COMPUTER ASSISTED INSTRUCTION

SABBATICAL REPORT

JULY AND AUGUST 1977

JO ANNE COFFMAN MAYER

MT. SAN ANTONIO COLLEGE

1100 N GRAND AVENUE

WALNUT, CA 91789

TABLE OF CONTENTS

I. SABBATICAL PURPOSE

"A sabbatical leave is granted to permit an employee to take advantage of an opportunity which will result in her/his rendering more service to the college."

As a data processing manager in an ever increasing maze of complexity of change of hardware, software, legislation, local policy, etc. a sabbatical leave is necessary to study any topic comprehensively. An environment where "Murphy's Law" is dominant is not conducive to spare time study of anything of such magnitude and scope.

For the purpose of study of Computer Assisted Instruction, the Mt. San Antonio College Board of Trustees authorized my two month sabbatical leave.

My request to study this very exciting topic was based on my personal belief that utilization of computing in the educational environment has potential to provide service to the student clientele that can augment and enhance the service provided by an excellent faculty.

The intent is to explore ways to assist our students in reaching their educational goals.

The need is here. If the computing environment can assist the faculty in educating our students, I am interested in contributing my efforts toward that mutual goal at Mt. San Antonio College.

II. OBJECTIVES OF STUDY

TO

--- gain perspective of Computer Assisted Instruction and the state of the art

--- visit selected sites where Computer Assisted Instruction is being successfully utilized

--- read articles, papers, books and manuals relating to the field of CAI

--- collect a list of contact people, organizations in the field for purpose of future reference

--- make observations of hardware, software, and courseware that are elements in a successful environment of CAI

--- gather ideas regarding staffing requirements and organization structure necessary for success in the endeavor

--- record, where available, information about the number of students served and hours of availability of services

--- determine what physical facilities are necessary to provide the proper environment

--- identify specific need that can be met with this mode of delivery

--- identify elements of attitudes that are necessary for successful implementation (Board, Administration, Faculty, Staff and Student)

--- present observations and make recommendations for further study and/or action at the college

III. INTRODUCTION

SCOPE

The scope that could be presented in this paper must be delimited or the author will take her pen to the grave. If someone asks, "Tell me all that there is about Computer Assisted Instruction," it is just as absurd as saying, "Tell me all that you know about computers or education."

TOPICS

I have chosen to write about the specific site visitations and on two related topics, Cognitive Mapping and a computer based guidance system DISCOVER.

The selection of this approach seems the most logical to me as I want to relate things that I believe to be of special interest in our institution to meet our needs in the framework of our environment. Cognitive Mapping and DISCOVER seem worthy of exploration in addition to other general applications. My particular interest lies in the area of providing assistance in the basic skills as a place to begin.

CHARACTERISTICS OF SITES VISITED

The characteristics of the sites visited are of great variety, clientele of districts varying from 5,000 full time to 25,000 part time at Fox Valley Technical Institute, a community college, to an excess of 25,000 students at the University of Akron. Berkeley's Lawrence Hall of Science has 175,000 visitors in a year and is very community services oriented.

The observed use of CAI served students from 4 years old (Lawrence Hall of Science) to the oldest college student (several persons were older than the author). The potentials are limited only by the human imagination and the financing (the latter being the only real constraint observed).

THE PEOPLE

Without fail, the persons in pursuit of success in this exciting arena were bright, creative, enthusiastic and dedicated to quality education. There is truly a professional collegiality among them and a contagion of enthusiasm that you can't help but catch. It is clear that the persons involved are key to its success.

The variety of possibilities is somewhat reflected in this paper. There are no two like situations and no similar solutions. Once again, the uniqueness and creativity of individuals are largely responsible for this phenomenon.

IV. SITE VISITATIONS

A. LAWRENCE HALL OF SCIENCE
UNIVERSITY OF CALIFORNIA, BERKELEY

Located high in the hills above most of the Berkeley campus, this unique facility provides services to 175,000 annual visitors. Carpeted and with contemporary decor, it has a very pleasant air. Adults and children can compare their reflex reaction times or compete to land on the moon via a computerized simulation. There are films and lectures, teacher training programs, a science education library, research activities, special programs for deaf, special materials for blind and partially sighted and many activities and exhibits relating to computing and its uses.

HARDWARE AND SOFTWARE

The computer hardware used (July 77) is 2 Data General Novas. This equipment is owned. The software includes a time sharing system BASIC and PILOT (a subset of BASIC) are used. The courseware is in excess of 100 programs including simulations, learning games, problem solving and drill and practice. Computer programming in BASIC and PILOT are taught.

As is typical, staff members desire more computer hardware, particularly main storage and disk. There is capability to support 120 terminals, currently (July 77) 60 to 70 are outside the building and 30 to 35 are in the building.

The funding is partially from the National Science Foundation, industrial grants, endowments and gifts and some self supporting revenues.

SERVICES

The Lawrence Hall of Science is offering the services of its educational computer center and staff to schools, colleges and learning centers in Northern California. Special opportunities for teachers and students include "timesharing," providing connection directly into Bay Area classrooms from the Lawrence Hall computer, classes at the Lawrence Hall, computer demonstrations and workshops. The main objective of these activities is to offer services to educators, practically and at minimal cost.

For administrators and teachers seeking computer involvement for their students, the Lawrence Hall provides needed information and computer training based on grass-roots educational and technical experience. Since 1970, the Hall has been bringing the computer into

Bay Area classrooms. Many California teachers have explored computers through Lawrence Hall workshops, introduced them to their students and begun timesharing at their schools with an initial typewriter style "terminal" communicating with the Hall's computer by telephone. The Lawrence Hall computer presently reaches more than forty schools and educational institutions in Northern California including a Montessori School in San Francisco, elementary schools in Orinda and Walnut Creek, high schools in Richmond, Crockett, Piedmont, and Marin, the California School for the Deaf, Town School for Boys in San Francisco, Head-Royce School in Oakland, the California Maritime Academy in Vallejo, Dominican College in San Rafael, and others. Teachers in these schools are currently using the computer in their own classrooms daily in a wide range of curricula. In many cases computer exploration through the Lawrence Hall by a school or district has led to mushrooming enthusiasm and involvement by teachers, administrators, and especially students. The increased demand has led to further commitment and expansion on the program through additional computer terminals connecting to the Lawrence Hall, or in some cases, eventual purchase of a school or district computer. For communities who want the opportunity to explore

computers and learn how to identify and meet their own objectives, the Lawrence Hall system provides an ideal method of learning first hand what it's all about.

Teachers and parents introducing the computer to their school often avail themselves of Lawrence Hall workshops and seminars designed around the needs of the participants. There are a variety of ways of getting involved. Teachers often take courses at the Hall dealing with computer topics such as "computers in society," programming in BASIC, and in PILOT, a quickly learned computer language which elementary students can begin using in a few lessons, and with which teachers readily create original teaching programs. Classes are designed to de-mystify the computer and put it into the hands of educators as the flexible and resourceful tool of learning it should be.

For most teachers beginning to use the computer in their classes the first surprise is the computer's ability to turn kids on to schoolwork. Studying math, language arts, sciences, or any subject on the computer gives new freedom and pleasure to inquiring minds. As one teacher in Walnut Creek recently put it, "a motivated student means more than half the battle is already won. The other half has a lot to do with resources. For schools on the Lawrence Hall computer system via tele-

phone, the West Coast's most outstanding library of learning games, scientific simulations, teacher authored lesson models, and other educational programs is backed up by people--a staff engaged in continued research in the uses of computers in learning.

