	17	4	215	8
Central	Mililani-uka	1,165				17	29	0	54		1	13	0	0	3	0		100	12
Central	Mililani-waena	893				19	22	0	41		1	9	0	0	3	0		77	12
Central	Moanalua E	672				33	17	0	31		1	9	0	0	6	0		63	11
Central	Moanalua H	1,817		1,817	1,359	99	45	20	84	4	3	13	26	8	17	17	4	241	8
Central	Moanalua I	703	703			52	18	0	32	4	2	9	0	0	9	7		80	9
Central	Mokulele	567				28	14	0	26		1	9	0	0	5	0		55	11
Central	Nimitz	747				29	19	0	34		1	9	0	0	5	0		68	11
Central	Pearl Harbor	622				24	16	0	29		1	9	0	0	4	0		58	11
Central	PH-Kai	601				70	15	0	28		1	9	0	0	12	0		64	10
Central	Pearl Ridge	445				5	11	0	20		1	6	0	0	1	0		39	11
Central	Radford	1,707		1,707	1,195	109	43	19	79		3	13	16	7	18	6	4	218	8
Central	Red Hill	763				26	19	0	35		1	9	0	0	4	0		69	12
Central	Salt Lake	676				26	17	0	31		1	9	0	0	4	0		62	11
Central	Alvah Scott	773				19	19	0	36		1	9	0	0	3	0		68	12
Central	Shafter	294				14	7	0	14		1	6	0	0	2	0		30	10
Central	Solomon	1,033				58	26	0	48		1	13	0	0	10	0		97	11
Central	Wahiawa E	549				90	14	0	25		1	9	0	0	15	0		64	10
Central	Wahiawa I	794	794			101	20	0	37	4	2	9	0	0	17	8		96	9

COMPUTER EDUCATION: STANDARDS FOR MICROCOMPUTERS (1986-87)

DISTRICT	SCHOOL	REG ENR	INT ENR	9-12 ENR	10-12 ENR	SE ENR	EXPL	COMPSCI	CAI-REG	CAREER	CMI	CIR	VTLAB	VTCLASS	CAI-SE	SCI LAB	NEWSWRT	OVERALL OTAL	OVERALL SCH RATIO
Central	Waialua E	537				31	13	0	25		1	9	0	0	5	0		53	11
Central	Waialua H	955	288	667	504	167	24	7	44	4	2	9	32	3	28	9	4	166	7
Central	Waimalu	809				27	20	0	37		1	9	0	0	5	0		72	12
Central	Webling	439				32	11	0	20		1	9	0	0	5	0		44	11
Central	Wheeler E	872				34	22	0	40		1	9	0	0	6	0		78	12
Central	Wheeler I	838	838			51	21	0	39	4	2	9	0	0	9	8		91	10

COMPUTER EDUCATION: STANDARDS FOR MICROCOMPUTERS (1986-87)

DISTRICT	SCHOOL	REG ENR	INT ENR	9-12 ENR	10-12 ENR	SE ENR	EXPL	COMPSCI	CAI-REG	CAREER	CMI	CIR	VTLAB	VTCLASS	CAI-SE	SCI LAB	NEWSWRT	TOTAL	OVERALL SCH RATIO
Leeward	District	27,412	4,075	8,230	5,929	1,819	685	91	1,261	36	47	295	128	36	306	118	20	3,025	10
Leeward	August Ahrens	1,455				53	36	0	67		1	13	0	0	9	0		126	12
Leeward	Barbers Pt	318				55	8	0	15		1	6	0	0	9	0		39	10
Leeward	Campbell	1,771		1,771	1,257	163	44	20	81	4	3	13	33	8		17	4	254	8
Leeward	Ewa	345				1	9	0	16		1	6	0	0	1	0		32	11
Leeward	Ewa Beach	415				23	10	0	19		1	6	0	0	4	0		40	11
Leeward	Highlands	1,109	1,109			62	28	0	51	4	2	13	0	0	10	11		119	10
Leeward	Honowai	749				39	19	0	34		1	9	0	0	7	0		70	11
Leeward	Ilima	869	869			60	22	0	40	4	2	9	0	0	10	8		95	10
Leeward	Iroquois Pt	969				3	24	0	45		1	9	0	0	1	0		79	12
Leeward	Kaimiloa	459				12	1.	0	21		1	6	0	0	2	0		42	11
Leeward	Kanoelani	793				2	20	0	36		1	9	0	0	1	0		67	12
Leeward	Lehua	373				13	9	0	17		1	6	0	0	2	0		36	11
Leeward	Leihoku	683				15	17	0	31		1	9	0	0	3	0		61	11
Leeward	Maili	879				52	22	0	40		1	9	0	0	9	0		81	11
Leeward	Makaha	850				37	21	0	39		1	9	0	0	6	0		77	12
Leeward	Makakilo	446				14	11	0	21		1	6	0	0	2	0		41	11
Leeward	Nanana	330				17	8	0	15		1	6	0	0	3	0		33	10
Leeward	Mauka Lani	307				3	8	0	14		1	6	0	0	1	0		29	11
Leeward	Momilani	248				0	6	0	11		1	6	0	0	0	0		25	10
Leeward	Nanaikapono	983				66	25	0	45		1	9	0	0	11	0		91	12
Leeward	Nanakuli E	404				32	10	0	19		1	6	0	0	5	0		41	11
Leeward	Nanakuli H	1,002	331	671	474	143	25	7	46	4	2	13	17	3	24	10	4	155	7
Leeward	Palisades	382				1	10	0	18		1	6	0	0	1	0		35	11
Leeward	Pearl City E	510				41	13	0	23		1	9	0	0	7	0		53	10
Leeward	Pearl City H	2,284		2,284	1,690	120	57	25	105	4	3	13	32	10	20	22	4	296	8
Leeward	PC Highlands	435				32	11	0	20		1	6	0	0	5	0		43	11
Leeward	Pohakea	536				47	13	0	25		1	9	0	0	8	0		56	10
Leeward	Waianae E	931				74	23	0	43		1	9	0	0	12	0		88	11
Leeward	Waianae H	1,620		1,620	1,130	193	41	18	75	4	3	13	17	7	32	16	4	229	8
Leeward	Waianae I	851	851			129	21	0	39	4	2	9	0	0	22	8		105	9
Leeward	Waiau	442				24	11	0	20		1	6	0	0	4	0		42	11
Leeward	Waipahu E	905				36	23	0	42		1	9	0	0	6	0		80	12
Leeward	Waipahu H	1,884		1,884	1,378	137	47	21	87	4	3	13	29	8	23	18	4	257	8
Leeward	Waipahu I	875	875			120	22	0	40	4	2	9	0	0	20	8		106	9

COMPUTER EDUCATION: STANDARDS FOR MICROCOMPUTERS (1986-87)

DISTRICT SCHOOL	REG ENR	INT ENR	9-12 ENR	10-12 ENR	SE ENR	EXPL	COMPSCI	CAI-REG	CAREER	CMI	C'R	VTLAB	VTCLASS	CAI-SE	SCI LAB	NEWSWRT	TOTAL	OVERALL SCH RATIO
Windward District	17,936	2,271	5,259	3,998	1,389	448	58	825	28	35	232	63	24	232	72	16	2,035	9
Windward Ahuimanu	572				14	14	0	26		1	9	0	0	2	0		53	11
Windward Aikahi	463				35	12	0	21		1	6	0	0	6	0		46	11
Windward Castle	1,924		1,924	1,470	232	48	21	89	4	3	13	27	9	39	19	4	275	8
Windward Enchanted Lake	453				15	11	0	21		1	6	0	0	3	0		42	11
Windward Hauula	447				45	11	0	21		1	6	0	0	8	0		46	11
Windward Heeia	671				40	17	0	31		1	9	0	0	7	0		64	11
Windward Kaaawa	144				6	4	0	7		1	6	0	0	1	0		18	8
Windward Kaelepulu	225				1	6	0	10		1	6	0	0	1	0		24	9
Windward Kahaluu	308				28	8	0	14		1	6	0	0	5	0		34	10
Windward Kahuku	1,662	443	843	616	129	42	9	76	4	1	13	11	4	22	12	4	198	9
Windward Kailua E	531				28	13	0	24		1	9	0	0	5	0		52	11
Windward Kailua H	1,232		1,232	956	166	31	14	57	4	2	13	17	6	28	12	4	186	7
Windward Kailua I	843	843			97	21	0	39	4	2	9	0	0	16	8		99	9
Windward Kainalu	557				51	14	0	26		1	9	0	0	9	0		58	10
Windward Kalaheo	1,260		1,260	956	85	32	14	58	4	2	13	8	6	14	12	4	166	8
Windward Kaneohe	439				10	11	0	20		1	6	0	0	2	0		40	11
Windward Kapunahala	326				62	8	0	15		1	6	0	0	10	0		40	10
Windward Keolu	321				18	8	0	15		1	6	0	0	3	0		33	10
Windward King	784	784			87	20	0	36	4	2	9	0	0	15	8		93	9
Windward Laie	886				23	22	0	41		1	9	0	0	4	0		77	12
Windward Lanikai	301				9	8	0	14		1	6	0	0	2	0		30	10
Windward Maunawili	343				18	9	0	16		1	6	0	0	3	0		34	11
Windward Mokapu	357				22	21	0	39		1	9	0	0	4	0		75	12
Windward Parker	569				28	14	0	26		1	9	0	0	5	0		55	11
Windward Pope	372				44	9	0	17		1	6	0	0	7	0		41	10
Windward Puohala	296				14	7	0	14		1	6	0	0	2	0		30	10
Windward Sunset Beach	349				15	9	0	16		1	6	0	0	3	0		34	11
Windward Waiahole	154				9	4	0	7		1	6	0	0	2	0		19	8
Windward Waimanalo	647	201			58	16	0	30	4	1	9	0	0	10	2		72	10

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2.0 mm

COMPUTER EDUCATION: STANDARDS FOR MICROCOMPUTERS (1986-87)

DISTRICT	SCHOOL	REG ENR	INT ENR	9-12 ENR	10-12 ENR	SE ENR	EXPL	COMPSCI	CAI-REG	CAREER	CMI	CIR	VTLAB	VTCLASS	CAI-SE	SCI LAB	NEWSWRT	TOTAL	OVERALL SCH RATIO
Hawaii	District	20,645	3,071	5,661	4,232	1,092	516	63	950	76	40	260	65	25	183	84	32	2,294	9
Hawaii	DeSilva	375				11	9	0	17		1	6	0	0	2	0		35	11
Hawaii	Haaheo	115				0	3	0	5		1	6	0	0	0	0		15	8
Hawaii	Hilo H	1,409		1,409	1,030	92	35	16	65	4	2	13	12	6	15	14	4	186	8
Hawaii	Hilo I	503	503			40	13	0	23	4	1	9	0	0	7	5		61	9
Hawaii	Hilo Union	697				46	17	0	32		1	9	0	0	8	0		67	11
Hawaii	Holualoa	299				18	7	0	14		1	6	0	0	3	0		31	10
Hawaii	Honaunau	400	52			23	10	0	18	4	1	6	0	0	4	1		44	10
Hawaii	Honoka'a	1,019	123	426	361	70	25	5	47	4	2	13	4	2	12	5	4	123	9
Hawaii	Hookena	183	38			17	5	0	8	4	1	6	0	0	3	0		27	7
Hawaii	Kahakai	487				25	12	0	22		1	6	0	0	4	0		46	11
Hawaii	Kalanianaole	670	144			13	17	0	31	4	1	9	0	0	2	1		65	10
Hawaii	Kapiolani	433				16	11	0	20		1	6	0	0	3	0		40	11
Hawaii	Kau	498	60	233	159	40	12	3	23	4	1	6	4	1	7	3	4	67	8
Hawaii	Kaumana	270				1	7	0	12		1	6	0	0	1	0		27	10
Hawaii	Keaau	724	134			17	18	0	33	4	1	9	0	0	3	1		70	11
Hawaii	Kealakeha	762					19	0	35		1	9	0	0	0	0		64	12
Hawaii	Kealakeha I	558	558				14	0	26	4	1	9	0	0	0	5		59	9
Hawaii	Keaukaha	261				13	7	0	12		1	6	0	0	2	0		28	10
Hawaii	Kohala	722	117	200	159	56	18	2	33	4	2	9	4	1	9	3	4	90	9
Hawaii	Konawaena E	568				28	14	0	26		1	9	0	0	5	0		55	11
Hawaii	Konawaena H	1,327	130	1,197	922	140	33	13	61	4	2	13	22	6	23	13	4	194	8
Hawaii	Laupahoehoe	330	51	95	73	24	8	1	15	4	1	6	4	0	4	1	4	49	7
Hawaii	Mt View	630	88			18	16	0	29	4	1	9	0	0	3	1		63	10
Hawaii	Naalehu	380	63			8	10	0	17	4	1	6	0	0	1	1		40	10
Hawaii	Paauilo	196	39			8	5	0	9	4	1	6	0	0	1	0		27	8
Hawaii	Pahoa	1,631	233	427	30[illegible]	92	41	5	75	4	3	13	4	2	15	6	4	172	10
Hawaii	Waiakea E	884				37	22	0	41		1	9	0	0	6	0		79	12
Hawaii	Waiakea H	1,674		1,674	1,224	122	42	19	77	4	3	13	11	7	20	16	4	216	8
Hawaii	Waiakea I	851	578			60	21	0	39	4	2	9	0	0	10	6		91	10
Hawaii	Waiakeawaena	938				12	23	0	43		1	9	0	0	2	0		79	12
Hawaii	Waimea	851	160			45	21	0	39	4	1	9	0	0	8	2		83	11

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DISTRICT	SCHOOL	REG ENR	INT ENR	9-12 ENR	10-12 ENR	SE ENR	EXPL	COMPSCI	CAI-REG	CAREER	CMI	CIR	VTLAB	VTCLASS	CAI-SE	SCI LAB	NEWSWRT	TOTAL	OVERALL SCH RATIO
Maui	District	14,766	2,118	4,286	3,174	742	369	48	679	48	27	200	39	19	124	62	20	1,634	9
Maui	Baldwin	1,483		1,483	1,068	100	37	16	68	4	2	13	14	6	17	14	4	196	8
Maui	Haiku	365				9	9	0	17		1	6	0	0	2	0		34	11
Maui	Hana	357	50	89	67	22	9	1	16	4	1	6	7	0	4	1	4	54	7
Maui	Iao	579	387			21	14	0	27	4	1	9	0	0	4	4		62	10
Maui	Kahului	1,109	233			31	28	0	51	4	1	13	0	0	5	2		104	11
Maui	Kalama Int	504	504			11	13	0	23	4	1	9	0	0	2	5		56	9
Maui	Kam III	831				25	21	0	38		1	9	0	0	4	0		73	12
Maui	Kaunakakai	423				29	11	0	19		1	6	0	0	5	0		42	11
Maui	Keanae	24				0	1	0	1		0	1	0	0	0	0		3	9
Maui	Kihei	972	203			41	24	0	45	4	1	9	0	0	7	2		92	11
Maui	Kilohana	151				6	4	0	7		1	6	0	0	1	0		19	8
Maui	Kualapuu	230				12	6	0	11		1	6	0	0	2	0		25	10
Maui	Kula	437				20	11	0	20		1	6	0	0	3	0		41	11
Maui	Lahaina	374	241			24	9	0	17	4	1	6	0	0	4	2		44	9
Maui	Lahainaluna	692		692	514	41	17	8	32	4	2	9	7	3	7	7	4	99	7
Maui	Lanai	432	60	162	115	19	11	2	20	4	1	6	1	1	3	2		51	9
Maui	Lihikai	1,105	217			55	28	0	51	4	1	13	0	0	9	2		108	11
Maui	Makawao	627				32	16	0	29		1	9	0	0	5	0		60	11
Maui	Maui	1,437		1,437	1,085	99	36	16	66	4	2	13	7	7	17	14	4	185	8
Maui	Maunaloa	83				0	2	0	4		0	6	0	0	0	0		12	7
Maui	Molokai	646	223	423	325	41	16	5	30	4	2	9	3	2	7	6	4	88	8
Maui	Paia	91				53	2	0	4		1	6	0	0	9	0		22	6
Maui	Pukalani	604				6	15	0	28		1	9	0	0	1	0		54	11
Maui	Waihee	296				18	7	0	14		1	6	0	0	3	0		31	10
Maui	Wailuku	914				27	23	0	42		1	9	0	0	5	0		79	12

COMPUTER EDUCATION: STANDARDS FOR MICROCOMPUTERS (1986-87)

DISTRICT	SCHOOL	REG ENR	INT ENR	9-12 ENR	10-12 ENR	SE ENR	EXPL	COMPSCI	CAI-REG	CAREER	CMI	CIR	VTLAB	VTCLASS	CAI-SE	SCI LAB	NEWSWRT	TOTAL	OVERALL SCH RATIO
Kauai	District	8,239	1,093	2,519	1,881	444	206	28	379	16	15	106	37	11	76	35	12	921	9
Kauai	Eleele	392				10	10	0	18		1	6	0	0	2	0		36	11
Kauai	Hanalei	188				18	5	0	9		1	6	0	0	3	0		23	9
Kauai	Kalaheo	459				16	11	0	21		1	6	0	0	3	0		42	11
Kauai	Kapaa	1,259				62	31	0	58		1	13	0	0	10	0		114	12
Kauai	Kapaa H	1,102	338	764	560	102	28	8	51	4	2	13	14	3	17	11	4	155	8
Kauai	Kauai	1,221	381	840	628	97	31	9	56	4	2	13	4	4	16	12	4	155	9
Kauai	Kekaha	382				13	10	0	18		1	6	0	0	2	0		36	11
Kauai	Kilauea	207				1	5	0	10		1	6	0	0	1	0		23	9
Kauai	Koloa	430				8	11	0	20		1	6	0	0	1	0		39	11
Kauai	Niihau	21	4	8	8	1	1	0	1		0	0	0	0	1	0		3	8
Kauai	Waimea Canyon	635	370			26	16	0	29	4	1	9	0	0	4	4		67	10
Kauai	Waimea H	907		907	685	52	23	10	42	4	2	9	19	4	9	9	4	134	7
Kauai	Wilcox	1,035				38	26	0	48		1	13	0	0	6	0		94	11

COMPUTER EDUCATION: STANDARDS FOR MICROCOMPUTERS (1986-87)

DISTRICT	SCHOOL	REG ENR	INT ENR	9-12 ENR	10-12 ENR	SE ENR	EXPL	COMPSCI	CAI-REG	CAREER	CMI	CIR	VTLAB	VTCLASS	CAI-SE	SCI LAB	NEWSWRT	TOTAL	OVERALL SCH RATIO
Special	Schools	99	0	0	0	162	2	0	5	0	0	0	4	0	27	0	0	38	7
Special	HI Df & Bld					38	0	0	0						6			6	6
Special	Pohukaina					42	0	0	0						7			7	6
Special	Olomana	99				40	2	0	5				4		7			18	8
Special	Jefferson Orth					42	0	0	0						7			7	6

APPENDIX C

Educational Specifications, Computer Resource Room

EDUCATIONAL SPECIFICATIONS, COMPUTER RESOURCE ROOM

Educational Specifications and Standards for Facilities, Volumes I, II and III include provisions for accommodating computer resource centers for elementary, intermediate and high schools. The approved educational specifications and standards for computer resource rooms for high schools are included in this Appendix.