The Computer Education Project offers a full schedule of classes at the Hall for the public--children, adults, individuals and groups--anyone who is interested. These range from introductory experiences of enjoying and understanding computers first hand to programming at all levels of proficiency. As many as twenty-five local schools a year use the Hall's computer facility as an extended classroom, many in programs for gifted children. Students come to the Hall once a week for eight to thirty weeks in courses tailored to the needs and interests of individual groups. Experimental courses combine computer activities with other sciences such as astronomy, or biology, and several such courses have become subjects or research in logical thinking, attitude change, creativity and problem solving. In addition, each week during the school year, Northern California children are introduced to computer activities in single-visit, one-hour computer workshops; such workshops are attended by over 16,000 participants annually.

COSTS

Sharing time on the Lawrence Hall computer system involves renting a computer "port" (connection with the machine) by the month, and paying for storage of programs you keep on-line on your account, as outlined below:

Computer Port*	12 Month Basis $130 per month ($1,560 per year)	9 or 10 Month Basis $150 per month ($1,350 or $1,500 per year)
Storage*	$0.01 per sector per day	(an average program costs about $2.00 a month)

A computer "terminal" (such as a teletypewriter) is needed at the school or other site. In addition, there are expenses for reaching the Hall by phone, and maintenance of equipment which connects the phone line to the computer and to the terminal. For closer distances, schools telephone the Hall with a normal telephone receiver which fits into an "acoustic coupler" at their end. Each school has a private number which reaches its portoon the computer. Costs for the telephone vary and are paid to the phone company. Cost for the answering phone at the computer is $14 per month for each port. Maintenance of communications equipment at the Lawrence Hall is $13 per month for each port. Each school purchases its own computer terminal(s) and acoustic coupler(s).

* 1976 prices

For longer distances, schools use special "leased-lines" rented from the phone company. Each line can carry signals for six separate ports, so in some cases schools share a line. Maintenance for communications equipment used with leased-lines is $13 per month. Each school purchases equipment which connects the leased-line to the terminal and to the computer (this takes the place of the acoustic coupler and the answering phone at the computer). Such equipment is located by the Lawrence Hall for the school at the lowest price possible.

Costs for leased-lines vary with distance, and are paid to the telephone company. The Lawrence Hall provides guidance in establishing the most cost-effective means of telephone communication and equipment choice, and will seek ways of reducing costs whenever possible. The Hall will provide estimates for each specific case.

This facility is unique in its funding, clientele served and community services objectives.

B. FOX VALLEY TECHNICAL INSTITUTE

APPLETON, WISCONSIN

Fox Valley is a 2 year college with a local Board of Trustees. It is the third largest in the state of Wisconsin. The district population is about 650,000 people. There are 26 high schools in the district. The student population consists of 5,000 full-time students and in excess of 25,000 part-time students. There are about 200 full-time faculty members.

The administration and staff are very progressive and creative in finding ways to meet their students' needs. Cognitive Mapping is being used here (see section on cognitive mapping later in this report). Future plans at Fox Valley include the utilization of DISCOVER (see later section).

The atmosphere in this unique college is positive and staff are encouraged to be creative and supported in their endeavors.

The technical and vocational majors offered by the college are:

Account Clerk

Accounting

Agri-Business

Auto Body

Auto Mechanics

Automotive Technology

Banking and Finance

Child Care and Development

Clerk Typist

Conservation Technology

Data Processing

Diesel Mechanics

Electronics Technology

Fashion Merchandising

Fire Science Technology

Food Preparation Assistant

Industrial Drafting

Interior Decoration

Machine Tool Operation

Marketing

Mechanical Design

Metal Fabrication - Welding

Nursing Assistant

Occupational Therapy Assistant

Operating Room Assistant

Police Science Technology

Practical Nursing

Printing

Printing and Publishing

Production Agriculture

Pulp and Paper Technology

Real Estate

Restaurant and Hotel Cookery

Secretarial Science

Stenographic

Truck Driving

Ward Clerk

The apprenticeship programs provided are:

Auto Body Repairman

Auto or Truck Mechanic

Barber

Bricklayers and Masons

Carpenter

Cosmetologist

Electricians

Electric Power Lineman

Electrical Repairman

Electronic Instrumentation

Farm Implement Mechanic

Foundryman

Machinist

Maintenance Mechanics

Meat Cutter

Millwright

Painter and Decorator

Pattern Makers

Pipe Fitters

Plumbers

Radio - Television Repairman

Related Printing

Sheet Metal

Tool and Die

Welder

Comskil, an Installed User Program (IBM) is an English Communication Skills program used extensively by the students.

Other areas with CAI support are noted in the following table of contents from their CAI manual.

TABLE OF CONTENTS

The Institute is very committed to the use of Computer Assisted Instruction and enjoys significant support from the Administration.

The Computer Center budget (1977) contains $80,000 for salaries and $285,000 for equipment. A separate CAI budget administered by a CAI Specialist is about $97,000.

The District had an IBM 370/125 and planned to move to an IBM 370/138. More terminals were in existance with plans to expand.

This installation was an excellent example of a well coordinated effort among the computer center, the CAI specialist, administration and the faculty and staff.

C. OAKLAND COMMUNITY COLLEGE

BLOOMFIELD HILLS, MICHIGAN

Oakland Community College District has a central office for administration and four campuses. It services a predominately upper middle class community. Many families working in the auto industry make their homes here. The enrollment is between 18,000 and 19,000 students.

The data processing manager reports to the college President (the District Superintendent) in the District Office. The commitment (to individualize instruction) here is a direct reflection of the President's philosophy. They have had some Computer Assisted Instruction since 1972.

From an article written by Joseph Hill, President, and Derek N. Nunney, Vice President, "A complex, technological society is characterized by pervasive change, quick obsolescence of skills, and outdating of factual knowledge. Most men today can expect to pursue at least three different careers during their lifetimes. A man whose career preparation has been limited to acquisition of skills narrowed by over-specialization may see the job he is capable of performing eliminated by technological advancement.

Selection of appropriate careers requires two types of knowledge: self-knowledge--proper assessment of one's skills, aptitudes, and learning capabilities; and job knowledge--a combination of skills required for successful performance, shifts in employment opportunities, and projection for new careers.

To facilitate vertical and lateral job mobility, Oakland Community College has developed a core-cluster approach to vocational education and a personalized education program that provides a diversity of approaches to the accomplishment of educational objectives."

They use a large IBM computer 360/50 (July 1977) with 384K and 1 megabyte of LCS (large capacity storage, which is slower than regular storage).

They also have a Prime mini computer front end for telecommunication. The teleprocessing monitor used is Taskmaster. There are 35 terminals in the District.

Other software available is GPSS (General Purpose Simulator System) and SAS (Statistical Analysis System) from the graduate department at North Carolina State University.

Some of the concepts implemented to carry this philosophy into practice include the Core-Cluster Concept, Personalized Programs, Cognitive Style Mapping (see later section of this report), Programmed Learning, Student Tutors, Independent Study and Mini Courses.

The Core-Cluster Concept. To achieve greater articulation between the various vocational programs, OCC restructured its courses in the field of Applied Sciences and Arts into seven broad occupational clusters. Course work is divided into core classes common to all occupations within each cluster, related training, and areas of specialization.