Specifications and standards for computer resource rooms for elementary and intermediate schools are identical to those established for high schools. Those for elementary schools are found on pages 69, 69a, 159a-159d; for intermediate schools on pages 84a-84b, 219a-219d.

J. Computer Resource Room

1. Program Description

The computer education program uses the computer as an object of instruction, a medium of instruction, and as an aid to managing instruction. The four major areas of the program are computer literacy, computer-assisted instruction, computer-based information retrieval and computer-managed instruction. Computer literacy has three components: exploratory for grades K-12, computer science for grades 9-12, and vocational-technical computer education for grades 10-12. The computer literacy area develops the awareness, provides the basic understandings, and gives the practical experiences which include life skills training. Computer-assisted instruction provides course content instruction for tutorial, discovery, and drill and practice exercises, instructional games and simulation. Computer-based information retrieval is the means to access and retrieve information from local and national data bases for individual class and school level use. Student performance data serve as input to the computer-managed instruction component to establish a comprehensive data base. This data base allows for evaluation and diagnosis of individual student progress, planning individualized instruction and managing effective use of resources.

2. Program Activities

The computer education program is thematic (exploratory computer literacy), program specific with specific courses (computer science), occupational skill oriented (vocational-technical) and individual student focused (computer-assisted, computer-based information retrieval and computer-managed instruction). The program combines direct instruction, directed study to pursue individual interests and hands-on laboratory experiences with computers and other computer-related equipment. These experiences are provided in regular classrooms and computer resource centers.

3. Discernible Trends

The trend in computer education is to maintain flexibility and resourcefulness in keeping up the rapid technological advances in the development and uses of computers. Students need to be exposed to the range of available equipment and uses and to be able to readily adjust to new developments in technology throughout their [illegible] (including post-secondary) experience and beyond formal schooling as adult citizens.

4. Facilities Requirements

Many of the learning experiences can be provided in the general classroom setting. However, as schools begin to meet their optimal equipment needs, computer resource centers are required for the following reasons:

a. Optimum utilization of hardware through shared-use.

b. Maximum security control during and outside of school hours.

c. Appropriate supervision with increased accessibility to students.

d. Favorable facility and environmental conditions for hardware and software maintenance.

The number and location of these centers within a school will be determined by the size of the school, with each center functionally able to service multiple programs and strategically located on the campus to insure accessibility. The centers will also be used for inservice training of teachers, administrators and other department staff. Orientation sessions for parents and other community members will also be conducted in these centers.

Each resource center should accommodate four work stations. Each work station should accommodate 4-5 microcomputers, at least one printer, and other peripherals, and furniture to accommodate two students per microcomputer. Additional furniture and equipment requirements include common work areas with tables, storage and chairs, and televisions and other sound and graphic peripherals.

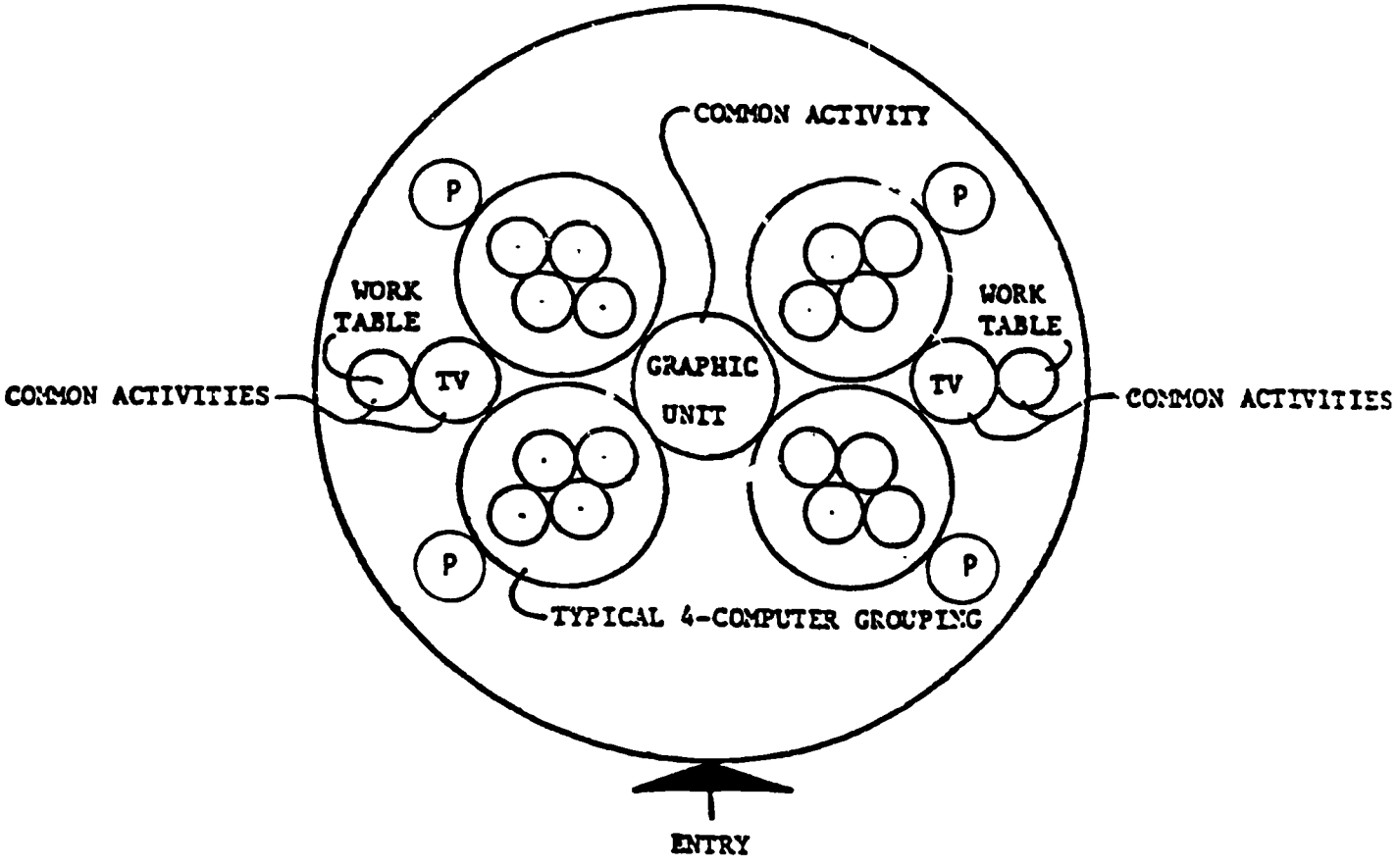
Attendant electrical, temperature control and security accommodations will be considered.

V. OTHER PROGRAMS AND SUPPORT FACILITIES

The following "Support Programs" are included in this section:

- Administrative Center
- Adult Education
- Cafetorium/Multi-Purpose Center
  1) Student Dining/Multi-Purpose Room
  2) Staff Dining Room
  3) Custodial Services Center
  4) Kitchen/Service
- Community-School Library
- Interscholastic Athletics
- Library Media Center
- Student Activities
- Miscellaneous Special Rooms
  1) Faculty Center
  2) Custodial Closet
  3) Boy's Toilet (Gang Type)
  4) Girl's Toilet (Gang Type)
- Computer Resource Room

The architectural specifications for each "Support Program" are displayed in detail in the ensuing pages.



FUNCTIONAL RELATIONSHIP DIAGRAM
COMPUTER RESOURCE ROOM - HIGH

Approved by DPED and DB&F 12/85

ARCHITECTURAL CONSIDERATIONS FOR COMPUTER RESOURCE ROOM - HIGH

TYPE OF SPACE	UNIT CAPACITY	NO. OF UNITS	UNIT AREA (Net Sq. Ft.)	TOTAL AREA (Net Sq. Ft.)	STRUCTURAL			ENVIRONMENTAL				BUILT-INS				MEDIA				UTILITIES			OTHER
					WALLS	FLOORS	CEILINGS	THERMAL	ACOUSTICAL	VISUAL	ESTHETICS	INSTRUCTIONAL SURFACES	STUDENT STATIONS	INSTRUCTOR STATIONS	STORAGE	AUDIO	TV	AV	CON/TIA	ELECTRICAL	PLUMBING	MECHANICAL	
GENERAL REQUIREMENTS					GS 1	GS 5	GS 8	GS16	GS	-	GS	GS26	-	-	32	-	GS42	-	GS45	GS57	GS60	GS17	GS71
GROUP ACTIVITY AREA	8	4	150	600	-	GS 6	-	-	-	-	GS	GS27	-	-	32	GS41	GS43	-	-	GS58	-	-	-
COMMON ACTIVITY AREA	1	1		100	-	GS 6	-	-	-	-	GS	-	-	-	32	-	-	-	-	GS58	-	-	-
CIRCULATION AREA				200	GS 4	GS 6	-	-	-	-	GS	GS29	-	-	-	-	-	-	-	-	-	-	-
Total				900																			

NOTES TO ARCHITECTURAL CONSIDERATIONS - COMPUTER RESOURCE ROOM - HIGH

Structural

1. Four full height fixed walls; maximize primary window openings with sill height at 42" from floor, oriented perpendicular to prevailing wind; windows must have room darkening capability as well as optimal ventilation; every unit shall be provided with a minimum of one door for direct accessibility from exitway; all exterior window and door openings shall be adequately protected from the elements by means of overhangs or other provisions; security measures for all exterior doors and windows.
5. Lanais of appropriate dimensions shall be provided to each room unit with entry door.
6. Resilient tile
8. Minimum ceiling height of 9 feet; adequate roof deck insulation to meet minimum noise and temperature standards; acoustical ceiling treatment.

Environmental

16. Natural Ventilation
17. Mechanical ventilation including A/C, may be provided if proper justifications can be furnished.

Built-ins

26. Provide tackboards on available wall surfaces, not exceeding a total of 8 linear feet.
27. 16 linear ft. (minimum) felt-board; chart hanger rail.
29. Locate tackboard in close proximity to entrance.
32. Utilize storage cabinets and base cabinets.

Media System

41. PA speaker.
42. ETV circuitry, see Appendix for directions.
43. TV outlet.
45. Program bell and fire alarm on exterior of building audible to occupants of building.

Utilities

56. General lighting requirements to conform to current standards. Locate all light fixture switches at entry door.
57. Duplex outlet for synchronized or regular clock.
58. Outlets (pedestal type) for each computer, printer, and graphic unit.
60. Locate drinking fountains, as required, along exterior of lanai wall

Others

71. Positive security of windows, doors, and other areas to prevent illegal entry into rooms. Security screening of windows, deadbolt lock on doors, astragal, and burglar alarm systems

FURNITURE AND EQUIPMENT STANDARDS - COMPUTER RESOURCE ROOM - HIGH

ROOM/AREA Item	Dimensions (") L	W	H	No. Required	CFCI	SFCI	SFSI
Group Activity Area							
Computer, Micro				16			E
Table	30"	36"	vari-able	16			P
Chairs, Student	V A	R I	E S	32			P
Bookcase, Portable w/casters	36	12	42	4			P
Printers				4			E
Table (Printer) w/paper feed rack	30"	30"	29"	4			P
Common Activity Area							
25" Color Monitor, w/video & RGB input/output				2			E
TV Stand (for above)				2			E
*Table, Metal W.T. w/o center drawer	72"	30"	29"	2			P
Chair, Student				4			P
**Graphic Unit				1			
Table (Graphic)	36"	30"	29"	1			P
Closet - Storage	48"	24"	84"	4	X		
Teacher Station							
Desk, Single Pedestal	60"	30"	30"	1			C
Chair, Swivel w/casters				1			C
Closet - Storage	48"	24"	84"	2	X		

* Shared by two groups, each four students each.
** Shared by four groups, each four students each.

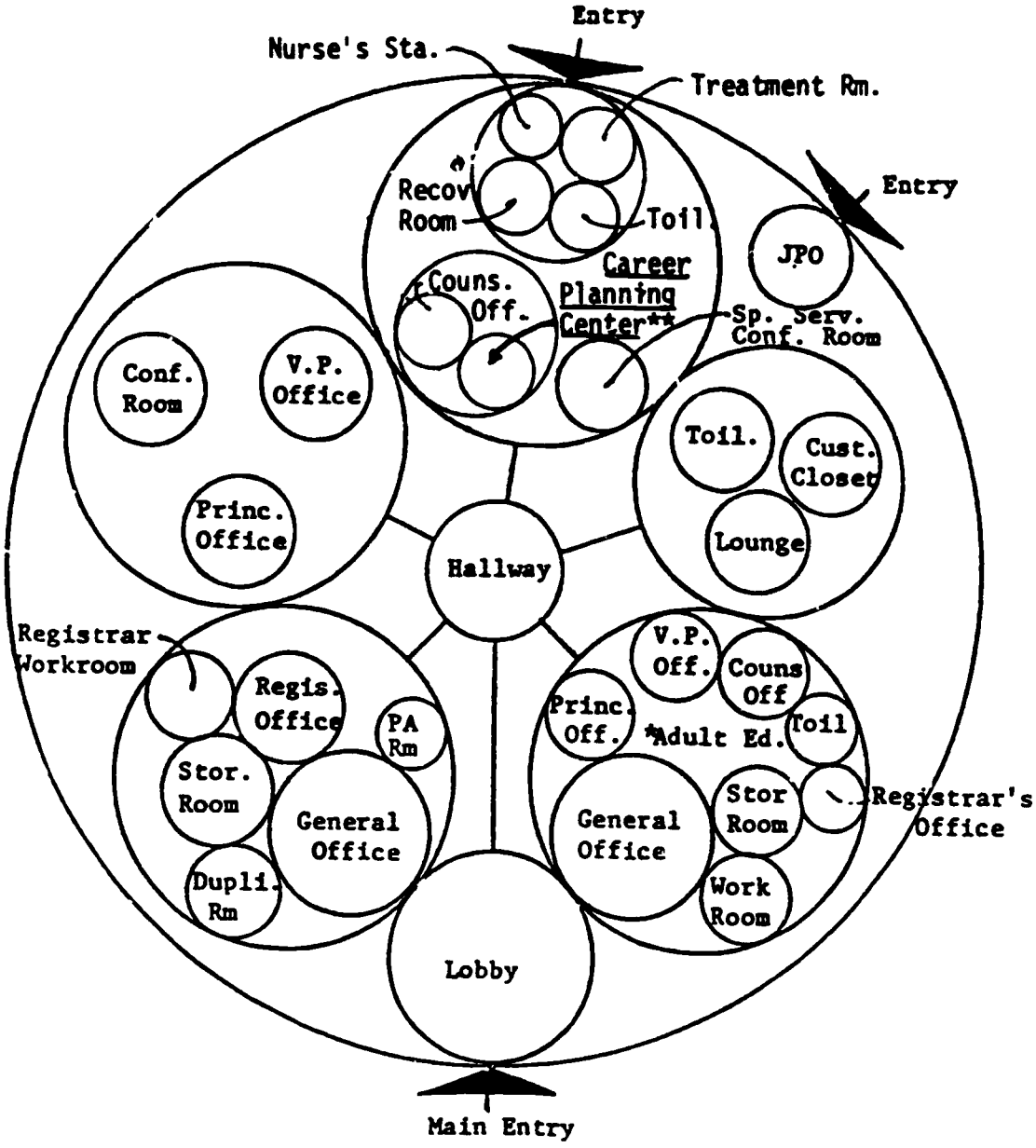
Approved by DPED and DB&F 12/85 -42id- 114

APPENDIX D

Educational Specifications, Career Resource Center

EDUCATIONAL SPECIFICATIONS, CAREER RESOURCE CENTER

Educational Specifications and Standards for Facilities, Volumes I, II and III include provisions for accommodating career planning centers in high schools. The approved educational specifications and standards for career planning centers are included in this Appendix.



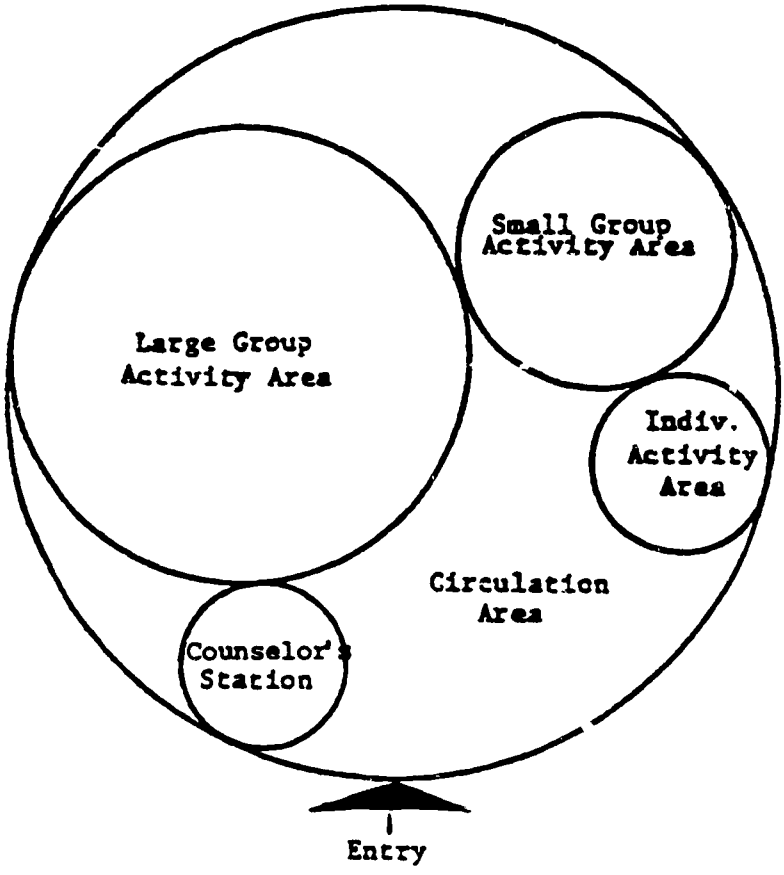
FUNCTIONAL RELATIONSHIP DIAGRAM - ADMINISTRATION BUILDING

HICH

*Omit Adult Education facilities if Adult Education Program not sanctioned by the district superintendent for school in question.

**See enlarged diagram (page 335a).

Approved by DB&F/DPED 12/27/85



FUNCTIONAL RELATIONSHIP DIAGRAM - CAREER PLANNING CENTER

HIGH SCHOOL

Approved by DB&F/DPED 12/27/85

ARCHITECTURAL CONSIDERATIONS FOR ADMINISTRATIVE CENTER - HIGH

TYPE OF SPACE	UNIT CAPACITY	NO. OF UNITS	UNIT AREA (Net Sq. Ft.)	TOTAL AREA (Net Sq. Ft.)	STRUCTURAL			ENVIRONMENTAL				INSTRUCTIONAL SURFACES	BUILT-INS			MEDIA				UTILITIES			OTHER
					WALLS	FLOORS	CEILINGS	THERMAL	ACOUSTICAL	VISUAL	ESTHETICS		STUDENT STATIONS	INSTRUCTOR STATIONS	STORAGE	AUDIO	TV	AV	CON/FLM	ELECTRICAL	PLUMBING	MECHANICAL	
PRINCIPAL'S OFFICE	SEE SUMMARY TABLE		200	SEE SUMMARY TABLE	GS 1	GS 4	GS	GS	GS24	GS	GS	GS34	-	-	-	-	-	-	GS55	GS76	-	-	-
VICE PRINCIPAL'S OFFICE					GS 1	GS 4	GS	GS	GS24	GS	GS	GS34	-	-	-	-	-	-	GS55	GS76	-	-	-
GENERAL OFFICE					GS16	GS 4	GS	GS	GS	GS23	GS	GS34	GS46	GS35	-	-	-	-	GS52 56	GS76	-	-	-
Duplicating room					GS 5	GS 4	GS	GS	GS22	GS	GS	GS34	-	GS39	-	-	-	-	-	GS75	GS71	-	-
Storage room					GS 6	GS 4 7	GS	GS	-	-	-	-	-	-	GS40	-	-	-	-	GS	-	-	-
P.A. room					GS 1	GS 4	GS	GS	GS26	GS	GS	GS34	GS44	-	-	GS57	-	-	-	GS75	-	-	- 88
LOBBY					GS13	GS 4	GS	GS	GS	GS	GS	GS36	-	-	-	-	-	-	-	GS66	GS69	-	-
STAFF CONFERENCE ROOM					GS 2	GS11	GS	GS	GS	GS	GS	GS34	-	-	-	-	GS53	GS54	GS56	GS80	-	-	-
REGISTRAR'S OFFICE:					GS 1	GS 4	GS	GS	GS	GS	GS	GS34	-	-	-	-		-	GS55	GS76	-	-	-
Registrar's workroom					GS 1	GS 4	GS	GS	-	-	GS	GS42	-	-	-	-	-	-	GS51	GS75	GS79	-	-
HEALTH SERVICE:																				76,78			
Treatment room					GS 3	GS 4	GS	GS	GS21	GS	GS	-	-	GS37	GS41	-	-	-	-	GS75 77	GS38	-	- 86
Recovery room*			50		GS12	GS 4	GS	GS	-	GS45	GS	-	GS45	-	-	-	-	-	-	GS	-	-	-
Nurse Sta/Waiting Area					GS15	GS 4	GS	GS	GS	GS33	GS	GS34	GS33	-	-	-	-	-	GS55	GS76	-	-	-
Toilet					GS 9	GS10	GS	GS	GS	GS	-	-	-	-	-	-	-	-	-	GS	GS73	-	- 87
COUNSELOR'S OFFICE			140		GS 1	GS 4	GS	GS	GS21	GS	GS	GS34	-	-	-	-	-	-	GS55	GS76	-	-	-
CAREER PLANNING CENTER**																							
General Requirements					GS 1	GS 3	GS 5	GS16	GS16	-	GS	GS26	-	-	-	-	GS42	-	GS45	GS56	GS69	GS	-
Large Group Act. Area	24			290	GS 2	GS 4	-	-	-	-	GS	GS27	-	-	- 30	GS41	GS53	GS54	-	GS57	-	-	-
Small Group Act. Area	10			214	GS 2	GS 4	-	-	-	-	GS	-	-	-	- 30	-	-	-	-	-	-	-	-
Individual Act. Area	10			191	GS 2	GS 4	-	-	-	-	GS	-	GS30	-	- 30	-	-	-	- 60	GS58	-	-	-
Counselor's Station	2			58	-	GS 4	-	-	-	GS17	GS	GS29	-	-	-	-	-	-	-	-	-	-	-
Circulation Area				147	GS 2	GS 4	-	-	-	-	GS	-	-	-	-	-	-	-	-	-	-	-	-
CRC Total				900																			
CONF./SPEC. SERV. ROOM	SEE SUMMARY TABLE			SEE SUMMARY TABLE	GS 2	GS 4	GS	GS	GS	GS25	GS	GS34	-	GS36	-	-	GS53	GS54	-	GS70	GS74	-	-
STAFF LOUNGE					GS 5	GS 5	GS	GS	GS	GS	GS	GS34	-	-	GS38	-	-	-	-	GS75 77	GS71		
MEN & WOMEN TOILETS		2	45		GS 9	GS10	GS	GS	GS24	-	-	-	-	GS32	-	-	-	-	-	GS	GS72	-	-

*50 sq. ft./300 students.

** For notes to Architectural Considerations, see page 339b.

ARCHITECTURAL CONSIDERATIONS FOR ADMINISTRATIVE CENTER - HIGH (contd)

TYPE OF SPACE	UNIT CAPACITY	NO. OF UNITS	UNIT AREA (Net Sq. Ft.)	TOTAL AREA (Net Sq. Ft.)	STRUCTURAL			ENVIRONMENTAL					BUILT-INS			MEDIA				UTILITIES			
					WALLS	FLOORS	CEILINGS	THERMAL	ACOUSTICAL	VISUAL	ESTHETICS	INSTRUCTIONAL SURFACES	STUDENT STATIONS	INSTRUCTOR STATIONS	STORAGE	AUDIO	TV	AV	CON/TLN	ELECTRICAL	PLUMBING	MECHANICAL	OTHER
CUSTODIAL CLOSET	SEE SUMMARY TABLE			SEE SUMMARY TABLE	GS 5	GS 8	GS	GS	-	-	-	-	-	-	GS40	-	GS58	-	GS59	GS68	GS67	-	-
HALLWAY/WAITING ALCOVE					GS	GS 4	GS	GS	GS	GS	GS	-	-	-	-	-	-	-	-	GS66	-	-	-
JPO STORAGE ROOM					GS 5	GS 4	GS	GS	-	-	-	GS34	-	-	GS31	-	-	-	-	GS	-	-	-
ADULT EDUCATION*					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	GS90

*Include Adult Education facilities if program sanctioned for school by district superintendent. See adult education architectural considerations.

CAPACITY AND SPACE SUMMARY TABLE

ADMINISTRATIVE CENTER - HIGH

TYPE OF SPACE	Level of Enrollment													
	0-500		501-750		751-1000		1001-1250		1251-1500		1501-1750		1751-2000	
	U.C.	Net Sq Ft	U.C.	Net Sq Ft	U.C.	Net Sq Ft	U.C.	Net Sq Ft	U.C.	Net Sq Ft	U.C.	Net Sq Ft	U.C.	Net Sq Ft
PRINCIPAL'S OFFICE	4	200	4	200	4	200	4	200	4	200	4	200	4	200
V.P. OFFICE		-		-		20'	4	200	4	200	5	400	8	400
GENERAL OFFICE	2	290	2	355	2	355	3	420	3	420	3	420	3	420
Duplicating Room	2	100	2	100	2	100	3	130	3	130	3	130	3	130
Storage Room		190		215		215		240		240		240		240
P.A. Room	4	60	4	60	4	60	4	60	4	60	4	60	4	60
LOBBY	6	155	8	195	8	195	10	240	10	240	10	240	10	240
STAFF CONFERENCE ROOM	20	240	20	240	20	240	20	240	20	240	20	240	20	240
REGISTRAR'S OFFICE	3	120	3	120	3	120	3	120	3	120	3	120	3	120
Reg. Work Room	3	400	3	500	3	500	3	600	3	600	3	600	3	600
HEALTH SERVICE														
Treatment Room	1	170	1	170	1	170	1	170	1	170	1	170	1	170
Recover Room*	2	100	2	100	3	150	4	200	4	200	5	250	6	300
Nurse's Sta/Waiting Area	5	150	5	150	5	150	5	150	5	150	5	150	5	150
Toilet	1	30	1	30	1	30	1	30	1	30	1	30	1	30
COUNSELOR'S OFFICE	6	140	12	280	12	280	18	420	18	420	24	560	24	560
CAREER PLANNING CENTER**	46	900	46	900	46	900	46	900	46	900	46	900	46	900
CONF/SPEC SERV ROOM	20	264	20	264	20	264	20	264	20	264	20	264	20	264
STAFF LOUNGE	7	145	7	145	7	145	10	190	10	190	10	190	10	190
MEN & WOMEN TOILETS	2	144	2	144	2	144	2	144	2	144	2	144	2	144
CUSTODIAL CLOSET		40		40		40		40		40		40		40
HALLWAY/WAITING ALCOVE		549		610		650		800		864		1002		1083
JPO STORAGE ROOM		40		40		40		40		40		40		40
Total		3527		3957		4248		4898		4962		5490		5621

ADULT EDUCATION: Refer to Adult Education Section

*Minimum 2 beds

**Center may be located in the administration building or with other buildings on the campus; therefore, square footage has not been added to the administrative center total.

NOTES TO ARCHITECTURAL CONSIDERATIONS - ADMINISTRATIVE CENTER - HIGH

Structural

1. Self-contained room with full-height walls and half-glass door.
2. Self-contained room, full-height walls; flexibility to darken room.
3. Hallway and exterior doors adequate to accommodate stretcher and/or wheelchair patient.
4. Resilient tile.
5. Self-contained room with full-height walls.
6. Self-contained room with full-height walls; maximum door and window security.
7. Floor safe.
8. Finished concrete.
9. 4' ceramic tile wainscot.
10. Ceramic tile wainscot.
11. Carpet.
12. 7' wall with glass top for visual control from nurse station.
13. Wall with pass-through window with lock at service counter if lobby serves adult education office as well; if not, open space concept.
14. Main health service entry from hallway.
15. As per adjoining activity requirements.
16. Office-lobby design based on open space concept if lobby does not service adult education; if it serves adult education; reception counter to be walled in with lockable pass-through window.
17. Four full height fixed walls; maximize primary window openings with sill height at 42" from floor, oriented perpendicular to prevailing wind; windows must have room darkening capability as well as optimal ventilation; every room shall be provided with a miminum of one door for direct accessibility from exitway; all exterior window and door openings shall be adequately protected from the elements by means of overhangs or other provisions; special security measures for all exterior doors and windows.
18. Utilize portable bookcase and/or display cases as space dividers, if necessary.
19. Lanais or other exitways of appropriate dimensions shall be provided to each classroom unit with entry door.
20. Minimum ceiling height of 9 feet; adequate roof deck insulation to meet minimum noise and temperature standards; acoustical ceiling treatment.

Environmental

21. Privacy for counseling.
22. Contain reproduction equipment noise.
23. Visual control of lobby.
24. Auditory privacy.
25. Provision to darken room.
26. Acoustically designed.
27. See appendix for temperature/acoustical design guidelines.
28. Maximize visual control capability from teacher's desk over all activity areas.

Built-ins

31. Uniform shelf with clothes hook underneath.
32. Toilet stalls; necessary accessories.
33. 23' clear span for vision test; visual control of recovery room.
34. 4'x4' tackboard and/or chalkboard.
35. Reception counter facing lobby with teacher mailboxes built onto 1 end of counter surface, storage shelving below.
36. 4'x8' tackboard; display case.
37. Base cabinet with s.s. sink,

NOTES TO ARCHITECTURAL CONSIDERATIONS - ADMINISTRATIVE CENTER - HIGH (cont'd)

Built-ins (cont'd)

double gooseneck spout and wrist-control blades; cupboards over sink.

38. Base and wall cabinets with sink.
39. Base cabinet with sink; wall cabinets above; bottom of wall cabinet to clear tallest repro equipment; base cabinet to have adjustable shelves.
40. Storage shelving; 18" deep.
41. 20 sq. ft walk-in storage closet with lock and adjustable shelving.
42. 4'x16' master calendar on wall.
43. Base and wall cabinets; work counter with shelves below along lanai wall with pass-through window.
44. Work counter with knee spaces for four student stations.
45. Curtain tracks for screening cots.
46. Counter for telephone switchboard.
47. Provide tackboards on available wall surfaces, not exceeding a total of 16 linear feet.
48. 8 linear ft. chalkboard, chart hanger rail.
49. Locate tackboard in close proximity to desk, if possible.
50. Utilize storage cabinets as well as the classroom central storage room.

Media

51. Telephone(s) adjacent to desk(s).
52. Telephones adjacent to clerical desks; central fire-alarm, master clock, and program bell control stations.
53. T.V. outlet under chalkboard.
54. Movie screen bracket above chalkboard.
55. Telephone adjacent to desk.
56. Synchronized clock.
57. Public address central control on work counter.

Media (cont'd)

58. E.T.V. panel with duplex outlet.
59. Telephone panel with duplex outlet.
60. PA speaker above chalkboard.
61. For general ETV circuitry, see Appendix.
62. Program bell and fire alarm on exterior of building audible to occupants of building.

Utilities

66. Duplex outlets spaced for custodial requirements.
67. Service sink with cold water line.
68. Main electrical panel.
69. Water cooler or drinking fountain (tap water).
70. Duplex outlets - 1 on end wall, 1 over base cabinet.
71. Cold water line to sink.
72. W.C. and Lav.; add urinal for men.
73. W.C. and Lav.
74. Cold water line with clay trap for sink.
75. Duplex outlets above counter top.
76. Duplex outlet adjacent to desk.
77. 120-v outlet to refrigerator.
78. Duplex outlet adjacent to each 30'x60' tables.
79. S.S. sink with cold water line.
80. Duplex outlets, one each end.
81. General lighting requirements to conform to current school design standards. Locate all light fixture switches at entry door.
82. Duplex outlet below chalkboard; outlet with sychronized or regular clock above chalkboard; outlet at rear of 24-pupil activity area.
83. One duplex outlet centered over each carrel. Provide appropriate circuitry and outlets for each microcomputer and printer.
84. Provide one telephone outlet for each microcomputer station.

NOTES TO ARCHITECTURAL CONSIDERATIONS - ADMINISTRATIVE CENTER - HIGH (cont'd)

Other

86. Facility should be on ground floor with outside entrance adequate to accommodate stretcher and/or wheel-chair patient.
87. Stainless steel shelving and 18"x24" mirror over lavatory.
88. Entry door facing general office.
89. Create alcove off of hallway, close to health and counseling offices.
90. Provide hallway doors at strategic locations, together with other provisions, to block off high school administration facilities from adult education.

NOTES TO ARCHITECTURAL CONSIDERATIONS - CAREER PLANNING CENTER - HIGH

Structural

1. Four full height fixed walls; maximize primary window openings with sill height at 42" from floor, oriented perpendicular to prevailing wind; windows must have room darkening capability as well as optimal ventilation; every classroom unit shall be provided with a minimum of one door for direct accessibility from exitway; all exterior window and door openings shall be adequately protected from the elements by means of overhangs or other provisions; special security measures for all exterior doors and windows.
2. Utilize portable bookcase and/or display cases as space dividers, if necessary.
3. Lanais of appropriate dimensions shall be provided to each classroom unit with entry door.
4. Resilient tile.
5. Minimum ceiling height of 9 feet; adequate roof deck insulation to meet minimum noise and temperature standards; acoustical ceiling treatment.

Environmental

16. See appendix for temperature/acoustical design guidelines.
17. Maximize visual control capability from teacher's desk over all activity areas.

Built-ins

26. Provide tackboards on available wall surfaces, not exceeding a total of 16 linear feet.
27. 8 linear ft. chalkboard; chart hanger rail.
29. Locate tackboard in close proximity to desk, if possible.
30. Utilize storage cabinets, as well as the classroom central storage room.
31. Provide acoustical/divider panel between and sides of of micro-computer units.

Media System

41. PA speaker above chalkboard.
42. For general ETV circuitry, see appendix.
43. TV outlet below chalkboard.
44. Movie screen bracket above chalkboard.
45. Program bell and fire alarm on exterior of building audible to occupants of building.