OCC had found that many students' career selections were based on a fuzzy knowledge of job expectations and almost no knowledge of alternatives. Little thought had been given to personal strengths and weaknesses relative to successful performance.

Under the new approach, introductory seminars are offered for each cluster. They are designed to familiarize students with the variety of job opportunities in a selected cluster and to permit them to make an intelligent selection of a specific occupational field of study. For example, the introductory seminar to Allied Health introduces the student to employment opportunities in such occupations as dental assistant, medical office assistant, medical lab technician, and nursing.

The other concepts are implemented much as we know them, but all are used in combination for a very personalized program for each student. Pat Cross' "Beyond Education for All toward Education for Each" has truly been addressed at this institution.

See the section on Cognitive Mapping for more about Oakland Community College.

An interesting though unrelated note, the District has had Collective Bargaining since 1967! The Director of Data Processing (Director of Academic and Management Information Systems) serves on the Bargaining Team!

D. UNIVERSITY OF AKRON

AKRON, OHIO

This University is one of the 16 State Universities in Ohio. It enrolls between 21,000 and 22,000 students in credit courses and an additional 4,200 students in adult education. There are over 800 full time faculty members and administrators.

This University, established in 1870, is dedicated to the establishment and maintenance as a "center of learning" as contrasted to an "agency of instruction."

In 1964, the University became aware that its ability to meet its faculty-student-administrative information processing requirements would necessitate the use of computers.

As of this visit, the University had an IBM System 370 Model 158 (with 3 1/2 meg). The system supports over 70 terminals, many of which are off campus. The computer is run on 3 shifts 6 days a week and 8 hours on Sunday. There are 17 staff members in systems and programming, plus 4 systems programmers, and 20 people in operations. Also, there is a manager of academic services and of staff members to directly work with faculty and using departments. The Computer Center budget is about

$2 million. They have 875 computer programs for Administrative Applications. These include services to library, state reporting, personnel and payroll, financial aids, purchasing, housing and accounts payable and receivable. They were discussing data base and planning to get IDMS if they go with anything.

Over eight years ago, the University of Akron assumed an active role in providing leadership in educational technology. They have hosted many conferences relating to Computer Assisted Instruction. Many of the nationally recognized leaders have been presenters at these conferences.

The material gathered at Akron includes papers by Harvey Long (IBM), John Hirschbuhl (Akron University), Patrick Suppes (Stanford), Joseph Denk (New Jersey Educational Computer Network) and others recognized as pioneers in this exciting field.

The CAI center in Akron is open from 9 a.m. to 9 p.m., Monday through Friday, 9 a.m. to 5 p.m. on Saturday and 1 p.m. to 6 p.m. on Sunday. This center was started in 1972.

The center houses thirteen 3270 terminals and were busy all the time the author was observing. (We were able to use them for a while, but didn't want to keep them from the students). There are 10 terminals off campus in public schools and the others are not in the main center.

The topics that have some CAI Modules available are:

Accounting

Business

Chemistry

Computer Programming

English

Games and Introductories

German

Guidance and Counseling

Mathematics

Medicine

Metric System

Music Theory

Psychology

Reading

Sociology

Statistics

Steel Design

Tests and Measurement

Over 4,000 students are involved in using CAI.

The major benefits of CAI at Akron are listed by the CAI Director, Dr. John Hirschbuhl:

-- CAI enables many students and several teachers to engage in a one-to-one dialogue using a high-speed computer as the communication medium. This approach

provides individualization of instruction, for learning on a competency-paced rather than a time-dependent basis.

-- CAI permits self-paced instruction, which is beneficial to students in need of remedial help in skill areas and to students at the opposite end of the achievement range who are bored and in search of more powerful means for expressing and developing their ideas.

-- CAI is able to provide students with reinforcement by means of its provision for appropriate feedback.

-- CAI can provide many paths to the same learning goal. This feature allows teachers to provide students with choice and flexibility in their learning encounters.

-- CAI helps develop an inner confidence and self-dependence within the students that it serves.

-- CAI is success-oriented, thus maintaining a positive mental attitude toward learning.

-- Dr. Hirschbuhl states, "When one makes the assumption that the amount learned and the number of students served are real cash value items, CAI becomes a cost-effective means for delivering instruction. One of education's biggest problems is how to cut costs without cutting quality." He points out that "CAI lets us cut costs by enabling

us to personalize, and individualize instruction in such a way as to reduce the failure rate in required entry-level courses, without necessitating reduced student/teacher ratios".

The future of computer utilization at Akron is stated by Dr. Guzzeta, President, "Our goal is to upgrade the total level of education. We are doing this through such things as Computer Assisted Instruction, which takes individuals from where they are, accepts them, and moves them on a competency-pacing basis rather than a time-pacing basis only. This is why our university is firmly committed to CAI."

The future direction will be to further exploit computer energy to expand the educational teaching-learning process and the management-administrative support services. This growth will take the form of greater use of remote terminals and displays by faculty, students, and administrative personnel within the university, as well as outside users, such as colleges and elementary/secondary schools.

In particular, in the administrative area, computer terminals will be employed in an online registration system. These terminals will permit computer calculation of fee assessment during the open and late registration processes.

E. COAST COMMUNITY COLLEGE DISTRICT

COSTA MESA, CALIFORNIA

The commitment to Computer Assisted Instruction in this District has been evidenced as early as 1963. In 1968, hardware was procured to start support a communication system for the CAI environment. The District is recognized as a leader in this field in California and nationally.

Computer Assisted Instruction has become an integral part of the total instructional program. Starting with Chancellor (supported by the Board) the continued commitment to this leadership role has insured continued support for the hardware, software and staffing necessary.

The Coast Community College District served as a model for both State and national institutes for instructors of other community colleges in data processing. In 1963, 1964, 1965, 1966, 1969 and 1970, summer institutes in vocational data processing were conducted by the staff instructors.

The vocational program which made computers a subject of instruction had a great impact on the curricula of the entire district. The guiding principles were to:

1. Train the student so that he/she would be competitive in the employment market and productive on his/her first job
2. Provide the student with a foundation of knowledge which would enable him/her to learn whatever new system concepts or generation of computer he would meet in his vocational career

These goals were achieved by the addition of new courses in the curriculum and coordination with courses in other departments. All instructors in the vocational data processing program had teaching assignments in other disciplines each year, for example, accounting, business, mathematics, and science.

Immediately, the instructors began to use the computer as an aid to instruction in the non-computer-related classes. In the areas of mathematics and science, students were given short courses in programming and were expected to use the computer as a tool for analysis of problems or data obtained experimentally in the laboratory. In 1964, a management games center was established, and simulation of business systems was used in courses of marketing, retailing, and small business management. By the time a teleprocessing terminal-oriented system was available on the district campuses, many instructors were deeply involved in computer-assisted instruction without knowing the implication of the term.

Full-fledged thrusts into CAI came with the advent of third generation hardware. The district's first approach was to use an interactive language developed at the University of California at Irvine called CAL (Course Author Language). It soon became apparent that a specialized language was too difficult for the district's personnel resources. The district then had the good fortune of discovering APL (A Programming Language) in its early stages. After some study, it was accepted as the language of choice for the district for use on the computer terminals. There were several considerations. First, APL required much less technical programming support at the early stage. The district also took the predefined CAI functions which were utilized in CAL and programmed them as functions under APL. This allowed continuity of early efforts and provided an easy entry point into programmed instruction on the computer. APL also contained the most powerful calculator mode available, making problem-solving objectives easily obtainable.

Wide utilization was encouraged by faculty incentives. Freedom to utilize the system by interested faculty was established by making the system available for long hours and by providing terminals which could be used at the college, in the instructor's office, or at home. New participation was encouraged by in-service training. District-sponsored faculty fellowships, which provided

funds, assistance, and release time for development of materials, were supported by an enthusiastic Board of Trustees.

The Office of Educational Development serves as a district resource to aid in obtaining information and in providing support and expertise in implementing developmental or evaluative projects in its instructional programs. The Office of Educational Development also encourages and supports creativity, innovation, and improvement within the district's programs.

The Office has a responsibility to maintain technical expertise and to assist interested and willing faculty members who wish to develop and implement new ideas under the guidance of their college administrations. In addition, the Office serves as the district office of institutional research and prepares and administers reimbursed and other instructionally related activities, including the district's Faculty Fellowship Program.

Component to the Office is the district's Consultant in Computer-Assisted Instruction, who is a faculty member released essentially full time, teaching a single course on alternate campuses, during alternate semesters. He serves as a consultant and vehicle for faculty members developing course segments. Assisting him is a learning systems programmer on the staff of the Office of Educational Development. In addition, he is assisted by the

programming staff of the district's Information Systems division.

The Consultant in Computer-Assisted Instruction serves as a resource person to any faculty member at Golden West or Orange Coast on any problem or concept involving programs. He may be contacted directly for his expertise in this field. He also serves as a consultant to district personnel on computer equipment.

In addition, he conducts courses and seminars for faculty members and district personnel, and also serves as the chief advisor to all members of the district staffs on the use, and possible use, of the computer.

Some sample areas that have been implemented into CAI modules by faculty are:

Algebra

Anatomy

Arithmetic

Art

Aviation

Biology

Business

Business Law

Calculus

Chemistry

Computers

Economics

Electronics

Engineering

English

French

Genetics

Geography

Geology

Geometry

German

Graphic Arts

Graphing

History

Italian

Journalism

Language

Library

Logic

Math

Morse Code

Music

Obstetrics

Photography

Physics

Political Science

Police Science

Psychology

Secretarial

Slide Rule

Spanish

Statistics

Trigonometry

Typing

V. SPECIAL TOPICS OF INTEREST

A. COGNITIVE MAPPING

Cognitive Style Mapping, while virtually unheard of a few years ago, is now becomming an integral part of the curriculum process at many educational institutions.

An individual's educational cognitive style is a description of the way he or she seeks meaning from the formalized structures of knowledge. Mapping an individual's educational cognitive style enables the teacher/counselor to identify specific strengths which can be used to develop educational prescriptions.

When a student seeks admission at Oakland Community College (OCC), Oakland, Mich., he/she finds among the more traditional entrance exams a few tests that ask him/her to taste cheese, listen to music and assemble puzzles.

These unusual activities are not intended as simple diversions, but are specifically designed to discover how the student perceives his/her world. The purpose is to help tailor education at OCC to reflect the way a student learns and thereby offer the greatest likelihood of success in learning.

The approach is called cognitive style mapping, and the main proponent of its development as an educational science at OCC is President Joseph E. Hill. "Education is a search for meaning," he explains. "If man derives meaning from his environment through symbols, then symbols and their meaning play a fundamental role in education."

Reflecting this view is the three-hour battery of tests given to incoming students. Test results go into Oakland's IBM computer to produce a tabular "map" of 84 traits that describe how each student thinks and learns--their cognitive style. The measured traits can produce 2,304 combinations that show how he/she handles qualitative and theoretical symbols, how cultural influences affect the way meaning is given to symbols, and how meaning is derived from the symbols perceived. In practice, the "maps" have produced up to 19 ways of teaching the same course material, each one aimed at a particular kind of learning style.

The student's map helps the student counselors determine, for example, whether this would probably be better suited to learning chemistry in a classroom setting, by individual study with programmed materials, through informal conferences with other students, or by combining all of these approaches in patterns that

change from unit to unit during the course. The result is a "personalized educational prescription"--a suggested game plan intended to make the student's learning process as fruitful as possible.

An array of coordinated learning facilities helps broaden the student's options. A student whose cognitive style map indicates he/she will progress fastest of they work at their own pace but with tutorial help might find the "individualized programmed learning laboratory" most useful. There he/she can use programmed texts, reading machines, films and three-dimensional dynamic models. Faculty trained in individualized instruction methods are available to help the student with difficulties.

Or, a student who works best in an informal group may find the "carrell arcades" most conducive to learning. These offer audiovisual equipment to view viedotaped lectures and to listen to instructional tapes or view slides. They also offer talk sessions with other students, guided by a paraprofessional or student tutor.

Other options open to students include seminars with professors or visits to the "learning resource center" with its variety of instructional packages and microfilms in addition to the usual library materials.

In all cases, the student is free to use any or all of the resources available on OCC's four campuses,

whether his/her instructor is among those participating in the cognitive style program or not. A student may also ignore the suggestions of the prescription and stick to the conventional classroom and lecture hall setting.

Mr. Hill found some faculty immediately enthusiastic, while othere were skeptical. As for student reactions, Mr. Hill reports considerable interest in cognitive style mapping among sutdents, but this is often coupled with the incorrect assumption that the method makes learning easier by reducing course content. "We meet many students," he says, "who feel if they don't undergo some stiff lecturing and have to do a paper, then the class is 'mickey-mouse.' I think some of the students oriented in this rigid style of education begin to realize that ease of learning isn't necessarily related to degree of learning."

The stress on personalized education generates a substantial demand for tutors. Faculty participating in the program put in tutoring time, but much of the help is provided by paraprofessionals and OCC's "youth-tutor-youth" program. The latter capitalizes on the view that a student in need of course-work help can sometines understand difficult areas faster when they're explained by a fellow student who has mastered them.

The following charts and definitions describe the variables utilized for mapping.