Utilities

56. General lighting requirements to conform to current school design standards Locate all light fixture switches at entry door.
57. Duplex outlet below chalkboard; outlet with synchronized or regular clock above chalkboard; outlet at rear of 24-pupil activity area.
58. One duplex outlet centered over each carrel. Provide appropriate circuitry and outlets for each microcomputer and printer.
59. Locate drinking fountains, as required, along exterior of lanai wall.
60. Provide one telephone outlet for each microcomputer station.

FURNITURE AND EQUIPMENT STANDARDS FOR ADMINISTRATIVE CENTER - HIGH SCHOOL
(Continued)

ROOM/AREA Item	Dimensions (")			No. Required	CFC	SFCI	SFSI
	L	W	H				
Health Services-Treatment Room (Cont'd)							
Refrigerator - portable, 1.9 cu. ft.; with 0.41 cu. ft. freezer				1			E
Scale/measuring rod				1			E
Stretcher - pole aluminum				1			E
Storage cabinet - 2-door, 5-shelf, with lock				1			P
File - 3-drawer, legal, with lock				1			C
Screen - 3-panel (if exam room not separate)				1			P
Step-on can - covered, stainless steel, with defumer				1			E
Bulletin board	48	36		1	x		
Wastebaskets				2			E
Treatment table - portable, on wheels				1			P
Bookcase - 3-shelf	48	12	42	1	x		
Pamphlet display rack				1			E
Health Services - Nurse's Office							
Desk - double-pedestal (for aide)	45	30	30	1			C
Chair - secretary				1			C
File - 3-drawer, legal, with lock				1			C
Bookcase - 3-shelf	48	12	42	1	x		
Chairs - side				4			P
Guidance and Counseling Complex (G&CC)-Counselor's Office							
Desk - double-pedestal	60	30	30	1			C
Chair - executive				1			C
Chair - side, with arm rest				2			P
-student 17/18"				7			P
Table - 48" round				1			P
File - 4-drawer, legal, with lock	29	18	42	1			C
Bookcase - 4-shelf	40	12	48	1	x	or	P
Bulletin board	48	48		1	x		
Typewriter and typewriter stand				1			E
File - mental, for 5" x 8" cards				2			E
Career Planning Center:							
Large Group Activity Area							
Table	60	30	adj.	4			P
Chairs, student				24			P

FURNITURE AND EQUIPMENT STANDARDS - CAREER PLANNING CENTER

ROOM/AREA Item	Dimensions (") L	W	H	No. Required	CFCI	SFCI	SFSI
Large Group Activity Area (contd)							
Movie screen, wall hanging type				1			E
Projector, slide				1			E
Television, color receiver with VTR input and output				2			E
TV stand with wheels and shelf	30	20	44	2			E
Video tape player				1			E
Projector, filmstrip				1			E
Small Group Activity Area							
Chairs, tablet arm				10			P
Racks, display - for pamphlets and soft cover books	48	12	42	2			P
Shelves - single unit, enclosed sides and backs, adjustable shelves	36	10	42	4			P
- single unit, enclosed sides and backs, adjustable shelves (built in)	36	10	78	4			P
Individual Activity Area							
Microcomputer							
Microcomputer (120 vac. 200w.)				4			E
Work table	24	48		4			E
Printer (120 vac. 300w.)				4			E
Chair, student				4			P
Carrel							
Carrels - Dry	24	36		6			P
File, 4-drawer, legal, with lock	29	18	42	6			P
Cabinets, storage, steel, 2-door, with lock	18	36	72	2			C
Record players with earphones				2			E
Cassette tape recorder				2			E
Cassette tape player				3			E
Filmstrip cassette super viewer with automatic sight and sound				1			E
Chair, student				6			P

FURNITURE AND EQUIPMENT STANDARDS - CAREER PLANNING CENTER

ROOM/AREA Item	Dimensions (") L	W	H	No. Required	CFCI	SFCI	SFSI
Teacher Station							
Desk, single pedestal	45	30	30	1			C
Chair, secretarial, posture				1			C
Typewriter, electric				2			E
Stand, typewriter				2			E
G&CC-Conference/Special Services Room							
Table	120	48	30	1			P
Side Chairs				20			P
Storage cabinet with lock	48	24	84	1	x		
Pamphlet and magazine display rack	48	12	42	1			E
Cassette tape recorder				1			E
Record player				1			E
Filmstrip viewer				1			E
Staff Lounge							
Sofa (or 3 lounge chairs)				1			P
Arm chairs				4			P
Coffee table				1			P
Refrigerator				1			*
Duplicating Room							
Table (or built-in work counter)	60	36	30	1	x	or	P
Coin counter				1			E
Spirit duplicator				1			E
Mimeograph machine				1			E
Copy machine (too vague)				1			E
Collating machine				1			E
Binding machine				1			E
Storage Room							
Files - 4-drawer, legal, with lock A 500 - 750				3			P
B 1000 - 1500				5			P
C 2000 - 2500				7			P
Key cabinet				1	x		
Janitor's Closet							
Mop rack				1	x		

*Space only. Not provided by P, C, or E.

APPENDIX E

Exploratory Computer Literacy Framework, Grades K-12

EXPLORATORY COMPUTER LITERACY FRAMEWORK

GOALS: The student will feel confident about using computers

The student will know how the computer can be used as a tool for problem solving and decision making.

The student will be aware of, appreciate, and understand the functions and impact of computers in daily life.

The student will recognize the limitations as well as the usefulness of computer (science) technology in advancing human welfare.

The student will recognize educational and career opportunities related to the specific and general uses (application) of computers.

I. The student will feel confident about using computers.

A. Demonstrations of confidence implies ability to use the computer.

1. Interact with a prepackaged computer program.

(GRADE 3 EXPECTATION: THE STUDENT RECOGNIZES THAT A COMPUTER NEEDS INSTRUCTIONS TO OPERATE.)

(GRADE 3 EXPECTATION: THE STUDENT READS INSTRUCTIONS, THE KEYBOARD, AND OUTPUT.)

(GRADE 3 EXPECTATION: THE STUDENT USES BASIC CONTROL KEYS AND COMMANDS.)

(GRADE 6 EXPECTATION: THE STUDENT SELECTS AND USES APPROPRIATE RESOURCES (MANUALS) FOR OPERATING THE COMPUTER.)

(GRADE 6 EXPECTATION: THE STUDENT EXPERIMENTS WITH PROGRAMS AS A USER.)

(GRADE 6 EXPECTATION: THE STUDENT TAKES APPROPRIATE ACTION IN RESPONSE TO ERROR MESSAGES IN USING PREPACKAGED PROGRAMS.)

2. Identify the fact that information is processed according to a set of predefined computer rules: organize, coded, given meaning and transmitted.

(GRADE 6 EXPECTATION: THE STUDENT GIVES REASONS FOR PROCESSING INFORMATION.)

(GRADE 6 EXPECTATION: THE STUDENT DETERMINES THE STRUCTURAL COMPONENTS OF INFORMATION PROCESSING, E.G., ORGANIZING, CODING, PROCESSING AND REPORTING.)

(GRADE 6 EXPECTATION: THE STUDENT SEQUENCES THE STEPS REQUIRED IN A PROCESS.)

(GRADE 12 EXPECTATION: THE STUDENT RECOGNIZES THAT COMPUTERS PROCESS INFORMATION BY SEARCHING, SORTING, DELETING, UPDATING, SUMMARIZING, STORING, ETC.)

3. Identify the fact that we communicate with computers through specific symbols and words.

(GRADE 8 EXPECTATIONS: THE STUDENT RECOGNIZES THAT PROGRAMMING LANGUAGES ARE USED TO GIVE INSTRUCTIONS TO COMPUTERS.)

(GRADE 8 EXPECTATION: THE STUDENT RECOGNIZES WORDS OR SYMBOLS THAT OPERATE THE COMPUTER.)

4. Use computer languages (e.g., BASIC, PASCAL, LOGO, assembler/machine languages.)

a. Develops good programming style (includes logical structure, documentation readability, efficiency, elegance).

b. Selects and uses appropriate utility programs.

B. Develop positive attitudes and behaviors toward computers

(GRADE 6 EXPECTATION: THE STUDENT DEMONSTRATES POSITIVE ATTITUDES AND BEHAVIORS TOWARD COMPUTERS IN THE FOLLOWING WAYS:

1) SEEKS WORK OR PLAY WITH COMPUTERS.

2) DESCRIBES PAST EXPERIENCES WITH COMPUTERS WITH POSITIVE-AFFECT WORDS LIKE FUN, EXCITING, CHALLENGING, ETC.)

II. The student will understand how a computer can be used as a tool for problem solving and decision making.

A. Explains what a simple algorithm/flowchart accomplishes, i.e., interpret, generalize, and discuss applications.

(GRADE 8 EXPECTATION: THE STUDENT INTERPRETS, GENERALIZES, AND DISCUSSES APPLICATIONS OF A SIMPLE ALGORITHM/FLOWCHART.)

B. Uses a computation/information system (computer or computer system) to solve simple problems and make decisions.

(GRADE 8 EXPECTATION: THE STUDENT TRANSLATES A SIMPLE ALGORITHM/FLOWCHART INTO A PROGRAM.)

(GRADE 12 EXPECTATION: THE STUDENT DEVELOPS AN ALGORITHM FOR SOLVING A SIMPLE PROBLEM AND/OR TO SOLVE A SET OF SIMILAR PROBLEMS.)

III. The student will be aware of, appreciate, and understand the functions and impact of computers in daily life.

A. Functions are treated at two different levels:

1. Identification of basic operations of computer systems including identification of input, memory, control, arithmetic and output components.

(GRADE 3 EXPECTATION: THE STUDENT IDENTIFIES THE INPUT AND OUTPUT UNITS.)

(GRADE 6 EXPECTATION: THE STUDENT DESCRIBES THE FUNCTIONS OF THE INPUT, OUTPUT, AND CPU COMPONENTS.)

(GRADE 8 EXPECTATION: THE STUDENT DESCRIBES THE FUNCTIONS OF THE INPUT, OUTPUT, CPU, ARITHMETIC, AND MEMORY COMPONENTS.)

(GRADE 8 EXPECTATION: THE STUDENT INVESTIGATES ELECTRONIC COMPONENTS AND THEIR FUNCTIONS.)

2. Recognition and use of the data processing, process control, and information storage and retrieval applications in business and industry, government, education, health and social services, recreation, creative arts, etc.

(GRADE 6 EXPECTATION: THE STUDENT IDENTIFIES COMPUTER APPLICATIONS IN BUSINESS AND INDUSTRY, GOVERNMENT, EDUCATION, HEALTH AND SOCIAL SERVICES, RECREATION, CREATIVE ARTS, ETC.)

B. Impact is treated in relation to how computers affect employment, public surveillance, privacy of individuals, progress and culture, personalization/impersonalization, regulatory and enforcement functions, and daily relationships with people, agencies, organizations, etc.

1. Values efficient information processing.

2. Understands advantages and disadvantages of routine tasks.

3. Appreciates economic benefits of computerization for society.

4. Values increased communication and availability of information made possible through computer use.

(GRADE 6 EXPECTATION: THE STUDENT VALUES INCREASED COMMUNICATION AND AVAILABILITY OF INFORMATION MADE POSSIBLE THOROUGH COMPUTER USE.)

5. Understands that computers can be used to effect the distribution and use of economic and political power, in criminal and other antisocial activities, to change society in undesirable ways.

6. Identifies specific applications of computer science and technology in medicine, law enforcement, education, engineering, business, transportation, military, recreation, government, library, creative arts, etc.

C. Understanding that technology differs from science in that the aim of technology involves the means of building and doing useful things while the aim of science is the development of knowledge and understanding.

(GRADE 6 EXPECTATION: THE STUDENT KNOWS HOW ELECTRONIC TECHNOLOGY EVOLVED.)

IV. The student will recognize the limitations as well as the usefulness of computer technology.

A. Recognize disadvantages of computers as tools -- dependency, limitations, costs.

(GRADE 8 EXPECTATION: THE STUDENT LISTS AT LEAST THREE LIMITATIONS OF COMPUTERS.)

B. Identify major applications of computers for information storage and retrieval, simulation and modeling, quality or process control and decision making, computation, data processing.

(GRADE 8 EXPECTATION: THE STUDENT SEQUENCES THE STEPS REQUIRED IN A PROCESS.)

(GRADE 12 EXPECTATION: THE STUDENT RECOGNIZES THAT COMPUTERS PROCESS INFORMATION BY SEARCHING, SORTING, DELETING, UPDATING, SUMMARIZING, STORING, ETC.)

C. Investigate major applications of computers for information storage and retrieval, simulation and modeling, quality or process control and decision making, computation, data processing.

V. The student will recognize educational and career opportunities related to the specific and general (application) of computers.

A. Support services: e.g., data entry, word processing, computer operations personnel, etc.

B. Technical services: e.g., programmer, analyst, data processer, equipment maintenance and repair personnel, etc.

C. Scientific personnel: e.g., computer scientist, electrical engineer, computer engineer, etc.

D. Computer skilled/applications personnel integrated with another category or career.

The following expectations are applicable to V, A-D.

(GRADE 3 EXPECTATION: .HE STUDENT IDENTIFIES SUPPORT SERVICE, TECHNICAL AND SCIENTIFIC CAREERS IN THE COMMUNITY AND STATE THAT INVOLVE COMPUTERS.)

(GRADE 6 EXPECTATION: THE STUDENT IDENTIFIES NATIONAL AND INTERNATIONAL CAREERS THAT INVOLVE COMPUTERS.)

(GRADE 8 EXPECTATION: THE STUDENT COMPARES EDUCATIONAL REQUIREMENTS AND OPPORTUNITIES FOR CAREERS THAT INVOLVE COMPUTERS.)

APPENDIX F

Secondary Task Force Report

REPORT OF THE TASK FORCE ON THE DELIVERY OF COMPUTER PROGRAMS AT THE SECONDARY LEVEL

At the secondary level the computer literacy program should provide experiences for all students to further develop their understandings and skills in the application of computers in their daily lives. The computer literacy program, a thematic area, consists of three components: exploratory, computer science and vocational-technical. As computer literacy instruction can be provided through a variety of courses at the secondary level, appropriate planning to meet the needs of all students is essential. A Task Force, composed of state and district specialists, school administrators, teachers, and university personnel, was established to address the problems and concerns related to the delivery of the secondary computer literacy program. Specific concerns that had been raised by school personnel included the following:

1. While content area teachers would like to incorporate computer applications into their courses, these teachers feel that they cannot "give up" the time from their already full program to teach initial computer literacy knowledge and skills.

2. Should there be specific computer courses included in the ACCN?

3. Should/How can courses offered in each of the three components (exploratory, computer science, and vocational-technical) be differentiated?

The recommendations proposed by the Task Force are summarized below. Attachments A-C provide further details.

1. At the intermediate school level (grades 7-8) all students be provided computer experiences to meet the following minimum requirements by the end of Grade 8:

   -Knowledge of operations and functions of computers,

   -Ability to use the computer as a tool in learning

-through tutorials, simulations and games
-through use of applications packages such as word processing and graphics
-through information retrieval, and

-Knowledge of impact, values, and ethics of computer applications.

The school administrator, in consultation with staff and other resource personnel, shall determine an appropriate program of computer instruction.

A discussion of the recommendation, guidelines and implementation models is provided in Attachment A.

2. Six elective computer education courses are proposed for inclusion in the ACCN:

   a. Exploratory Computer Literacy
      1 semester, Grades 7-12

   b. BASIC Programming I
      1 semester, Grades 7-12

   c. Pascal Programming I
      1 semester, Grades 7-12

   d. BASIC Programming II
      1 semester, Grades 9-12

   e. Pascal Programming II
      1 semester, Grades 9-12

   f. Advanced Placement Computer Science
      1 year, Grades 11-12

   Course descriptions are included in Attachment B.

3. The delivery of the three components of computer literacy (exploratory, computer science, vocational technical) will be differentiated by the computer applications incorporated into the particular content area course.

   a. Exploratory Computer Literacy

      After students have acquired the initial skills and knowledge in using a computer at the

intermediate-school level as proposed in Recommendation #1 above, additional exploratory computer literacy experiences will focus on using the computer to assist and enhance learning experiences in the content areas. For example, the computer can be used as a tool in learning new concepts, manipulating data to develop decision-making skills or obtaining access to information not available in the school library. Students with computer experiences will better be able to discuss questions such as those regarding public versus private information and the potential misuses of computer technology.

Exploratory computer literacy experiences at the secondary level should reinforce students' skills and knowledge as well as address those performance expectations identified for grade 12. These secondary experiences could be delivered through any of the five alternative models or a combination of the models described in Attachment A.

b. Computer Science

The computer science component provides students the opportunity to further develop those skills and methodologies needed to create computer-based solutions to problems. A primary objective is to enable students to write logically-structured, well-documented computer programs. Courses that focus on developing programming techniques will be offered through Computer Education listings in the ACCN. Courses that focus on applications of computing to solve problems in a particular content area, such as mathematics, will be offered through courses in that area.

c. Vocational Technical

Computer literacy applications in the vocational technical component focus on developing the skills and knowledge necessary for using the microcomputer as a tool for accomplishing job tasks related to the specific career field or for repair and maintenance of said computer

hardware. Courses will focus on developing those skills essential for continuing education or entry-level employment in careers related to 1) office, 2) marketing, 3) agriculture, 4) food service, 5) electronics, 6) drafting, and 7) graphic arts.

Attachment C displays the relationships among these components.

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EXPLORATORY COMPUTER LITERACY
DELIVERY AT THE SECONDARY LEVEL

Introduction

The exploratory computer literacy program aims to develop computer-literate students capable of functioning in a society which has become increasingly dependent upon computer technology. Until the exploratory computer literacy program is established in all elementary schools, many secondary students will have had little or no prior computer experiences.

Description of the Problem

Feedback from secondary teachers indicate that many find having to provide the initial experiences necessary to develop minimal background on the functions and use of the computer difficult to accomplish within their content area course. These teachers feel that the time necessary to provide this initial experience makes it difficult, if not impossible, to meet the objectives of their content area courses. These same teachers, however, also feel that they would like to incorporate computer applications into their courses if students have acquired a certain level of computer expertise.