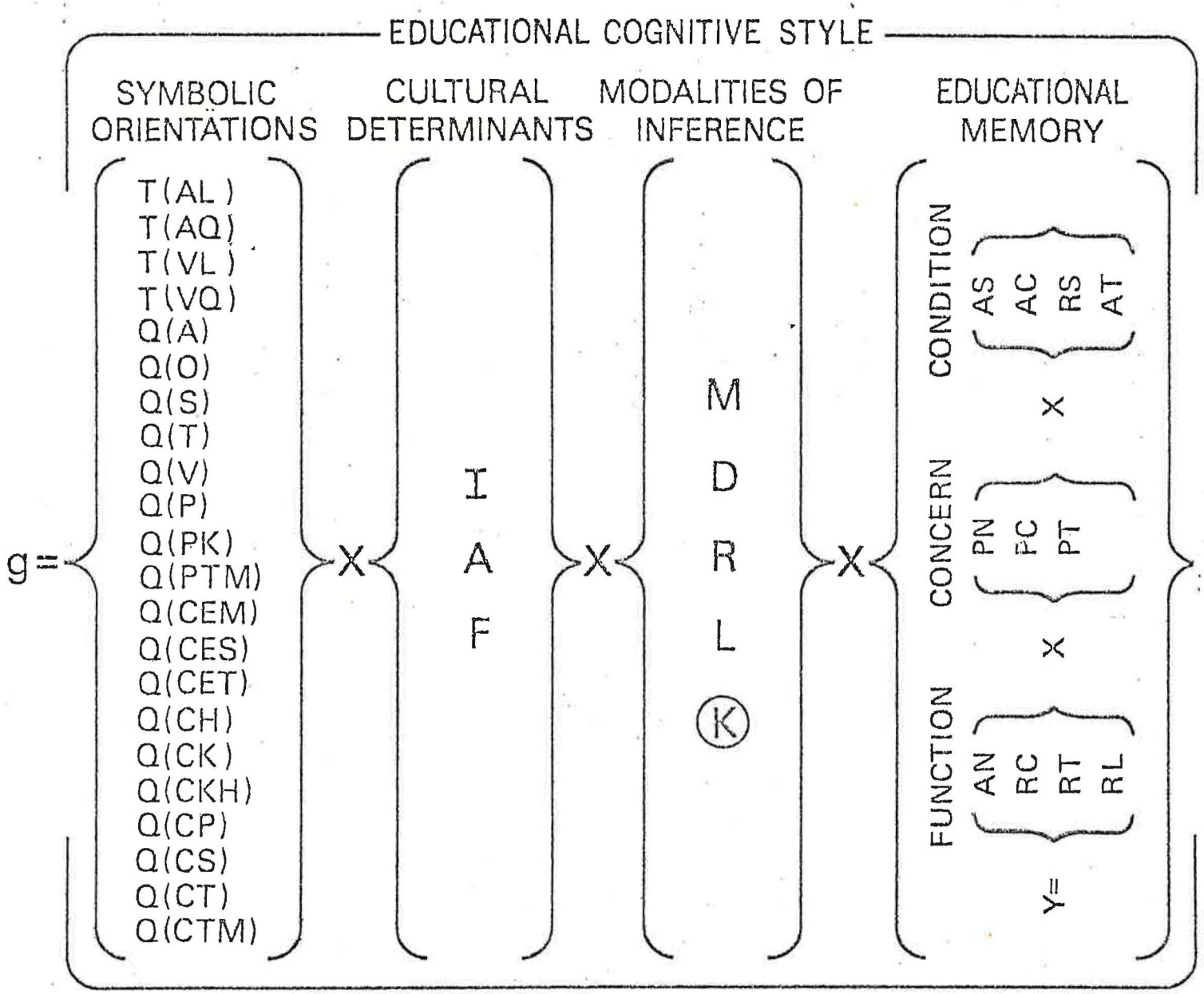

EDUCATIONAL COGNITIVE STYLE
SYMBOLIC ORIENTATIONS
CULTURAL DETERMINANTS
MODALITIES OF INFERENCE
EDUCATIONAL MEMORY
g =
T(AL)
T(AQ)
T(VL)
T(VQ)
Q(A)
Q(O)
Q(S)
Q(T)
Q(V)
Q(P)
Q(PK)
Q(PTM)
Q(CEM)
Q(CES)
Q(CET)
Q(CH)
Q(CK)
Q(CKH)
Q(CP)
Q(CS)
Q(CT)
Q(CTM)
X
I
A
F
X
M
D
R
L
(K)
X
CONDITION
AS
AC
RS
AT
X
CONCERN
PN
PC
PT
X
FUNCTION
AN
RC
RT
RL
Y=

Figure 1

A BRIEF GUIDE TO COGNITIVE STYLE MAPPING
Symbols and Their Meanings

Two types of symbols, theoretical (e.g., words and numbers) and qualitative (e.g., code data) are basic to the acquisition of knowledge and meaning. Theoretical symbols differ from qualitative symbols in that the theoretical symbols present to the awareness of the individual something different from that which the symbols are. Words and numbers are examples of theoretical symbols. Qualitative symbols are those symbols which present and then represent to the awarness of the individual that which the symbol is. (Feelings, commitments and values are some examples of the meanings conveyed by the qualitative symbols.)

There are four Theoretical Symbols:

T(VL) Theoretical Visual Linguistic — ability to find meaning from words you see. A major in this area indicates someone who reads with a better than average degree of comprehension.

T(AL) Theoretical Auditory Linguistic — ability to acquire meaning through hearing spoken words.

T(VQ) Theoretical Visual Quantitative — ability to acquire meaning in terms of numerical symbols, relationships, and measurements.

T(AQ) Theoretical Auditory Quantitative — ability to find meaning in terms of numerical symbols, relationships and measurements that are spoken.

Meanings for qualitative symbols are derived from three sources: 1) sensory stimuli; 2) cultural codes (games); and 3) programmatic effects of objects which convey an almost automatic impression of a definite series of images, scenes, events or operations. At the present time, there are 20 qualitative symbols included in the "symbolic" set; five of them associated with sensory stimuli, five that are programmatic in nature, and ten associated with cultural codes.

The five qualitative symbols associated with sensory stimuli are:

Q(A) Qualitative Auditory — ability to perceive meaning through the sense of hearing. A major in this area indicates ability to distinguish between sounds, tones of music, and other purely sonic sensations.

Q(O) Qualitative Olfactory — ability to perceive meaning through the sense of smell.

Q(S) Qualitative Savory — ability to perceive meaning by the sense of taste. Chefs should have highly developed qualitative olfactory and savory abilities.

Q(T) Qualitative Tactile — ability to perceive meaning by the sense of touch, temperature, and pain.

Q(V) Qualitative Visual — ability to perceive meaning through sight.

The qualitative symbols that are programmatic in nature are:

Q(P) Qualitative Proprioceptive — ability to synthesize a number of symbolic mediations into a performance demanding monitoring of a complex task (e.g., playing a musical instrument, typewriting); or into an immedicate awareness of a possible set of interrelationships between symbolic mediations, i.e., dealing with "signs."

Q(PD) Qualitative Proprioceptive Dextral — a predominance of right-eyed, right-handed and right-footed tendencies (a typically right-handed person) while synthesizing a number of symbolic mediations into a performance demanding monitoring of a complex task (e.g., playing a musical intrument, typewriting).

Q(PK) Qualitative Proprioceptive Kinematics — ability to synthesize a number of symbolic mediations into a performance demanding the monitoring of a complex physical activity involving motion.

Q(PS) Qualitative Proprioceptive Sinistral — a predominance of left-eyed, left-handed and left-footed tendencies (a typically left-handed person) while synthesizing a number of symbolic mediations into a performance demanding monitoring of a complex task (e.g., playing a musical instrument, typewriting).

Q—PTM) Qualitative Proprioceptive Temporal — ability to synthesize a number of symbolic mediations into a performance demanding the monitoring of a complex physical activity involving timing.

The remaining ten qualitative symbols associated with cultural codes are defined as:

Q(CEM) Qualitative Code Empathetic — sensitivity to the feelings of others; ability to put yourself in another person's place and see things from his point of view.

Q(CES) Qualitative Code Esthetic — ability to enjoy the beauty of an object or an idea. Beauty in surroundings or a well-turned phrase are appreciated by a person possessing a major strength in this area.

Q(CET) Qualitative Code Ethic — commitment to a set of values, a group of principles, obligations and/or duties.

Q(CH) Qualitative Code Histrionic — ability to exhibit a deliberate behavior, or play a role to produce some particular effect on other persons. This type of person knows how to fulfill role expectations.

Q(CK) Qualitative Code Kinesics — ability to understand, and to communicate by, non-linguistic functions such as facial expressions and motions of the body (e.g., smiles and gestures).

Q(CKH) Qualitative Code Kinesthetic — ability to perform motor skills, or effect muscular coordination according to a recommended, or acceptable, form (e.g., bowling according to form, or golfing).

Q(CP) Qualitative Code Proxemics — ability to judge the physical and social distance that the other person would permit, between oneself and that other person.

Q(CS) Qualitative Code Synnoetics — personal knowledge of oneself.

Q(CT) Qualitative Code Transactional — ability to maintain a positive communicative interaction which significantly influences the goals of the persons involved in that interaction (e.g., salesmanship).

Q(CTM) Qualitative Code Temporal — ability to respond or behave according to time expectations imposed on an activity by members in the role-set associated with that activity.

Cultural Determinants

There are three cultural determinants of the meaning of symbols: 1) individuality, 2) associates; and 3) family. It is through these "determinants" that cultural influences are brought to bear by the individual on the meanings of symbols

F — Family I — Individual A — Associates

Modalities of Inference

The forms of inference the individual uses in the process of deriving meaning:

M Magnitude — a form of "categorical reasoning" that utilizes norms or categorical classifications as the basis for accepting or rejecting an advanced hypothesis. Persons who need to define things in order to understand them reflect this modality.

D Difference — This pattern suggests a tendency to reason in terms of one-to-one contrasts or comparisons of selected characteristics or measurements. Artists often possess this modality as do creative writers and musicians.

R Relationship — this modality indicates the ability to synthesize a number of dimensions or incidents into a unified meaning, or through analysis of a situation to discover its component parts. Psychiatrists frequently employ the modality of relationship in the process of psychoanalyzing a client.

L Appraisal — is the modality of inference employed by an individual who uses all three of the modalities noted above (M, D, and R), giving equal weight to each in his reasoning process. Individuals who employ this modality tend to analyze, question, or, in effect, appraise that which is under consideration in the process of drawing a probability conclusion.

K Deductive — indicates deductive reasoning, or the form of logical proof used in geometry or that employed in syllogistic reasoning.

GLOSSARY OF TERMS

1. CAMPI
Computer Assisted Management of Personalized Instruction. CAMPI is a specialized form of PEP.

2. CA—Carrel Arcades
Carrel Arcades are large areas for relaxed individual study, small group discussions and tutorial sessions. A separate staff primarily composed of paraprofessionals working in a supportive role in the arcades help students seek meaning in their own way and at their own speed in activities designed by regular faculty members.

The Carrel Arcades contain audio-visual resources, and here students may review videotaped lectures, listen to audio-tapes, view films, or study course materials on other audio-visual equipment. Small groups meet for informal talk sessions with teachers and resource people

3. Cognitive Style Mapping
The cognitive style map gives a picture of the way a student derives meaning from his environment and personal experience. Each map, like each student, is different. A student's cognitive style is determined by the way he takes notice of his total surroundings — how he seeks meaning — how he becomes informed. Is he a listener or a reader? Is he concerned only with his point of view or is he influenced in decision-making by his family or by his group associates? Does he reason more like a mathematician or social scientist or fisherman?

4. Educational Prescriptions
Using this cognitive style map and subjective information gathered in private conversation with the student, a team of teachers and the student jointly develop a Personalized Education Program for the student which is geared to his strengths and weaknesses — a program which is his personal educational prescription and which promotes his success. A computer may be used to expedite the process.

5. IPLL—Individualized Programmed Learning Laboratory
In the IPLL, students use programmed texts and other highly organized materials under supervision of faculty members especially trained in individualized education techniques. The student receives expert guidance to solve his specific problems. Many of these students prefer to work alone rather than in groups.

He is given diagnostic tests when he first enters the laboratory. These tests are used in choosing the programs the student will work.

6. LRC
The LRC includes the college library, but offers more than traditional library services. It is a clearinghouse for a large variety of instructional packages. In addition to the usual books and periodicals, the LRC collection includes microfilms, special displays and research materials in many forms.

7. PEP—Personalized Educational Program
The situation in which the student's work will be chosen by the student and his instructor on the basis of the student's needs, ability and cognitive style. They will jointly develop an educational prescription. The student will remain responsible for the content of his courses but may "Burst" into any of several instructional modes available.

At the heart of PEP is the classroom teacher or team of teachers. Scheduled classes remain an essential part of the educational approach, and teachers remain the student's principal point of reference.

The flexible programming that makes success so available to students involves the careful balancing of professional skills, scientific methods and equipment.

8. Performance Testing
Courses in the PEP curriculum are broken down into units of a few weeks. These units are actually mini-courses — each having well-defined goals.

Students take tests to move from one unit to the next. They must succeed in each unit before moving on. Successful completion of each unit reinforces a student's positive view of himself and of the course materials.

Constant interaction with faculty, paraprofessionals, and tutors is designed to guarantee successful performance and modifying his prescription, the educational program of each student is humanized and personalized.

9. Seminars
The student who comes alive in the dynamics of group interaction may participate in free and easy "rap" sessions with teachers and other students. Other students may prefer a seminar with a faculty member who presents more of a "fatherly" image and with whom they feel more comfortable and confident. The student who related to teachers more easily on a one-to-one basis may work through conferences with his instructor.

10. YTY—Youth-Tutor-Youth
YTY makes student help available to other students on a regular basis. Students who have already mastered course materials are trained by the professional staff to tutor other students. Because the youth tutors, themselves, may have experienced problems, with course material, they often can spot trouble and show students approaches that might escape a faculty member.

B. COMPUTER BASED GUIDANCE SYSTEM - DISCOVER

DISCOVER is a computer-based career guidance and counselor support system. It was originally developed for grades 7-12. A college level DISCOVER system developed the DISCOVER Foundation, Inc. and is available as IBM Installed User Program.

The student uses a keyboard/CRT (TV like) terminal to interact with the system.

PURPOSE OF DISCOVER

DISCOVER is designed to provide assistance to the counselor in the delivery of a systematic career guidance program to every student. The developers of DISCOVER believe that students need assistance with educational and vocational decision making although the amount of this assistance varies with students' differing levels of vocational maturity. The counselors alone cannot provide the level and amount of assistance needed due to the present counselor-student ratios and additional assigned responsibilities of each counselor.

DISCOVER is the computerized implementation of a systematic career guidance program based upon the best of current career development theory. It makes

use of some of the best tools and techniques available in the profession. The computer is used to relieve counselors of instructional, information-giving, and file-sharing tasks. The optimal career guidance program is one in which the counselor and the computer work together to provide harmonized programs in which the best capabilities of both are used.

The system is modular in design and contains the following modules:

1a. Clarifying Values - this module helps the user come to a better understanding of the meaning and importance of personal values in the career development process and throughout life.

1b. Values and Occupations - this module stresses the relationships of values and careers. Included are a computer search of 320 occupations based on weights the user attaches to nine work related values.

2a. Effective Decision Making - this module introduces the user to several different decision making strategies and "teaches" the planful decision strategy (which is most valued in our society).

2b. Decision Making and Careers - this module uses the Tiedemen and O'Hara decision making paradigm to introduce the highly complex nature of decision making. Many career development tasks are explained in terms of the several phases of the Tiedemen and O'Hara paradigm.

3a. Organization of the Occupational World - two occupational classification systems are introduced and a series of exercises is provided for the user to gain an understanding of these classification systems.

3b. Browsing Occupations - the user may select from a list of 500 occupations, select titles from a list and see a display description of the occupations work setting and tasks.

4. Reviewing Interests and Strengths - this module can be John Holland's Self Directed Search or ACT's Career Planning Program administered on-line. These instruments are self-reports of user's career-related interests, experiences, and competencies.