One of the major concerns addressed by the Task Force was that of providing exploratory computer literacy instruction for all students. The following criteria were established for the delivery of the exploratory computer literacy program:

1. That all secondary students be provided with computer experiences to enable them to meet the minimum performance expectations of the exploratory computer literacy program.

2. That these experiences provide sufficient background for students to pursue further applications in other content areas or computer science courses.

3. That more emphasis be given to the use of applications programs and less to programming.

4. That secondary schools be provided the flexibility in determining the delivery of the exploratory computer literacy program.

Recommendations

To meet the criteria established for the delivery of exploratory computer literacy at the secondary level, the Task Force developed the following recommendations:

1. At the intermediate school level (grades 7-8) all students be provided computer experiences to meet the following minimum requirements by the end of Grade 8:

   -Knowledge of operations and functions of computers;

   -Ability to use the computer as a tool in learning
      -through tutorials, simulations and games,
      -through use of applications packages such as word processing and graphics,
      -through information retrieval; and

   -Knowledge of impact, values, and ethics of computer applications.

   More specifically, these minimum requirements are the Grade 8 performance expectations for exploratory computer literacy, with the exception of those specific to the use of programming languages. (See Attachment A1.)

2. At the secondary level, additional exploratory computer literacy experiences must be provided to reinforce skills already learned and to further develop these initial knowledge, skills and attitudes.

3. The school administrator, in consultation with staff and other resource personnel, shall determine an appropriate program of computer instruction.

   As the resources (hardware, software, personnel, budget, facilities) at schools vary, each school

must determine the instructional arrangement for delivery of exploratory computer literacy instruction.

Implementation Guidelines

Guidelines and alternative models are provided below to assist all secondary schools in determining their school program. Schools may choose to implement one of the suggested models or develop their own model based on two or more alternatives.

School planning guidelines include:

1. The school administrator, in consultation with the staff and other resource personnel, shall determine the instructional arrangement for delivery of the exploratory computer literacy program within available resources.

2. The frequency and length of the instructional unit shall also be established within available resources.

3. The school shall be responsible for developing a computer acquisition program for the delivery of instruction.

4. The school shall determine what personnel will be used to provide exploratory computer literacy instruction. The school should work with district personnel for the inservice training needs of its staff.

Alternative Models

A description of alternative models and a discussion of advantages and disadvantages of each are provided below:

1. Elective one-semester course

   A one-semester course may be offered as an elective. The course would consist of classroom instruction in combination with hands-on experiences in a computer lab to maximize the number of students accommodated by the program.

   A course description is provided in Attachment B.

Advantages: Sufficent time is provided for development of computer literacy understandings, skills and attitudes. Student-computer ratio allows for adequate hands-on time.

Disadvantages: Another semester elective may be difficult to schedule at the intermediate school level. Computer literacy experiences may be taught in isolation from application areas.

Suggested Hardware Arrangement: Computer lab with 16 microcomputers and 4 printers. (Based on two students per computer.)

2. Unit Within Content Area Course

A unit of study of set duration (4-8 weeks) would be worked into a part of a required course (e.g., language arts, social studies, mathematics). The unit would consist of hands-on experiences preceded by classroom instruction. The shorter duration would require greater concentration of time on the use of the computer and close coordination between the classroom teacher and the computer lab instructor.

A sample school implementation plan is included in Attachment A2.

Advantages: Computer literacy would be taught in a meaningful context. Student-computer ratio allows for adequate hands-on time. Many more students can be serviced in a school year.

Disadvantages: The required course would have to be compressed or intensified to cover the necessary content. Computer literacy experiences may be limited to one content area application.

Suggested Hardware Arrangement: Computer lab with 16 microcomputers and 4 printers. (Based on two students per computer.)

3. Shared Resource Center Arrangement

Instruction in computer literacy would be conducted in regular classrooms through existing courses

(e.g., language arts, mathematics, social studies, science, business). Hands-on experiences would be provided in a resource center arrangement where use is scheduled according to school-established criteria and procedures. Close coordination among the departments offering computer literacy experiences would be required.

Advantages: Computer literacy could be taught through a variety of applications. Computer use is maximized.

Disadvantages: Scheduling may be complex or inconvenient. Staffing requirements of the resource center and coordination among application areas must be planned. Inservice training must be provided to a larger target group.

Suggested Hardware Arrangement: Computer lab with a minimum of 16 microcomputers and 4 printers.

4. Computer Mini-Lessons

A series of mini-lessons on different aspects of computer literacy could be introduced through existing courses in several content areas. Hands-on experiences could be provided in the classroom on a rotation basis. Coordination among departments offering computer literacy experiences would be required.

Advantages: Computer literacy could be taught through a variety of applications. Schools with limited hardware and facilities could provide computer experiences to students.

Disadvantages: Hands-on experiences would be limited. Access to microcomputers housed in a classroom would be restricted.

Suggested Hardware Arrangement: A minimum of 2-4 microcomputers and 1 printer to be rotated among classrooms.

5. Demonstration Mode

A unit of study for a set duration would be taught in an existing content area course. Instruction

would be primarily through vicarious experiences provided through demonstrations, audio-visual presentations and off-computer exercises. Extremely limited hands-on experiences would be provided. This mode is included as an initial, interim model until schools are able to acquire additional equipment to increase students' hands-on time. Subsequently, the demonstration mode may be used in conjunction with one of the other four models.

SCOPE AND SEQUENCE

Attachment A1

Exploratory Computer Literacy
Secondary Schools

Goals, Objectives, Performance Expectations	Entry Level	Grades 7-8				Grades 9-12			
		LA	M	S	SS	LA	M	S	SS
GOAL 1: FEELS CONFIDENT ABOUT USING COMPUTERS									
1.1 Interacts With A Prepackaged Computer Program									
1.1.1 recognizes need for instructions	R	R	R	R	R	R	R	R	R
1.1.2 reads instructions, keyboard, output	R	R	R	R	R	R	R	R	R
1.1.3 uses basic control keys and commands	R	R	R	R	R	R	R	R	R
1.1.4 selects and uses resources for operating computer	R	R	R	R	R	R	R	R	R
1.1.5 experiments with programs as a user	R	R	R	R	R	R	R	R	R
1.1.6 responds appropriately to error messages	R	R	R	R	R	R	R	R	R
1.2 Identifies Computer Rules									
1.2.1 gives reasons for processing information	R	R	R	R	R	R	R	R	R
1.2.2 determines components of information processing	R	R	R	R	R	R	R	R	R
1.2.3 sequences steps required in a process	R	R	R	R	R	R	R	R	R
1.2.4 recognizes how computers process information	1	1	1	1	1	R	R	R	R
1.3 Identifies How We Communicate With Computers									
1.3.1 recognizes that program language instruct computers	1	R	R	R	R	R	R	R	R
1.3.2 recognizes words or symbols that operate computers	1	R	R	R	R	R	R	R	R
1.4 Uses Computer Languages									
1.4.1 develops good programming style	1		1	1			R	R	
1.4.2 selects and uses appropriate utility programs	1	1	1	1	1	R	R	R	R
1.5 Develops Positive Attitudes and Behaviors Toward Computers									
1.5.1 seeks work or play with computers	R	R	R	R	R	R	R	R	R
1.5.2 uses positive words to describe exerpiences	R	R	R	R	R	R	R	R	R

Exploratory Computer Literacy
Secondary Schools

Goals, Objectives, Performance Expectations	Entry Level	Grades 7-8				Grades 9-12			
		LA	M	S	SS	LA	M	S	SS
GOAL 2: KNOWS HOW THE COMPUTER IS USED FOR PROBLEM-SOLVING AND DECISION MAKING									
2.1 Explains What An Algorithm/Flowchart Accomplishes									
2.1.1 interprets an algorithm/flowchart	1	R	R	R		R	R	R	
2.1.2 generalizes how an algorithm/flowchart is used	1	R	R	R		R	R	R	
2.1.3 discusses the applications of algorithms/flowcharts	1	R	R	R		R	R	R	
2.2 Uses A Computation Information System To Solve Problems									
2.2.1 translates an algorithm/flowchart into a program	1		R	R			R	R	
2.2.2 develops an algorithm to solve a problem or set of problems	1		R	R			R	R	
GOAL 3: IS AWARE OF, APPRECIATES, AND UNDERSTANDS THE FUNCTIONS AND IMPACT OF COMPUTERS IN DAILY LIFE									
3.1 Identifies Basic Computer Operations									
3.1.1 identifies input and output units	R		R	R			R	R	
3.1.2 describes functions of input, output, and CPU components	R		R	R			R	R	
3.1.3 describes functions of arithmetic and memory components			R	R			R	R	
3.1.4 investigates electronic equipment components and their functions				R				R	
3.2 Recognizes And Uses Computer Applications In Society									
3.2.1 identifies applications in business, industry, arts, etc.	R	R	R	R	R	R	R	R	R
3.3 Recognizes How Computers Affect Daily Life									
3.3.1 values efficient information processing	1	1	1	1	1	R	R	R	R
3.3.2 describes advantages and disadvantages of routine tasks	1	1	1	1	1	R	R	R	R
3.3.3 understands economic benefits of computerization	1				1				R
3.3.4 values increased communication	R	1			1	R			R
3.3.5 understands how computers can be used in undesirable ways	1				1				R
3.3.6 identifies specific applications of computer science	1		1	1	1		R	R	R

Goals, Objectives, Performance Expectations	Entry Level	Grades 7-8				Grades 9-12			
		LA	M	S	SS	LA	M	S	SS
3.4 Understands How Technology Differs From Science									
3.4.1 knows how electronic technology evolved	R		R	R	R		R	R	R
GOAL 4: RECOGNIZES THE LIMITATIONS AND USEFULNESS OF COMPUTERS									
4.1 Recognizes Disadvantages of Computers									
4.1.1 lists as least three limitations	1	R	R	R	R	R	R	R	R
4.2 Identifies Advantages of Computers									
4.2.1 describes how computers assist people	1	R	R	R	R	R	R	R	R
4.2.2 describes how computers are used in solving problems		1	1	1	1	R	R	R	R
GOAL 5: RECOGNIZES EDUCATION AND CAREER OPPORTUNITIES RELATED TO COMPUTERS									
5.1 Recognizes careers in support services, technology and science	R	R			R	R	R	R	R
5.1.1 identifies careers in these three areas in the community	R	R	R	R	R	R	R	R	R
5.1.2 identifies national and international careers in these areas									
5.2 Recognizes Career Opportunities in Related Areas									
5.2.1 compares educational requirements and opportunities for careers	1	R	R	R	R	R	R	R	R

[1] Concept, skill introduced

[R] Concept, skill expectation reached and reinforced

Sample School Plan
Model 2: Unit Within Content Area Course

Resources Required:

1 teacher, computer educatior
1 computer lab with 16 microcomputers

Plan Provisions:

1. A maximum of 30 students per classroom period can be serviced over a 4 week period.

2. One required content area is chosen for the delivery of the program. Language arts or social studies is recommended.

3. Lesson plans are coordinated between the computer literacy teacher and the content area teacher such that:

    a. Lessons are curriculum related.
    b. A project is required.
    c. Grading is the responsibility of the content area teacher.
    d. Discipline is a shared responsibility.
    e. The content area teacher becomes more literate.

4. One week between sessions is allowed for the computer education teacher to prepare for the next teacher's classes.

Implications:

1. 192 students can be serviced in a four-week period.

2. 384 students can be serviced in a quarter.

3. A maximum of 1536 students may be provided computer literacy instruction in a year.

4. If only one grade level is targetted for computer literacy instruction, time can be scheduled for the

further development of computer literacy skills in a different content area. Another alternative would be to lengthen the computer literacy period from 4 week to 5 or 6 weeks.

Content:

Minimum requirements as outlined by the Task Force.

1. Knowledge of operations and functions of computers
2. Keyboarding skills
3. Ability to use the computer as a tool in learning
4. Knowledge of impact, values, and ethics of computer applications

COMPUTER EDUCATION
COURSE DESCRIPTIONS

EXPLORATORY COMPUTER LITERACY

(SEMESTER)
Grades 7-12

Objectives:

1. Develop knowledge of operations and functions of computers.
2. Develop ability to use the computer in learning.
3. Develop understanding of the impact, values and ethics of computer applications.
4. Develop knowledge of elementary programming concepts and skills.

Description:

This course is designed to provide opportunities for students to develop computer literacy skills and understandings through classroom instruction in combination with hands-on computer experiences. The focus of the class is on using the computer in learning through CAI programs, word processing and other application packages, and information retrieval. Programming concepts and skills are taught in a problem-solving context. Discussion of the impact, values and ethics of computer applications are integrated into the course and not isolated as a separate unit.

BASIC PROGRAMMING I

(SEMESTER)
Grades 7-12

Objectives:

1. Develop fundamental concepts and skills of BASIC programming.
2. Develop problem-solving and communication skills.
3. Develop structured programming techniques with appropriate documentation.

Description:

The major emphasis in this course is on developing structured programming skills using the BASIC language in a problem-

solving environment. Major topics to be covered include: accepting and using input from the keyboard; defining and producing output in text, graphics, and sound; using control structures for simple branches and loops; defining and using simple subroutines; defining and using numeric and string variables; using arithmetic operators; employing good debugging strategies; and using one-dimensional arrays. Knowledge of algebra, in particular, the concept of a variable, is highly recommended.

PASCAL PROGRAMMING I (SEMESTER)
Grades 7-12

Objectives:

1. Develop fundamental concepts and skills of Pascal programming.
2. Develop problem-solving and communication skills.
3. Develop structured programming techniques with appropriate documentation.

Description:

The major emphasis in this course is on developing structured programming skills using the Pascal language in a problem-solving environment. Major topics to be covered include: accepting and using input from the keyboard; defining and producing output in text, graphics, and sound; using control structures for simple loops, recursions and branches; defining and using numeric and string variables; using arithmetic operators; employing good debugging strategies; and using one-dimensional arrays. Knowledge of algebra, in particular, the concept of a variable, is highly recommended.

BASIC PROGRAMMING II (SEMESTER)
Grades 9-12

Objectives:

1. Reinforce and extend the programming skills learned in BASIC Programming I.
2. Develop good programming style, including logical structure, documentation, efficiency, and elegance.
3. Develop ability to use the computer as a tool for problem solving and decision making.

4. Develop student recognition of the ethical and social implications of computer use.

Description:

This course is designed to provide students the opportunity to further develop those skills and methodologies needed to create computer-based solutions to problems. Programming techniques for writing logically structured, well-documented programs in BASIC will be emphasized. Topics covered include: writing structured programs, selecting and using appropriate algorithms, designing and using numeric and string arrays and matrices, designing and manipulating sequential and random access files, designing appropriate error trapping routines, and introducing abstract and physical data structures. BASIC Programming I is a prerequisite for this course.

PASCAL PROGRAMMING II (SEMESTER)
Grades 9-12

Objectives:

1. Reinforce and extend the programming skills learned in Pascal Programming I.
2. Develop good programming style, including logical structure and documentation.
3. Develop ability to use the computer as a tool for problem solving and decision making.
4. Develop student recognition of the ethical and social implications of computer use.

Description:

This course is designed to provide students the opportunity to further develop those skills and methodologies needed to create computer-based solutions to problems. Programming techniques for writing logically structured, well-documented programs in Pascal will be emphasized. Topics covered include: writing structured programs, selecting and using appropriate algorithms, designing and using numeric and string arrays and matrices, designing and manipulating sequential and random access files, designing appropriate error trapping routines, and introducing abstract and physical data structures. Pascal Programming I is a prerequisite for this course.

ADVANCED PLACEMENT COMPUTER SCIENCE (YEAR)
Grades 11-12

Objectives:

1. Develop the ability to design and implement computer-based solutions to problems in several application areas.
2. Develop the ability to design and select appropriate algorithms and data structures to solve problems.
3. Develop the ability to code fluently in a well-structured fashion using an accepted high-level language, e.g., Pascal.
4. Develop the ability to identify the major components of a computer system (hardware and software), their relationship to one another, and the roles of these components within the system.
5. Develop student recognition of the ethical and social implications of computer use.

Description:

The major emphasis in an Advanced Placement Computer Science course is on programming methodology, algorithms, and data structures. Applications of computing provide the context in which these subjects are treated; applications are used to develop student awareness of the need for particular algorithms and data structures, as well as to provide topics for programming assignments to which students can apply their knowledge. A particular programming language constitutes the vehicle for implementing computer-based solutions to particular problems. Treatments of computer systems and the social implications of computing are integrated into the course and not isolated as separate units. Geometry and Algebra II are prerequisites for this course. Either BASIC or Pascal Programming I and concurrent enrollment in Trigonometry/Analytic Geometry are highly recommended.

Computer Experiences		Computer Education	Mathematics	Science	Language Arts	Social Studies	Practical Arts	Vocational Education
EXPLORATORY	Level A Exploratory Computer Literacy Grade 8 & Grade 12 PEs	Expl Comp Lit 1 sem course	Applications in existing courses	Applications in existing courses	Applications in existing courses	Applications in existing courses	Applications in existing courses	Applications in existing courses; e.g., Data Processing
		Delivery of Exploratory Computer Literacy through 5 models described in Attachment A						
COMPUTER SCIENCE	Level B Intro to programming skills and concepts	Programming I 1 sem course	None	None	None	None	None	Introduction to programming; e.g., Computer Programming I. Elementary applications in content area courses
	Level C Advanced programming skills & concepts	Programming II 1 sem course	Application in content area courses	Application in content area courses	None	None	None	Advanced Programming; e.g., Computer Programming IIA and IIB, Data Entry. Advanced applications in content area courses
	Level D Advanced Placement	AP Computer Science 1 year course						

APPENDIX G

CIR--Library

LIBRARY INFORMATION RETRIEVAL

The premise of providing equal access to resources through library information retrieval supported sharing, is dependent on expanding efforts to include all schools. Full implementation of the library information retrievel program is necessary to establish a statewide school library network that provides for optimum sharing of resources. Recent technological developments, e.g., CD-ROM systems with three million bibliographic records on two compact disks, have greatly facilitated the efforts to build local databases and to access them more easily.

In order for schools to share information and resources, attention must also be given to an attendant problem, that of resource management within the individual school library. The present manual system of locating materials in circulation is burdensome and time-consuming. Trying to combine an outmoded, manual system with a computerized statewide network will result in delays that may offset the advantages of computerization.

The Department's study regarding the inclusion of computer use in school libraries findings, to date, are:

- There is a critical need for a system that will provide information about resources available statewide in school libraries, resources available from public libraries and academic libraries, and online reference resources. Students and educators in Hawaii place a high priority on being able to borrow library books, audiovisual materials, and magazines from other libraries.

- The concept of sharing resources is a viable one. Personnel in an individual school are willing to consider their library holdings as part of a larger system, with frequent sharing through an interlibrary loan system.

- Establishing standards for database design, such as use of the national machine-readable-cataloguing (MARC) format, and statewide procedures are critical to the development of compatibility within the system. Without these standards, schools may build independent sub-systems that will remain isolated from other school libraries.

- There are backlogs existing in areas that would impact on a delivery system. It is essential to design into the statewide plan the use of current computer technology to eliminate present backlogs, to maintain an accurate inventory, and to ensure rapid retrieval of needed resources.

- A sufficient number of microcomputers must be available in school libraries. Providing access to information through a multi-user online public access catalog (OPAC) with simultaneous updating of information through automation of the inventory is essential.

- Utilization of continually evolving technology to build the statewide database is critical. Preliminary findings indicate that manual entry of data is the least cost-effective of the alternatives being studied for retrospective and on-going conversion of holdings to a computer database. It is also the least effective in relation to the number of access points, e.g., subject headings, provided to users.

The goals of library information retrieval are as follows: a) to provide the opportunity for students to use increased numbers of library resources in fulfilling instructional assignments, with equal access for all students, b) to provide students with the skills to access information in lifelong learning pursuits, and c) to provide for the networking of local library resources.

The objectives of the library information retrieval plan are to:

- Establish a statewide database of school library resources.
- Develop a combined listing of resources (union catalog) in machine-readable format available to all school libraries.
- Establish an interlibrary loan system with document delivery.
- Provide automation of library management functions.

The intent of inservice training is to help school library staffs feel confident and develop competence in integrating CIR into the total delivery of school library services.

Successful implementation of the CIR component requires in-depth training and timely follow-up assistance. Training will include instruction in the following areas: a) assisting with creation and expansion of the local database, b) automating library functions, c) utilizing the resource delivery component of CIR, d) learning to access local, national, and international databases and e) instructing students to access local, national, and international databases.

Prior to implementation there needs to be identification of compatible quality software that will be utilized by all school libraries as they create a system-wide local database network. Software requirements need to be based on user need specifications, inventory automation, compatibility, and OPAC capabilities.

Implementation of CIR necessitates the placement of microcomputers and the appropriate peripherals in the school library in order to allow for maximum accessibility to national and international databases and online services, and use of library resources. Attendant costs may include telecommunications online time, security measures and humidity controls. In many cases, this may entail rearrangement of existing library space and/or expansion of facilities.

APPENDIX H

CMI Checklist

CRITERIA FOR REVIEWING CMI

I. Rate items according to negative change (-), no change (0) or positive change (+). Add and rate other items as necessary.

	-	0	+
A. Improvement in staff productivity			
1. increase in volume of output			
2. increase in rate of output			
3. increase in variety of output			
4.			
B. Improvement in data access and utility			
1. increase in use of base data (e.g. no. of additional/ new reports generated)			
2. decrease in lag time between request and report			
a. parent requests			
b. student requests			
c. teacher requests			
d. counselor/registrar requests			
e. administration requests (school/district/state)			
3. decrease in "data not available" responses			
4. increase in reliability of statistical reports (use of actual data instead of "guesstimates")			
5. increase in use of data for instruct. decision making			
6.			
C. Improvement in teacher support of management functions			
1. increase in timeliness of data for instructional decision making			
2. increase in accessibility to current and historical data for instructional decision making			
3. availability of common, accurate and reliable data base for instructional decision making			
4.			

D. Improvement in adminis. support of management functions			
1. increase in timeliness of data for administrative decision making			
2. increase in accessibility to current and historical data for administrative decision making			
3. availability of common, accurate and reliable data base for administrative decision making			
4.			
E. Others			
1. Cost effectiveness			
2. Availability of funds			
3. Generalizability of project outcomes			
4. Importance of project findings for statewide planning			
5.			

II. Check categories of data to be used and current forms of recordkeeping. Add and check other categories as necessary.

A. Data for decision making	
1. classroom	
a. desired outcomes (FPOs, PEs, ECs, LOs, etc.)	
b. instruction (strategies, resources used, etc.)	
c. evaluation (progress, achievement, etc.)	
2. student	
a. background, prior performance, experience	
b. problems (physical, educational, personal, etc.)	
c. attendance	

3. school	
a. instructional programs available (regular, special, supplemental, etc.)	
b. related services available	
c. instructional materials available	
d. external services available	
4. staff	
a. types (certification, experience, reg., part-time)	
b. number	
c.	
5.	
B. Current Recordkeeping	
1. Form 12 Secondary Cumulative Record Form (7-12)	
2. Form 13 Elementary Cumulative Record Form (K-6)	
3. Form 14 Pupil's Health Record	
4. Pupil Progress Report	
5.	

APPENDIX I

Computer Literacy
Teacher Inservice Training Model

COMPUTER LITERACY
TEACHER INSERVICE TRAINING MODEL
FOR THE
HAWAII STATE DEPARTMENT OF EDUCATION

MAY 1984

ACKNOWLEDGMENT

The Department of Education acknowledges Gerald A. Knezek, under whose leadership this Computer Literacy Inservice Training Model was developed. Appreciation is extended to workshop and course leaders, Jolena B. McGuigan and Koki Tamashiro, for their expertise in the pilots of this model. Appreciation is also extended to the teacher advisory group, district educational specialists and teacher participants in the pilots for their input and assistance.

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INTRODUCTION

This document contains guidelines for training teachers to introduce computer literacy in Hawaii's public schools. The guidelines are consistent with the Exploratory Computer Literacy Framework, the Computer Science Framework, the Exploratory Computer Literacy Curriculum Guide, Grades K-6, and the Exploratory Computer Literacy Curriculum Guide, Grades 7-12. These guidelines include:

- o A list of skills, knowledge and processes teachers must have in order to implement the computer literacy curriculum, and
- o A series of courses or phases of training which will take teachers through the awareness and proficiency level of competence.

The teacher competencies and courses designed for teachers to acquire these competencies will be discussed in the remainder of this document.

REQUIRED SKILLS, KNOWLEDGE AND PROCESSES

Teachers must be well-versed in the knowledge, skills, and processes they will be expected to teach. As defined in the Department of Education (DOE) Plan for Computers in Education, computer literacy contains three components: exploratory, computer science, and vocational-technical. The Exploratory Computer Literacy Curriculum Guides Grades K-6 and Grades 7-12 focus on the exploratory component of computer literacy, through which students develop awareness and enabling skills to acquire and process computer-related information. Students learn about the computer (how it evolved, how it works, its limitations, etc.) as well as learn how to use it. In addition, students are provided hands-on experiences and opportunities to apply consumer skills and strategies in using computer systems, products and services.

Since the exploratory component is thematic in nature and is integrated into all subject areas of the K-12 curriculum, the potential target is all DOE teachers. Furthermore, since "... by the mid-Eighties ... (microcomputers) will be found in approximately 10% of all U.S. households (while) as many as 40% of all U.S. households could conceivably own computers by the end of the decade" (Pogrow, 1982), teachers lacking extensive knowledge of computer applications will find it increasingly difficult to relate their classroom activities to the computer-oriented daily lives of their students. In addition, teachers can benefit from a computer's labor-saving capabilities (word processing, data management, electronic mail, etc.) which may not be taught in their classrooms. It is reasonable to expect teachers to know more about computers than they will be required to teach.

Knowledge, skills, and processes relevant to teaching with or about computers can be divided into four major categories. Teachers should be competent in the areas listed below:

1. The Computer as a Topic. This category includes knowledge of computer terminology, knowledge of the history of computers,

knowledge of computer-related careers, knowledge of computer-related educational technology, knowledge of data processing and other information-handling applications, knowledge of elementary terminal interactions and operations, knowledge of computer uses in education, and the process of values clarification with respe to the role of computers in modern society. Information about computers is usually presented through audio-visual aids, field trips, and lessons that do not require a computer in the classroom in order to teach the concepts.

2. The Computer as a Tool. Word processing, curricular materials generation, test generation, scoring, and analyzing, grade computation, storage and retrieval, student progress recording and management (historically called Computer-Managed Instruction or CMI), and electronic mail and messaging are computer skills in this category. Here the computer is being used as an aid in the classroom.

3. The Computer as a Tutee. Skills in this category include programming (designing, coding, testing/debugging, implementing, revising) in a high level language such as BASIC, PILOT, Logo, or Pascal, developing and using algorithms, and flowcharting. Here the computer is accepting instructions from a person.

4. The Computer as a Tutor. The ability to use a computer for demonstrations, drill and practice, tutorials, simulations and games, and problem solving fall into this category. The ability to identify different types of Computer-Assisted Instruction (CAI) is also included. In this category, a computer program is usually the teacher and gives instructions to the student. Instructions may be delivered either in the one-student-per-computer mode, or to a larger group working as a team with one machine.

TRAINING PHASES

No present university or college course in Hawaii provides all of the content recommended for teacher training in the computer as a topic, tool, tutee, and tutor.

Approximately 80 contact hours of instruction over a four-phase sequence(*) of computer literacy inservice training activities is proposed for current DOE teachers. The first three phases cover the content which might someday be in a university course for all prospective teachers (see Appendix A for detailed description), while the fourth phase focuses on classroom

*This sequence is intended to form a spiral curriculum (Bruner, 1960). All major content areas are introduced in the early phases, then repeated later with a new approach and a different emphasis. A spiral curriculum is thought to be especially well-suited to ensure incremental review during a course of study which may be spread over more than a year.

implementation techniques. The time allocated for topic, tool, tutee, and tutor in each of the first three phases is shown graphically in Figure 1. Instructional goals, teacher outcomes and sample syllabi for all four phases are provided in the discussion which follows.

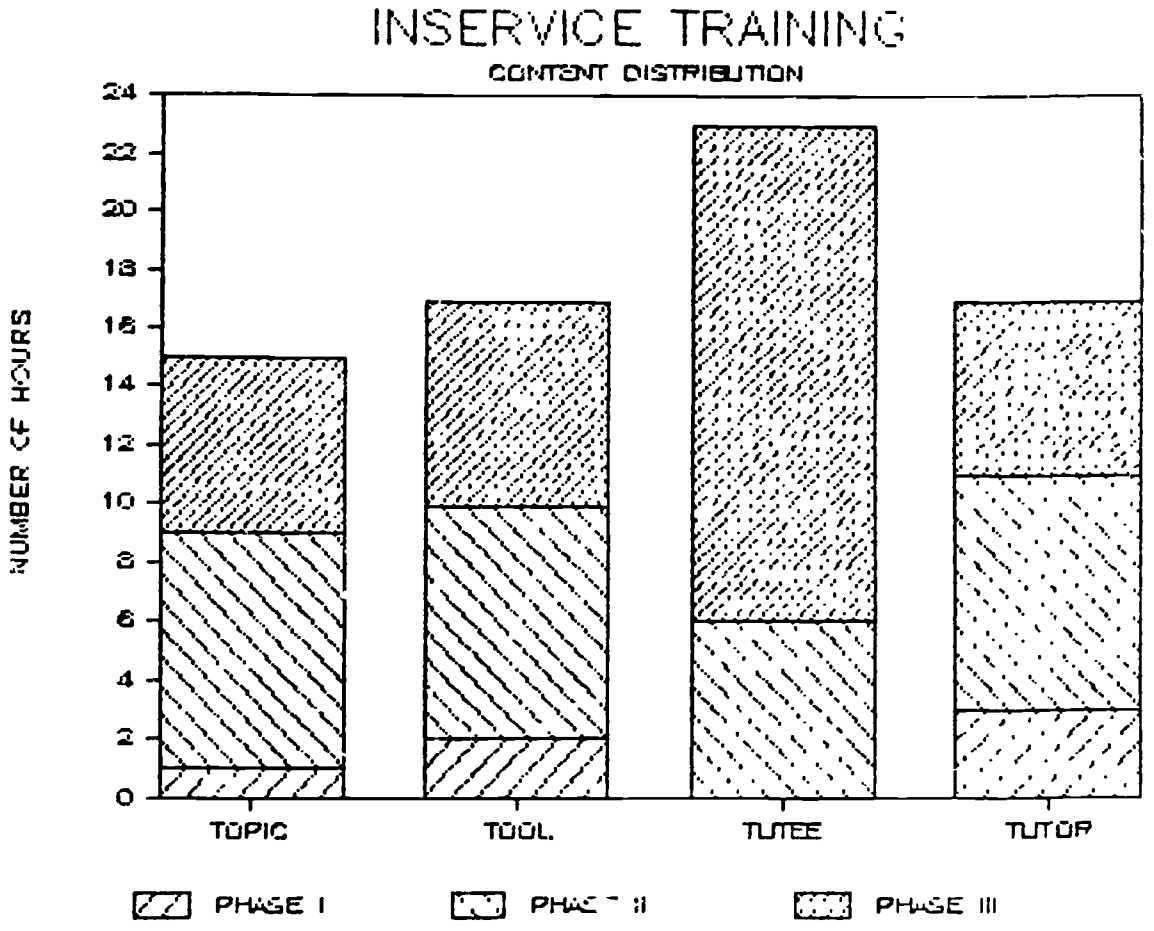

Figure 1

Phase I. Classroom Computing: Teacher Orientation.

A. Goals

The goals for this phase are:

1. To have teachers overcome fears they may have of computers.
2. To train teachers to identify different types of CAI, CMI, and instructional tool programs.
3. To make teachers aware of the scope and sequence of the DOE's computer literacy plan.
4. To spark teachers' interests to the point where they want to learn more through teacher training.

B. Outcomes

Upon completing the orientation, each participant will be able to:

(The Computer as a Topic)

1. Turn on a microcomputer, load a program, start and stop program execution.
2. Describe functions of most important keys.
3. Not fear taking part in additional learning experiences involving computers.
4. Maintain an interest in learning more about computers.

(The Computer as a Tool)

1. Identify specific programs as word processors.
2. Explain the utility of word processing programs.
3. Identify computer-based applications to generate curriculum materials.
4. Explain the utility of computerized curricular materials generation.
5. Identify test generation programs.
6. Explain the utility of test generation programs.
7. Identify test scoring programs.
8. Explain the utility of test scoring programs.

9. Identify test analysis programs.

10. Explain the utility of test analysis programs.

11. Identify grade computation programs.

12. Explain the utility of grade computation programs.

13. Identify grade storage and retrieval programs.

14. Explain the utility of grade storage and retrieval programs.

15. Identify CMI programs.

16. Explain the utility of computer-based management of instructional programs.

(The Computer as a Tutor)

1. Identify the demonstration mode of CAI.

2. Explain the purpose of computer-based demonstrations.

3. Identify drill and practice applications.

4. Explain the purpose of drill and practice applications.

5. Identify tutorial applications.

6. Explain the purpose of tutorial applications.

7. Identify simulation applications.

8. Explain the purpose of simulation applications.

9. Identify simulations as appropriate for individuals or groups.

10. Identify problem-solving applications.

11. Explain the purpose of problem-solving applications.

A sample syllabus for a one-day orientation is provided.

C. Content

CONTENT AREA	RESOURCES/ACTIVITIES	OUTCOMES (upon completion of the course each participant will be able to...)
1. THE COMPUTER AS A TOPIC		
a. Computer Terminology		
b. History of computer		
c. Computer-Related Careers		
d. Computer-Related Educational Technology		
e. Data Processing-Information Handling Technology		
f. Elementary Terminal	Microcomputer operations follow-me.	Turn on microcomputer, load program, start and stop program execution.
Interactions and Operations	Pairs run keyboard tutorial program.	Describe functions of most important keys.
g. Values Clarification	Pairs run personal interest program (Biorhythm, etc.).	Not fear future computer utilization.
Computers in Society	Pairs run competitive simulation program (Lemonade, etc.).	Maintain an interest in learning more about computer uses.
h. Computers in Education		

CONTENT AREA	RESOURCES/ACTIVITIES	OUTCOMES (upon completion of the course each participant will be able to...)
2. THE COMPUTER AS A TOOL		
a. Word Processing	Word processing demonstration. Pair complete. Word processing exercise.	Identify specific programs as word processors. Explain the utility of word processing applications.
b. Curricular Materials Generation	Pairs experiment with word puzzle generator.	Identify computer-based applications to generate instructional materials. Explain the utility of computerized curricular materials generation.
c. Test Generation	Pairs experiment with test generator program.	Identify test generation programs. Explain the utility of test generation programs.
d. Test Scoring	Pairs experiment with test scoring program.	Identify test scoring programs. Explain utility of computer-based test scoring.
e. Test Analysis	Pairs experiment with test analysis program.	Identify test analysis programs. Explain utility of test analysis programs.
f. Grade Computation	Gradebook program demonstration. Pairs complete. Gradebook program exercise.	Identify grade computation programs. Explain utility of grade computation programs.
g. Grade Storage and Retrieval	Gradebook program demonstration. Pairs complete. Gradebook program exercise.	Identify grade storage and retrieval programs. Explain utility of grade storage and retrieval programs.
h. Student Progress	Pairs experiment with CMI Program.	Identify CMI programs. Explain utility of computer-based management of instructional progress.
i. Electronic Mail and Messaging		

CONTENT AREA	RESOURCES/ACTIVITIES	OUTCOMES (upon completion of the course each participant will be able to...)