5. Making a List of Occupations to Explore - this module provides the user with five

alternate ways to make a list of personal vocational options, a) by relationship of occupations to personal work values, b) by use of the results of the Self Directed Search or the Career Planning Program, c) by selecting titles from a list of occupations by the terminal, d) by combining selected occupational characteristics (such as salary level, place of work, level of training, degree of independence, etc.) and/or e) by relating favorite school subjects to occupations.

6. Getting Information About Occupations - this module allows the user to get extensive information about the occupations on his/her list and leave the section with a list of them in which he/she has serious interest.

7. Narrowing A List of Occupations - the narrowing is assisted by the capability to 1) ask for additional information about any occupation on the list, 2) compare information about two occupations, and 3) analyze the remaining occupations in light of identified work values, desired level of training, and interests and competencies. Finally, the

user leaves the module with a list in priority order.

8. Exploring Specific Career Plans - the user enters this module with a specific occupation in mind. The system identifies possible paths. Choices include information about local jobs, financial aid, apprenticeships, four year college information and search, community colleges (answers questions and provides search capability), technical and special schools, continuing education, and military information and search capability.

This exciting program has been used at the Coast Community College District, but has temporarily been discontinued due to Proposition 13 cutbacks. Bob Schaulis, Director of Information Services at Coast, hopes to see the program reinstated in the future.

Other Guidance systems are available, but this is the most appealing as it contains the values clarification process as a "front end."

COMPARISON OF DISCOVER WITH OTHER COMPUTER-BASED GUIDANCE SYSTEMS

	DISCOVER	Guidance Information System GIS	System for Interactive Guidance Info SIGI
Conceptual Purpose	A systematic guidance program to assist all students with career development tasks (including sophisticated file searches)	A set of sophisticated file searches	A systematic approach to helping a student to identify personal work values and to find occupations which meet those values
Equipment Used	IBM 370 computer; 3270 cathode ray tube terminals with light pens	Hewlett-Packard 2000 C computer; typewriter terminals	DEC PDP 11/45 with Delta cathode ray tube terminals
Target Population	Present version, grades 7 - 12; future version for college level and adults	Secondary level, probably grades 9 - 12	Community college level
Content	GUIDANCE: 21 modules of material as follows: A. Entry module B. Understanding My Values C. Playing a Values Game D. Learning to Make Decisions E. Practice Career Decisions F. Learning How Occupations Can Be Grouped G. Reviewing My Interests and Strengths H. Making a List of Occupations to Explore I. Getting Information about Occupations J. Narrowing My List of Occupations	A. College selection and information B. Occupational selection and information C. Technical-specialized school selection and information D. Financial aids selection and information	A. Values-definition of ten work values; gaming to place values in conflict; personal weighting of values B. Information-identification of occupations which meet student's self-assessed values; collection of information about occupational alternatives and comparison C. Prediction-assistance in predicting success in community college curricula related to occupational choices D. Planning-making of a plan for reaching related occupational goal

*This analysis was done prior to availability of college version and it becoming an (IUP) Installed User Program from IBM.

	DISCOVER	GIS	SIGI
Content Continued	K. Exploring Specific Career Plans L. Local Jobs M. Financial Aid N. Apprenticeships O. Four-year College Information and Search P. Community and Junior Colleges Q. Graduate and Professional Schools R. Technical & Specialized Schools S. Continuing Education T. Military COUNSELOR- and ADMINISTRATIVE SUPPORT FUNCTIONS A. Student scheduling and schedule changing B. Building, updating, and recall of student records C. Limited search through student records D. Recall of all DISCOVER data bases FRAMEBUILDER; an easy author language		
Method of Use	Direct student use with recommended supportive group and individual guidance activities.	Often used by counselor on behalf of students; may be used directly by students.	Direct use by students

	DISCOVER	GIS	SIGI
Estimated Terminal Hours of Material	20 to 25 hours	4 to 5 hours	4 to 5 hours
Data Files and Guidance Materials Used	A. Occupational data file of 500 occupational descriptions, prepared by ACT B. Four-year and two-year college data file (approximately 2500 schools total) prepared by ACT C. National technical & specialized school data file of 11,000 schools prepared by USOE D. Inclusion of Holland's Self-Directed Search and ACT's Career Planning Program E. Use of Holland's classification system F. Use of Super's Career Decision Tree G. Use of a short form of ACT's financial needs assessment H. Use of an instrument to measure vocational maturity I. Use of work values developed at Educational Testing Service	A. National two and four-year college file with more than 2300 colleges, prepared and maintained by TimeShare B. Thousands of occupational descriptions, retrievable by DOT-like characteristics C. National scholarship and financial aid file	A. Ten occupational values designed and researched by SIGI team B. File of approximately 2000 occupations with their associated values developed by the SIGI team
Estimated Per Hour Cost for Student Use	Unknown at this time	Approximately $3.00 per hour	Yes, to a high degree

	DISCOVER	GIS	SIGI
Support Available for User	Maximum support from a not-for-profit corporation, DISCOVER Foundation, Inc.	Maximum support from Time-Share Corporation	Maximum support from Educational Testing Service
Cost for System	$7,875 annual lease which includes program, text, and data file maintenance	$9,000 annual lease which includes program, text, and data file maintenance	$9,000 to $13,000 per year software lease, depending upon enrollment community college, hardware purchase
Use of Student Data and Monitoring	Yes, to a high degree	No	Yes, to a high degree

VI. CONCLUSIONS AND RECOMMENDATIONS

The need for better delivery systems in the educational process is recognized by almost all. As is evidenced by cognitive mapping definitions, some students learn better by different modes than others. We in education have always acknowledged that there are individual differences, yet we continue to promote the traditional modes of delivery predominately.

We have thousands of students that come to Mt. Sac and they experience varying levels of "success." Many students drop out (thousands) partly due to their perceived personal failure.

CAI will not solve all these problems, but I am convinced that there are students that we currently lost that could be retained and "saved." The debate is still on as to how many of these would fall into this category.

If "mapping" or other techniques were used to identify the students that could benefit from other than the traditional and some other modes are provided, I believe we could experience significant success.

We have already identified the problem and are providing learning assistance services. We have an excellent learning resources environment. But, we can improve by providing some additional computer assisted support.

We have read the 5 Year Plan for the California Community Colleges and know that mastery learning is a goal well recognized. We have talked about the need for students to have increased self knowledge, to have personalized programs, to be able to pace themselves, to receive positive feedback and reinforcement, to have increased essential skills, etc., etc.

If we are to be a "center of learning" instead of just an "agency of instruction," we must put our commitments together toward this goal.

I believe that we want the opportunity to improve our success record. I believe that we have the people to make it happen. There is a set of faculty members that are enthused, capable and willing to work toward these goals.

The structure for this is not currently in existence but can be through the combined recommendations of the Computer Services Advisory Committee, Committee on Instructional Methods and appropriate faculty committees from the Faculty Senate and Association.

With the supportive leadership from Administrative Council members and the Board of Trustees, Mt. Sac can have Computer Assisted Instruction in its future.

SPECIFIC RECOMMENDATIONS

-- Administrative Council consider the creation of a Coordinator of CAL position (Computer Assisted Learning) and submit to Board of Trustees

-- The Coordinator of CAL works with the Manager of Computer Services and Director of Learning Resource to create a plan for CAI utilization for the future.

-- The Coordinator of CAL works with faculty members on a continuing basis for implementation.

-- The Coordinator of CAL explores funding possibilities with Assistant Dean Research and Grants (also evaluation and follow up studies)

It is further recommended that this occur in the very near future because extensive planning and lead time are required. (This can be a reassigned time assignment for a faculty member to begin with, but will rapidly become a full time assignment if the District decides to pursue a serious commitment to the area after the evaluation phase.

IN CONCLUSION

The success of a project utilizing computer technology for learning is dependent upon a combined commitment of Board of Trustees, Administration and Faculty.

Reinvention of the wheel is not necessary as is evidenced by documented successes in this arena. Creativity, however, is necessary as each site of implementation is unique. Dedication is also a requisite. Commitment to provision of resources is also a requisite.

All of these factors potentially exist at Mt. San Antonio College. We can make the difference.

PARTIAL GLOSSARY OF TERMS

BASIC - An algebra-like language used for problem solving by scientists, engineers and other non-professional programmers.

CAI - Computer Assisted Instruction

CAL - Computer Assisted Learning

Cognitive Style Mapping or Cognitive Mapping - Refers to the process of determining how an individual learns i.e. what modes of learning are the most likely to be successful for an individual.

COMSKL - An English Communication Skills Installed User Program used in a CAI environment (used at Fox Valley Technical Institute).

CRT - Cathode Ray Tube, a television-like terminal generally with a keyboard similar to a typewriter.

DISCOVER - A software system used as a guidance information system (originally developed by DISCOVER Institute)

GPSS - General Purpose Simulator System, a software package used to facilitate simulations of the real world.

hardware - The physical equipment of computers, etc. e.g. central processing unit, tape drive, disk drive, etc. Contrast with software.

IDMS - A data base management system provided by Cullinane Corp. (software).

IIS - Interactive Instructional System (a software package)

IPI - Individually Prescribed Instruction

IUP - Installed User Program, a customer developed software package, marketed by IBM

LCS - Large Capacity Storage, a larger, slower computer memory that costs less per unit of information stored.

meg - short for megabyte, a million bytes of computer storage (memory)

SAS - Statistical Analysis System, a software package used for statistical analysis.

software - computer programs, i.e. sets of instructions for a computer generally created by "programmers." Contrast with hardware.

terminal - a hardware device usually equipped with a keyboard (typewriter like) capable of sending and receiving information to and from a computer. (May have printed output or a TV-like CRT display.)

timesharing - a method using a computer system that allows a number of users to execute (perform) programs concurrently.

APPENDIX

(WORKSHOP HANDOUT, UNIVERSITY OF AKRON 1977)

A GUIDE TO COMPUTER-BASED INSTRUCTION IMPLEMENTATION

1. Determine whether your institution has an instruction-related problem which:
   - A. Is worth solving
   - B. Can be addressed through individualized or independent study.
   - C. Could be addressed through the saving of or the redistributing of study time.
   - D. Could be improved by making education more accessible.
   - E. Relates to "OPEN ENROLLMENT" or memorization
2. Determine whether your institution is willing to support an initial add-on cost which will:
   - A. Improve selected student performance.
   - B. Increase access to instruction.
   - C. Economically distribute instruction time.
   - D. Conserve human instructional resources.
3. Develop an awareness of the potential role of computers in the instructional process for:
   - A. Faculty

B. Administrators

C. Computer Center Management

D. Financial Supporters

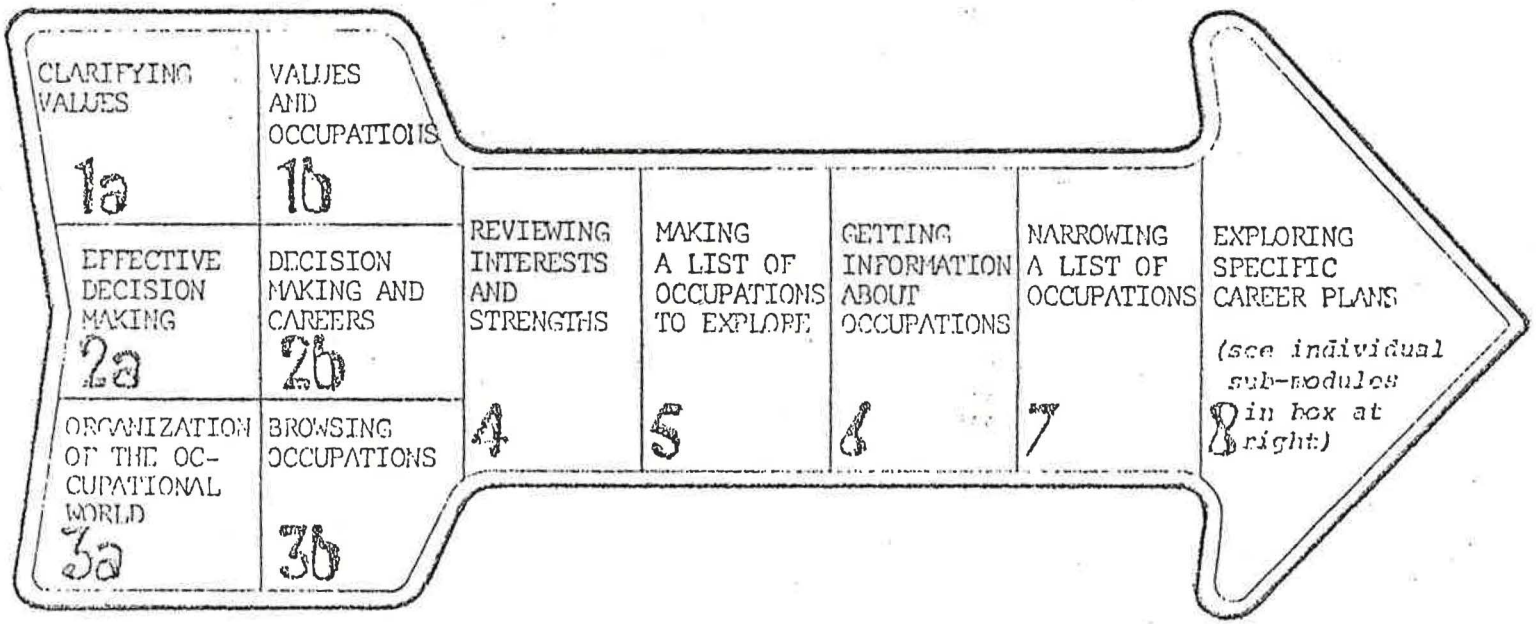
E. Students/Employees

4. Assign a responsible and well-accepted staff member to coordinate computer-based instructional interests, developments and implementation plans.
5. Have administration take a positive and well-publicized position on the role the computer will play in problem resolution.
6. Develop a faculty incentive plan for participation in any implementation program.
7. Determine the minimal hardware/software resources required for launching a partial solution and acquire these.
8. Acquire materials of instruction through:

   A. Vendor

   B. Other user organizations

   C. An internal development program
9. Go to extremes to assure reliability and availability.
10. Develop an internal marketing team.
11. Start small and develop a positive attitude.
12. Incrementally modify your education system to take full advantage of the instructional technology introduced.



MODULE 8 SUB-MODULES

- Local Jobs
- Financial Aid
- Apprenticeships
- Four-Year College Information and Search
- Community and Junior Colleges
- Graduate and Professional Schools
- Technical and Specialized Schools
- Continuing Education
- Military Information and Search
- Mid-career Job Changes
- Two and Four Year College Transfer and Articulation

The College-Level DISCOVER System

figure 1