3. THE COMPUTER AS A TUTEE

(Use appropriate high-level languages such as Logo, BASIC, or PILOT in conju on with):

a. Developing and Using Algorithms

b. Developing and Using Flowcharts

c. Designing Instructional Programs

d. Coding Instructional Programs

e. Testing/Debugging Instructional Programs

f. Implementing Instructional Programs

g. Revising Instructional Programs

CONTENT AREA	RESOURCES/ACTIVITIES	OUTCOMES (upon completion of the course each participant will be able to...)
4. THE COMPUTER AS A TUTOR		
(Identify, select, and use appropriate programs for):		
a. Demonstrations	Word processing, word puzzle, test generator, test scoring, test analysis, gradebook, CMI demonstrations.	Identify the demonstration mode of CAI. Explain the purpose of computer-based demonstrations.
b. Drill and Practice	Pairs run drill and practice exercise.	Identify drill and practice applications. Explain the purpose of drill and practice applications.
c. Tutorials	Pairs run keyboard tutorial program. Pairs run tutorial from non-computer area.	Identify tutorial applications. Explain the purpose of tutorial applications.
d. Simulations and Games	Pairs run simulation exercise for individual. Pairs run competitive simulation exercise.	Identify simulation/games as appropriate for individuals or groups.
e. Problem Solving		

D. Sample Syllabus for Phase I. Classroom Computing: Teacher Orientation

(6 contact hours delivered in one day)

Workshop Description:

Workshop is designed for inservice training of educators with emphasis on using computers. Participants will be provided with an introduction to fundamental microcomputer operations and hands-on experiences with different types of CAI, CMI and other instructional tool programs.

Since there are no prerequisites, the workshop is designed for those teachers who have had no previous experience with computers.

Hands-on activities will be an essential part of the course.

Objectives:

1. To have teachers overcome fears they may have of computers.

2. To train teachers to identify different types of instructional program e.g., CAI, tool, etc.

3. To make teachers aware of the scope and sequence of the DOE's Plan for Computers in Education.

4. To spark teachers' interests to the point where they want to learn more through teacher training.

Agenda

9:00 am	Introduction of coordinators, assistants and participants.
9:15 am	Group follow-me in fundamental microcomputer operations.
9:30 am	Participants run keyboard tutorial drill such as Apple Presents Apple, Exploring the IBM PC.
10:15 am	Participants run CAI programs such as those on the MECC Teachers Demo Diskette, IBM Education Demo.
11:00 am	Participants run competitive simulation games such as "Lemonade", "Checkers", "Chess", "Othello", etc.
11:30 am	Explanation of types of CAI, question and answer period.
12:00 pm	Lunch
1:00 pm	Group demo of word processing system.
1:15 pm	Group demo of computerized gradebook system.
1:30 pm	Participants produce documents using word processor.
2:00 pm	Participants enter sample class data into gradebook system, produce reports.
2:30 pm	Participants experiment with puzzle generators, test generators, and CMI programs such as those found on the MECC Teachers Utilities Diskette.
3:30 pm	DOE Plan for Computers in Education.
3:45 pm	Group discussion, question and answer period; participants complete evaluation forms.

Logistic and Management Suggestions

Hardware:	1 microcomputer for every two or three participants.
Group Size:	20-30 participants.

Phase II. Classroom Computing: Computers in Education.

A. Goals

The goals for this phase are:

1. To expose teachers to skills, knowledge, and processes in the four computer education areas of topic, tool, tutee, and tutor.

2. To teach participants the terminology associated with the day-to-day use of educational computing systems.

3. To train teachers to operate several different types of computer systems.

4. To familiarize teachers with the history of computers and computing.

5. To make teachers aware of the past, present, and future impacts of computers on society.

6. To make teachers aware of general issues pertinent to the selection, purchase, utilization, and maintenance of hardware/software systems in an educational environment.

7. To make teachers aware of the components of the DOE's computer literacy program.

B. Outcomes

Upon completing the workshop, each participant will be able to:

(The Computer as a Topic)

1. Correctly use computer-based education (CBE) terminology.

2. Name major computer system components.

3. Describe the functions of major computer system components.

4. Differentiate among different levels of computer competency (e.g., awareness, literacy, proficiency).

5. Describe major developments in the history of computing.

6. Describe the four generations of computer technology.

7. Describe the evolution of mass storage devices.

8. Discuss the growing importance of computers in education.

9. Describe the broad range of present and future careers requiring computer literacy.

10. Describe changes in the job market due to computer technology.

11. List general considerations for hardware selection.

12. Discuss potential future uses of videodisk, videotext, and computer-based communication (CBC) systems in education.

13. Describe the fundamental computer-based information handling operations: input, processing, and output.

14. Match computer system hardware components with appropriate functions.

15. Differentiate among the computer information coding hierarchy of bit, byte, field, record, file, and database.

16. Identify information storage and retrieval applications.

17. Explain utility of information storage and retrieval systems

18. Differentiate among microcomputers, minicomputers, and mainframe computers.

19. Teach fundamental microcomputer operations.

20. Perform routine upkeep for microcomputer systems.

21. Explain the microcomputer's potential utility as dumb/intelligent terminal.

22. Discuss major past, present, and probable future impact of computers on society.

23. Distinguish between administrative and academic computer uses in education.

24. Give examples of administrative computer applications.

25. Describe alternative state and local organizational models for educational computing services.

26. Describe the major categories of teacher competencies for computer education.

27. Explain rationale for major teacher competencies in computer education.

28. Justify the need for future citizens to learn about computers.

29. Discuss alternative definitions of computer literacy.

30. Justify the need for teachers to teach computer literacy.

31. Describe major DOE computer policies and activities relevant to computers.

32. Describe major components of the DOE computer literacy framework, curriculum guide, and teacher training plan.

33. Identify hardware/software combinations potentially matching the participant's educational demands.

(The Computer as a Tool)

1. Distinguish batch from interactive computing operations.

2. Discuss advantages and disadvantages of paper vs. terminal administration for computer-scored tests.

3. Discuss advantages and disadvantages of manual vs. computer-based test analysis.

4. Use a mark-sense reader (in conjunction with a computer program) to score a test.

5. Identify CMI applications.

6. Explain utility of CMI applications.

7. Distinguish CMI applications from CAI applications.

8. Compare and contrast integrated computer-based education (CBE) systems (e.g., PLATO) with CMI applications without affiliated CAI lessons.

9. Identify computer-based communication (CBC) applications.

10. Explain utility of electronic mail and other CBC applications.

11. Use an electronic mail system to communicate.

12. Distinguish CBC from CMI and CAI.

(The Computer as a Tutee)

1. Distirguish tutee from tutor applications.

2. Define "algorithm".

3. Describe the functions of algorithms.

4 Define "flowchart".

5. Describe the function of flowcharts.

6. Define "programming".

7. Be aware of various programs; e.g., BASIC, LOGO.

8. Identify programs written in a specific courseware authoring language (e.g., PILOT).

9. Identify the coding stage of program development.

10. Enter a simple BASIC program into a computer.

11. Enter a simple LOGO program into a computer.

12. Enter a simple courseware authoring program into a computer.

13. Verify correct operation of a simple BASIC program.

14. Verify correct operation of a simple LOGO program.

15. Verify correct operation of a program written in a courseware authoring language.

16. Identify testing stage of program development.

17. Identify implementation stage of program development.

18. Modify a simple BASIC program.

19. Modify a simple LOGO program.

20. Modify a simple program written in a courseware authoring language.

21. Identify revision stage of program development.

(The Computer as a Tutor)

List general considerations for software selection. (Compatible with hardware, educationally sound, using references with reviews, not relying on catalog description or sample provided.)

1. Compare and contrast demonstration, drill and practice, tutorial, simulation/game, and problem-solving CAI applications.

2. Explain appropriate uses for different types of CAI applications.

3. Compare/contrast videodisk and videotext CAI applications with applications using a microcomputer alone.

4. Compare/contrast CAI applications written in a courseware authoring language with non-courseware authoring products.

5. Use references provided to identify potentially useful CAI software (user groups, computer clubs, etc.).

A sample syllabus for a one-week workshop is provided. The one-day orientation (Phase I) would be the only prerequisite.

C. Content

CONTENT AREA	RESOURCES/ACTIVITIES	OUTCOMES (upon completion of the course each participant will be able to...)
1. THE COMPUTER AS A TOPIC		
a. Computer Terminology	Overview of CBE terminology.	Correctly use computer-based education (CBE) terminology.
	Definition of computer system components.	Name major computer system components. Describe the functions of major computer system components.
	Show and tell of computer hardware.	Match computer system hardware components with functions. Describe the four generations of computer technology. Describe the evolution of mass storage devices.
	Presentation of levels of computer competency.	Differentiate among levels of computer competency.
b. History of Computers	Presentation on relevance of computers in education (historical trends).	Discuss the growing importance of computers in education.
	Read brief history of computing.	Describe the major developments in the history of computing.
	Videotape - Computers - From Pebbles to Programs.	Describe major developments in the history of computing.
	Videotape- Now the Chips are Down.	Describe major developments in the history of computing.
c. Computer-Related Careers	Videotape - Goodbye Gutenberg.	Describe changes in job market due to computer technology. Describe the broad range of present and future careers requiring computer literacy.

CONTENT AREA	RESOURCES/ACTIVITIES	OUTCOMES (upon completion of the course each participant will be able to...)
d. Computer-Related Educational Technology	Exercise in CBC, videodisk, or videotext.	Discuss potential future uses of videodisk, videotext, and CBC system in education.
	Read hardware selection document.	List general considerations for hardware selection.
e. Data Processing/ Information Handling Technology	Presentation of fundamental computer-based information handling operations: input, processing, output.	Describe the fundamental computer-based information handling operations: input, processing, output.
	Explanation of information coding hierarchy.	Explain the computer information coding hierarchy of bit, byte, field, record, file and database.
	Demonstration of large information storage and retrieval systems.	Identify information storage and retrieval applications. Explain utility of information storage and retrieval systems.
f. Elementary Terminal	Show and tell of available facilities.	Interact with microcomputers, minicomputers and mainframes.
	Review of microcomputer care and operations.	Teach fundamental microcomputer operations. Perform routine upkeep for microcomputer systems.
Interactions and Operations	Hands-on timesharing exercise. Demonstration of microcomputer as terminal, downloading program.	Explain the microcomputer's potential utility as a dumb/intelligent terminal.
g. Values Clarification - Computers in Society	Distinguish between administrative and academic uses. Give examples of administrative computer applications.	Distinguish between administrative and academic uses. Give examples of administrative computer applications.

CONTENT AREA	RESOURCES/ACTIVITIES	OUTCOMES (upon completion of the course each participant will be able to...)
g. Values Clarification - Computers in Society (con't)	Videotape - Goodbye Gutenberg.	Describe changes in the job market due to computer technology.
	Videotape - Now the Chips are Down.	Discuss major past, present, and probable future impacts of computers on society.
		Justify need for future citizens to learn about computers.
	Explanation of alternative state/local organizational models.	Describe alternative state/local organizational models.
h. Computers in Education	Presentation on relevance of computers in education.	Discuss growing importance of computers in education. Justify need to teach computer literacy.
	Presentation of history of DOE policies and activities regarding computers. Presentation of computer literacy framework and curriculum guide.	Describe major DOE policies and activities relevant to computers. Describe major components of the DOE computer literacy framework, curriculum guide, and teacher training plan.
	Read overview of teacher competencies for computer literacy.	Explain rationale for major teacher competencies in computer education.
	Presentation of alternative definitions of computer literacy. Discussion of DOE inservice training plan. Read descriptions of computer resource organizations.	Describe major components of DOE teacher training plan. Describe alternative state and local organizational models for educational computing services.
	Read software selection document.	List general considerations for software selection.

CONTENT AREA	RESOURCES/ACTIVITIES	OUTCOMES (upon completion of the course each participant will be able to...)
b. Computers in Education (con't)	Presentation of sources for software, books, audio-visual materials. Exercise - Selecting a computer for education.	Identify hardware/software combinations potentially matching the participant's educational demands.
2. THE COMPUTER AS A TOOL	Read overview of computers as instructional tools.	Identify applications and explain utility of: Word Processing Curricular Materials Generation Test Generation Test Scoring Test Analysis Grade Computation
a. Word Processing		
b. Curricular Materials Generation		
c. Test Generation	Take computer literacy post test (machine administered)	Distinguish batch from interactive computing operations.

CONTENT AREA	RESOURCES/ACTIVITIES	OUTCOMES (upon completion of the course each participant will be able to...)
d. Test Scoring	Mark-sense scoring of computer literacy pretest.	Distinguish batch from interactive computing operations. Use a mark-sense reader (in conjunction with a computer program) to score a test.
	Take computer literacy post test (machine scored).	Discuss advantages and disadvantages of paper vs. terminal administration for computer-scored tests.
e. Test Analysis	Review summary report from machine-administered post test.	Discuss advantages and disadvantages of manual vs. computer-based test analysis.
f. Grade Computation		
g. Grade Storage and Retrieval		Grade Storage and Retrieval.
h. Student Progress Recording and Management	Demonstration of courseware authored CMI applications.	Distinguish CMI applications from CAI applications.
	Demonstration of PLATO CBE system.	Compare and contrast integrated CBE systems (e.g., PLATO) with CMI applications without affiliated CAI lessons.
	Read Overview of CMI.	Identity CMI applications. Explain utility of computer-based management of instructional progress.
i. Electronic Mail and Messaging	Electronic mail exercise.	Identity CBC applications. Explain utility of electronic mail and other CBC applications. Use an electronic mail system to communicate. Distinguish CBC from CMI and CAI.

CONTENT AREA	RESOURCES/ACTIVITIES	OUTCOMES (upon completion of the course each participant will be able to...)
i. Electronic Mail and Messaging (con't)	Receive and send electronic message.	Identify computer-based communication applications. Explain utility of electronic mail and other CBC systems. Use an electronic mail system to communicate.
	Read article about future CBC systems.	Discuss potential future uses of CBC systems in education.
3. THE COMPUTER AS A TUTEE	Exercise - Selecting a computer for education.	Identify hardware/software combinations potentially matching the participant's educational demands.
a. Developing and Using Algorithms	Courseware authoring exercise - algorithms.	Define "algorithm". Explain the utility of an algorithm.
b. Developing and Using Flowcharts	Courseware authoring exercise - flowcharts.	Define "flowchart". Explain the utility of a flowchart.
c. Designing Instructional Programs	Courseware authoring exercise - prog. design.	Identify design stage of program development.
d. Coding Instructional Programs	Courseware authoring exercise - coding	Identify programs written in an authoring language. Enter a simple courseware authoring program. Identify coding stage of program development.
	Enter simple LOGO program.	Identify LOGO programs. Identify coding stage of program development. Distinguish tutee from tutor applications.
	Enter simple BASIC program.	Identify BASIC program. Enter a simple BASIC program into a computer. Identify coding stage of program development.

CONTENT AREA	RESOURCES/ACTIVITIES	OUTCOMES (upon completion of the course each participant will be able to...)
e. Testing/Debugging Instructional Program	Courseware authoring exercise - testing.	Verify correct operation of an authoring language program. Identify testing/debugging stage of program development.
	Verify correct operation of simple LOGO/BASIC program.	Identify testing stage of program development. Distinguish tutee from tuor applications.
f. Implementing Instructional Programs	Courseware authoring exercise - implementing.	Identify implementation stage of program development.
	Have partner run completed LOGO program.	Identify implementation stage of program development. Distinguish tutee from tutor applications.
g. Revising Instructional Programs	Courseware authoring exercise - revision.	Modify a simple authoring language program. Identify revision stage of program development.
	Modify simple LOGO program.	Identify revision stage of program development. Distinguish tutee from tutor applications.
	Modify a simple BASIC program.	Modify a simple BASIC program. Identify revision stage of program development.

CONTENT AREA	RESOURCES/ACTIVITIES	OUTCOMES (upon completion of the course each participant will be able to...)
4. THE COMPUTER AS A TUTOR	Read overview of CAI.	Explain appropriate uses for different types of CAI applications. Compare and contrast demonstration, drill and practice, tutorial, simulation/game, and problem solving, CAI application.
	Read software selection document.	List general considerations for software selection.
	Exercise - Selecting a computer for education.	Identify hardware/software combinations potentially matching the participant's educational demands.
	Presentation of alternative courseware evaluation techniques. Walk-through of examples courseware evaluation process.	Describe alternative techniques. Identify major stages of courseware selection process.
(Identify, select, and use appropriate programs for):		
a. Demonstrations	Evaluate several demonstration programs.	Procure quality demonstration programs which meet the participant's needs.
b. Drill and Practice	Drill and practice exercise with videodisk or videotext.	Compare/contrast videodisk and videotext CAI applications with applications using a micro alone.
	Evaluate several drill and practice programs.	Procure quality drill and practice programs which meet the participant's needs.
c. Tutorials	Tutorial exercise with videodisk or videotext.	Compare/contrast videodisk and videotext CAI applications with applications using a micro alone.
	Evaluate several tutorial programs.	Procure quality tutorial programs which meet the participant's needs.

CONTENT AREA	RESOURCES/ACTIVITIES	OUTCOMES (upon completion of the course each participant will be able to...)
d. Simulations and Games	Simulation/game exercise with videodisk or videotext.	Compare/contrast videodisk and videotext CAI applications with applications using a micro alone.
	Evaluate several simulation/game programs.	Procure quality simulation/gaming programs which meet the participant's needs.
e. Problem Solving	Problem-solving exercises with videodisk or videotext.	Compare/contrast videodisk and videotext CAI applications with applications using a micro alone.
	Evaluate several problem-solving programs.	Procure quality problem-solving programs which meet the participant's needs.

D. Sample Syllabus for Phase II. Classroom Computing: Computers in Education

(30 contact hours over 6 contiguous days)

Course Description:

Course is designed to be a comprehensive introduction to instructional computing for educators. Participants will be provided with the knowledge and skills to effectively use computers in their own school situations. Focus is on practical knowledge which will help individuals to be more comfortable and self-sufficient in classroom computing. Major emphasis will be placed on the following classroom computing topics:

- how computers work and how they are instructed,
- choosing and using computer software and hardware for classroom use, and
- rudimentary aspects of programming.

Prerequisite: Phase I of DOE Computer Literacy training or comparable experience.

Hands-on activities will be an essential part of the course.

Objectives:

1. To expose teachers to skills, knowledge, and processes in the four computer education areas of topic, tool, tutee, and tutor.
2. To teach participants the terminology associated with the day-to-day use of educational computing systems.
3. To train teachers to operate several different types of computer systems.
4. To familiarize teachers with the history of computers and computing.
5. To make teachers aware of the past, present, and future impacts of computers on society.
6. To make teachers aware of general issues pertinent to the selection, purchase, utilization, and maintenance of hardware/software systems in an educational environment.
7. To make teachers aware of the components of the DOE's Plan for Computers in Education.

Agenda

Day 1

8:00 am	Introduction
	Hawaii State Plan for Computers in Education
9:45 am	BREAK
10:00 am	Computers in the Schools
11:00 am	History of Computing
12:00 pm	LAB--Operating and Using Computers
12:50 pm	Evaluation
1:00 pm	FINISH

Day 2

8:00 am	How A Computer Works
9:30 am	BREAK
9:45 am	A BIT of this, A BYTE of that...
11:30 am	BREAK
11:45 am	Computer Applications
12:50 pm	Evaluation
1:00 pm	FINISH

Day 3

8:00 am	Buying Software for Your Class
9:30 am	BREAK
9:45 am	LAB--Evaluating Some Commercially Prepared Programs
11:15 am	BREAK
11:30 am	Shopping for Equipment...and affording it!
12:50 pm	Evaluation
1:00 pm	FINISH

Day 4

8:00 am	Integrating Computers into Daily Teaching
9:30 am	BREAK
9:45 am	LAB--Programs That Make Life Easier and More Organized
11:15 am	BREAK
11:30 am	LAB--Introduction to Word Processing
12:50 pm	Evaluation
1:00 pm	FINISH

Day 5

8:00 am	The Idea of Programming, Part 1
9:30 am	BREAK
9:45 am	LAB--Programming
11:20 am	Evaluation
11:30 am	BREAK
11:45 am	The Idea of Programming, Part 2
1:00 pm	FINISH

Day 6

8:00 am	LAB--Programming
9:30 am	BREAK
9:45 am	Telecommunications - The Electronic Field Trip
11:15 am	BREAK
11:30 am	Computers and Teachers Staying Computer Literate
12:50 pm	Final Evaluation
1:00 pm	END

Logistic and Management Suggestions

Hardware: 10-15 microcomputer systems from at least three different companies, at least one modem, at least 2-3 printers, 1 large monitor.

Group Size: 20-25 participants.

Phase III. Classroom Computing: Instructional Applications.

The goals for this phase are:

1. To provide the teacher with the ability to determine whether or not a particular piece of courseware is suitable for use in his/her classroom.

2. To provide the teacher with model programs in the language and at the level most appropriate for the individual teacher's class.

3. To provide the teacher with a working knowledge of an instructional tool (e.g., word processor, gradebook manager).

4. To enable the teacher to modify the contents of CAI programs in BASIC, Logo, or PILOT, and to develop original content material for CAI "shell" (content-free, prepackaged) programs.

5. To enable the teacher to operate the equipment which runs the applications listed above, without outside assistance.

Upon completing the course, each participant will be able to:

(The Computer as a Topic)

1. Define major computer system components.

2. Setup and disassemble microcomputer systems.

3. Operate microcomputers with little or no outside assistance.

4. Define the major types of computer uses in education.

(The Computer as a Tool)

1. Explain utility of software evaluation.

2. Describe alternative software evaluation techniques.

3. Explain stages of software evaluation process.

4. Explain ways in which a word processor can be used as an instructional tool.

5. Routinely use a word processing program as an instructional tool.

(The Computer as a Tutee)

1. Describe similarities and differences among BASIC, Logo, and PILOT.

2. Use simple algorithms to solve common programming problems.

3. Read flowcharts.
4. Identify the design stage of program development.
5. Modify flowcharts to reflect altered problems.
6. Create original flowcharts for specific programs.
7. Read programming code (in BASIC, Logo, and PILOT).
8. Modify programming code to solve altered problems.
9. Write simple instructional programs (in BASIC, Logo, and PILOT).
10. Debug simple programs. (in BASIC, Logo, and PILOT).
11. Use original instructional programs in the classroom.
12. Revise and improve self-authored instructional programs.

(The Computer as a Tutor)

1. Describe alternative courseware evaluation techniques.
2. Identify major stages in courseware evaluation process.
3. Procure quality demonstration programs which meet the participant's needs.
4. Procure quality drill and practice programs which meet the participant's needs.
5. Procure quality tutorial programs which meet the participant's needs.
6. Procure quality simulation/gaming programs which meet the participant's needs.
7. Procure quality problem-solving programs which meet the participant's needs.

A sample syllabus for a course spanning six Saturdays is provided. The one-day orientation (Phase I) and one-week workshop (Phase II) would be prerequisites.

C. Content

CONTENT AREA	RESOURCES/ACTIVITIES	OUTCOMES (upon completion of the course each participant will be able to...)
1. THE COMPUTER AS A TOPIC		
a. Computer Terminology	Review of computer system components.	Define major computer system components.
b. History of Computers		
c. Computer-Related Careers		
d. Computer-Related Educational Technology	Microcomputer system set up exercise.	Set up and disassemble microcomputer system.
e. Data Processing-Information Handling Technology		
f. Elementary Terminal Interactions and Operations	Review fundamental microcomputer operations.	Operate microcomputer with little or no outside assistance.
g. Values Clarification Computers in Society		
h. Computers in Education	Review categories of computer uses in education.	Define major types of computer uses in education.
2. THE COMPUTER AS A TOOL	Description of alternative software evaluation techniques. Walk-through of example software evaluation process. Presentation on importance of software evaluation.	Describe alternative software evaluation techniques. Explain stages of software evaluation process. Explain utility of software evaluation.

CONTENT AREA	RESOURCES/ACTIVITIES	OUTCOMES (upon completion of the course each participant will be able to...)
a. Word Processing	Overview of word processing systems and techniques. Complete word processing assignment.	Explain ways in which word processor can be used as an instructional tool. Routinely use word processing programs as an instructional tool.
b. Curricular Materials Generation		
c. Test Generation		
d. Test Scoring		
e. Test Analysis		
f. Grade Computation		
g. Grade Storage and Retrieval	Overview of data base management DBM systems and techniques. Complete DBM assignment.	Describe different structures, uses, and costs of DBM systems. Routinely use a DBM system as an instructional tool.
h. Student Progress Recording and Management		
i. Electronic Mail and Messaging		
3. THE COMPUTER AS A TUTEE	Explanation of similarities and differences among BASIC, Logo, and PILOT.	Describe similarities and differences among BASIC, Logo, and PILOT.
(Use appropriate high-level languages such as Logo, BASIC, or PILOT in conjunction with):		
a. Developing and Using Algorithms	Presentation of fundamental problem-solving procedures.	Use simple algorithms to solve common programming problems.

CONTENT AREA	RESOURCES/ACTIVITIES	OUTCOMES (upon completion of the course each participant will be able to...)
b. Developing and Using Flowcharts	Presentation on reading and writing - flowchart.	Read flowcharts. Modify flowcharts to reflect altered problems. Create original flowcharts for specific programs.
c. Designing Instructional Programs	Walk-through of model instructional programs. Exercise in modifying model instructional programs.	Read programming code. Modify programming code to solve altered problems.
d. Coding Instructional Programs	Assignment to create an original instructional program.	Write simple instructional programs.
e. Testing/Debugging Instructional Programs	Test operations of original programming creations.	Debug simple programs.
f. Implementing Instructional Programs	Pilot-test original programs.	Use original instructional programs in the classroom.
g. Revising Instructional Programs	Revise programs to correct flaws.	Revise and improve self-authored software.
4. THE COMPUTER AS A TUTOR	Presentation of alternative courseware evaluation techniques. Walk-through of examples courseware evaluation process.	Describe alternative techniques. Identify major stages of courseware selection process.
(Identify, select, and use appropriate programs for).		
a. Demonstrations	Evaluate several demonstration programs.	Procure quality demonstration programs which meet the participant's needs.
b. Drill and Practice	Evaluate several drill and practice programs.	Procure quality drill and practice programs which meet the participant's needs.
c. Tutorials	Evaluate several tutorial programs.	Evaluate several tutorial programs. Procure quality tutorial programs which meet the participant's needs.

CONTENT AREA	RESOURCES/ACTIVITIES	OUTCOMES (upon completion of the course each participant will be able to...)
d. Simulations and Games	Evaluate several simulation/game programs.	Procure quality simulation/gaming programs which meet the participant's needs.
e. Problem Solving	Evaluate several problem-solving programs.	Procure quality problem-solving programs which meet the participant's needs.

D. Sample syllabus for Phase III. Classroom Computing: Instructional Applications

(36 contact hours over 6 weeks)

Course Description:

Course is designed to be a formal introduction to computer programming and the computer languages of Logo, BASIC, Pascal, and PILOT. Participants will be provided with the knowledge and skills to effectively introduce "computer as a tutee, topic, tool, and tutor" activities of the computer curriculum. Major emphasis will be placed on the following topics:

- courseware evaluation techniques
- computer applications
- computer programming

Prerequisite: Phases I and II or equivalent.

Objectives:

1. To provide the teacher with the ability to determine whether or not a particular piece of courseware is suitable for use in his/her classroom.
2. To provide the teacher with model programs in the language and at the level most appropriate for the individual teacher's class.
3. To provide the teacher with a working knowledge of at least two instructional tools (e.g., word processor, gradebook manager).
4. To enable the teacher to modify the contents of CAI programs in BASIC, LOGO, or PILOT, and to develop original content materials for CAI "shell" (content-free, prepackaged) programs.
5. To enable the teacher to operate the equipment which runs the applications listed above, without outside assistance.

Agenda

Day 1

8:30 am	Introduction
9:15 am	Getting (Re)Acquainted with the Computer
10:15 am	BREAK
10:30 am	Designing CAI Lessons for Microcomputer Use
11:30 am	Description of Final Project (Handout #1)
11:45 am	LUNCH
12:30 pm	Flowcharting
	Introduction to BASIC Programming
2:00 pm	BREAK
2:15 pm	BASIC Lab
3:10 pm	Evaluation
3:15 pm	FINISH

Day 2

8:30 am	Question Addressing
	Introduction to LOGO Programming
9:45 am	BREAK
10:00 am	LOGO Lab
11:30 am	LUNCH
12:15 pm	More BASIC Programming
1:30 pm	BREAK
1:45 pm	Group Meetings (Worksheet #1)
2:15 pm	BASIC Lab
3:10 pm	Evaluation
3:15 pm	FINISH

Day 3

8:30 am	Question Addressing
	More BASIC Programming
9:45 am	BREAK
10:00 am	BASIC Lab
11:15 am	LUNCH
12:00 pm	Additional Lesson Design Techniques
	More LOGO Programming
1:15 pm	BREAK
1:30 pm	Group Meetings (Worksheet #2)
2:00 pm	LOGO Lab
3:00 pm	Evaluation
3:15 pm	FINISH

Day 4

8:30 am	Question Addressing More LOGO Programming
9:45 am	BREAK
10:00 am	LOGO Lab
11:15 am	LUNCH
12:00 pm	More BASIC Programming
1:15 pm	BREAK
1:30 pm	Group Meetings (Worksheet #3)
2:15 pm	BASIC Lab
3:10 pm	Evaluation
3:15 pm	FINISH

Day 5

8:30 am	Question Addressing
	PILOT Programming
	Word Processing
	Authoring Programs
10:00 am	BREAK
10:15 am	PILOT, Word Processing, and Authoring Programs Lab
11:15 am	LUNCH
12:00 pm	Pascal Programming
2:00 pm	BREAK
2:15 pm	Pascal Lab
3:10 pm	Evaluation
3:15 pm	FINISH

Day 6

8:30 am	Group Meetings/Lab
9:45 am	BREAK
10:00 am	Group Project Viewing and Evaluation
12:00 pm	LUNCH
12:45 pm	Group Project Presentations:
	Group 1
1:15 pm	Group 2
1:45 pm	Group 3
2:15 pm	Group 4
2:45 pm	Group 5
3:15 pm	Final Evaluation
3:30 pm	END

Logistic and Management Suggestions

Hardware: 1 machine for every two teachers of the type needed for a particular content at lecture/lab site; minimum of 2 hours per teacher per week of access to terminal/computer outside of class.

Group Size: 15-20 participants.

FINAL PROJECT

Background

You and your project team have been contracted to develop a CAI lesson that would help students better understand a mathematical concept.

The publishing company that has contracted you has very few requirements except for the following:

1. that the CAI lesson be practical and readily used in the classroom setting.

2. that documentation accompanying the lesson include:

   a. target student characteristics such as grade and ability levels,

   b. lesson objectives and prerequisites,

   c. description of how the CAI lesson would fit into the curriculum,

   d. hardware/software requirements, and

   e. a program listing that is easily understood by other users.

Worksheets pertaining to the above requirements will be provided to help you design your lesson.

All requirements must be completed by 10:00 am. on Day 6. By then, your project team must also have at least 25 copies of both Worksheet #1 and the program's listing.

All project teams will evaluate each other's CAI lesson in terms of the following criteria:

   a. ease of use.

   b. appropriateness for grade and ability level.

   c. instructional effectiveness (to what extend have the lesson objectives been met?)

   d. completeness of documentation.

   e. marketability (would you buy the program?)

Following the team evaluations, each team's designated spokesperson will formally present their CAI lesson to the class, describing its instructional application, any problems encountered in its development, etc.

(To facilitate efforts, your team may wish to designate a spokesperson/chair who would be responsible for ensuring that all members participate in all phases of the project (designing, writing, coding) and a team recorder who would note group consensus thoughts on the worksheets.)

WORKSHEET #1

Project Team Name:

CAI lesson Topic:

CAI Mode (circle one): Drill and Practice Tutorial
Problem Solving Simulation

Lesson Objectives:

1.

2.

3.

Lesson's Prerequisite Skills:

Describe where the CAI lesson will fit into your Math curriculum, and in which of the three stages of a lesson your CAI module can be used:

Describe your target student population (grade, ability levels...)

Microcomputer hardware/software requirements:

Draw your program's flowchart below.

Instructional Design Step (from Gagne's Theories of Learning Algorithm)	Your Text (as it will appear on Screen and Read by the Student)	Program Code
1. Provide for motivation and/or attention. (Arouse curiosity, present challenge, create fantasy, pose questions, etc.)		
2. State/present objective to student. (How will learner know she has learned? Specifically, what must learner be able to do at completion of module?)		
3. Recall prerequisite skills.		

ERIC

Instructional Design Step (from Gagne's Theories of Learning Algorithm)	Your Text (as it will appear on Screen and Read by the Student)	Program Code
4. Present new material (via CAI type). (Remember not to have more than 3 consecutive displays of text without some kind of interaction.)		

Instructional Design Step (from Gagne's Theories of Learning Algorithm)	Your Text (as it will appear on screen and Read by the Student)	Program Code
5. Provide learning guidance. (examples, hints, clues, cues, etc. which might aid the student in understanding the material better.)		
6. Elicit performance/response. (Present situation/problem to student where what was learned so far can now be applied.)		
7. Provide feedback on correctness of response via words, music, pictures, etc. If feedback is for an incorrect response, provide more learning guidance (step #5 above) and repeat step #6 with a different problem.		

ERIC

Instructional Design Step (from Gagne's Theories of Learning Algorithm)	Your Text (as it will appear on Screen and Read by the Student)	Program Code
8. Assess performance. (reliability and validity)		
9. Suggestions to student to enhance retention of new material.		

Phase IV. Computer Literacy Curriculum Implementation.

A. Goals

The goals for this phase are:

1. To prepare the teacher to go into the classroom and effectively use a computer.

2. To assist the teacher in resolving the problems encountered while utilizing computers in a classroom for the first time.

B. Outcomes

Upon completion of this phase, the participant will be able to:

1. Teach computer literacy in the classroom.

2. Use the computer as an instructional tool.

3. Use computer-assisted instruction to aid in teaching non-computer subject matter.

4. Identify alternative solutions for the following concerns:

   a. power surges,

   b. classroom management,

   c. security

A sample syllabus for a 20-hour review of curriculum implementation sessions is provided. Prerequisites would include the one-day orientation (Phase I), the one-week workshop (Phase II), and the 36-hour course (Phase III).

C. Sample Syllabus for Phase IV. Classroom Computing: Computer Literacy Curriculum Implementation

(8-20 hours)

Workshop Description:

Workshop is designed to prepare the teacher to use computers effectively in the classroom. Two 4-hour workshops are planned. In the initial workshop, participants will be provided with instructional strategies and technical information to help them become more comfortable and self-sufficient in classroom computing.

In the second workshop, participants will share experiences and explore alternatives for resolving difficulties encountered.

Optional follow-up activities to assist teachers may be planned if necessary for an additional 12 hours.

Objectives:

1. To prepare the teacher to effectively use computers in the classroom.

2. To provide the teacher with alternatives for resolving problems encountered when using computers in the classroom.

Agenda

Preliminary Workshop (4 hours of training prior to beginning of classroom computer usage)

- Review of Guide.
- Teacher demonstration of an activity from the guide.
- Discussion of anticipated implementation problems.
- Subgroups plan a trial lesson and implement prior to next workshop.
- Workshop evaluation.

Follow-up workshop (4 hours of training after 3rd week of computer usage in classroom).

- Subgroups share developed activities with large group.
- Group feedback/discussion.
- "Panic Button" references given to teachers.
- Workshop evaluations.

Follow-up Activities (Optional - 12 hours of non-structured training)

- Additional subgroup interactions.
- Individual participant interactions with workshop leader.

Logistic and Management Suggestions

Hardware: For workshops - one of each type of machine to be used for demos, 1 large monitor; participants must also have usable equipment available in their schools.

Group Size: 20-30 from single level or discipline.

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