

## DOCUMENT RESUME

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**INSTITUTION** Association for the Development of Computer-based Instructional Systems.

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**DESCRIPTORS** \*Computer Assisted Instruction; Computer Graphics; \*Computer Oriented Programs; \*Computer Programs; \*Computers; Conference Reports; Cost Effectiveness; Higher Education; Information Networks

**IDENTIFIERS** CAI; CAI Authoring; Catalog Instruct Resource Computer Utiliz Teaching; CIRCUIT; Minicomputers

**ABSTRACT**

Abstracts of 23 papers given at the conference are presented. These deal with a variety of subjects related to educational uses of computers, including: 1) information networking, 2) computer-managed test item banks, 3) learner-controlled instruction and courseware, 4) computer-assisted instructional (CAI) systems such as Coursewriter III and PLATO, 5) CAI programs in different content areas, 6) CAI authoring, 7) cost-effectiveness and cost analysis of CAI, 8) computer graphics, and 9) minicomputers. Information on the Catalog of Instructional Resources for Computer Utilization in Teaching (CIRCUIT) is provided and minutes of the business meeting, a roster of persons attending, a financial statement of the Association for the Development of Computer-Based Instructional Systems (ADCIS) and a resolution of the Association supporting the leadership of the National Library of Medicine's efforts to implement CAI are appended. (PB)

U.S. DEPARTMENT OF HEALTH,  
EDUCATION & WELFARE  
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MINUTES AND PROCEEDINGS  
OF THE  
SEMI-ANNUAL MEETING  
OF THE  
ASSOCIATION FOR DEVELOPMENT  
OF  
INSTRUCTIONAL SYSTEMS  
(ADCIS)

HELD AT  
THE SCHOOL OF DENTISTRY  
UNIVERSITY OF MICHIGAN  
ANN ARBOR, MICHIGAN

AUGUST 7-9, 1973

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SECRETARY-TREASURER: PETER DEAN  
CONFERENCE SECRETARY: CATHERINE MORGAN  
GENERAL PROGRAM CHAIRMAN AND HOST: WILLIAM FITZGERALD

000 050

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## AGENDA

MONDAY, AUGUST 6 EVENING

7:00 - 9:00 Registration

TUESDAY, AUGUST 7

8:00 - 9:30 Registration

9:30 - 10:15 Call to Order  
--William F. FitzgeraldWelcome from the University of Michigan  
--Allan Smith, Vice-President for Academic AffairsWelcome from the School of Dentistry  
--William R. Mann, DeanPresidential Address  
--G. Ronald Christopher, President, Association for  
the Development of Computer-based Instructional SystemsAnnouncements  
--William F. Fitzgerald10:15 - 10:45 ACTIVITIES SUMMARIES  
--Ruann Pengov, ModeratorUniversity of Kentucky College of Dentistry  
--Timothy Smith & Harriet DobbinsUniversity of Florida College of Dentistry  
--Art KingUniversity of Florida College of Medicine  
--C. B. StevensUniversity of Arizona  
--Lotus KniefUniversity of Kansas Medical Center  
--James DeNioUniversity of California Medical Center  
--Martin Kamp

U. S. Army Signal Center  
--Frank Guinti

Joint Council on Educational Tele Communications  
--Robert M. Walp

Ohio State University College of Pharmacy  
--Dan Krautheim

Brigham Young University  
--C. Victor Bunderson

10:45 - 11:10

Coffee

11:10 - 11:50

Public Domain as seen by NSF  
--Jesse E. Laskin

11:50 - 12:10

PAPER SYNOPSES  
--Dr. Peter Dean, Moderator

Jinnet F. Lewis, Lister Hill Center, National  
Library of Medicine

Herbert S. Diamond, Charles Plotz & Max Weiner,  
State University of New York, Downstate Medical Center

Dewey Slough, Naval Personnel & Training Research  
Laboratory

Joan Hayes, Western Washington State College

12:10 - 12:35

ACTIVITIES SUMMARIES  
--Ruann Pengov, Moderator

Ohio State University (Administrative Science)  
--Thomas Kemper

Montgomery County Public Schools  
--William Richardson

Massachusetts General Hospital  
--Barbara Farquahar

Western Washington State College  
--Joan Hayes

Ohio State University, College of Medicine  
--Ruann Pengov

University of Michigan  
--William Fitzgerald

12:35 - 2:00

Lunch

2:00 - 3:30

## CONCURRENT SESSIONS

Health Sciences Interest Group

--William Harless, Chairman

A computer-managed test item bank for GRIPE

--Donald H. McClain, Thomas H. Kent & Stephen  
W. Wessels - University of IowaPanel: The Use of Computers in Elementary, Secondary,  
Vocational and Two-Year Colleges

--Jimmer Leonard, Moderator

Rebecca Willis, SECOS, Ronald Cody, Educational  
Information Services, Catherine Morgan, Montgomery  
County Public Schools - Participants.

3:30 - 3:40

Coffee

3:40 - 5:10

## INVITED ADDRESSES

--G. Ronald Christopher, presiding

Learner-controlled Courseware on the TICCIT System

--C. Victor Bunderson, Brigham Young University

Coursewriter III: A Successful Instructional  
Delivery Tool

--Harvey S. Long, IBM

CAI and PLATO IV

--Jim Perry, University of Illinois

Discussion

5:10 - 6:30

DEMONSTRATIONS - The CAIDENT Center

DIGILOG Corporation - Roy Gremberling

Ohio State University - Sandy Sweitzer

University of Michigan - Alan Kessler

Bell Telephone Company

University of California at San Francisco Medical  
Center - Martin Kamp

University of Michigan - Karl Zinn

IBM - Stan Zimmer

Hewlett-Packard - John Price

University of Michigan - Jud Spencer

Ohio State University - Lillian Connelly

University of Illinois - Jim Perry

Ann Arbor Terminals - Burt Johnston

WEDNESDAY, AUGUST 8

9:00 - 10:00

CONCURRENT SESSIONS

Health Sciences Interest Group

--William Harless, Chairman

Project Proposal to Committee on Recertification

--William Harless, University of the Pacific

General Papers

--Peter Dean, presiding

Three Years with Computer-assisted Instruction -

An Evaluation of the Agricultural Economics Experience

--John T. Winnery and David Hahn, Ohio State University

CAI - Computer Assistance for Individuals?

--Thomas M. Kemper, Ohio State University

Individualized Spelling

--Lydia Bubba, Red Deer College (Canada)

10:00 - 10:15

Coffee

10:15 - 12:00

JUSTIFICATION OF CAI/CMI

--Catherine Morgan, presiding

An Analysis of Development/ Use Time Ratios for a  
Computer Assisted Instruction Unit on Basic Household  
Electricity

--Frances Gailey, Ohio State University

A Mathematical Model for Project Planning and Cost  
Analysis in Computer Assisted Instruction

--William F. Fitzgerald, University of Michigan

Cost Savings Through CAI

--John Heavey, United Airlines

CMI Effectiveness and Cost Savings in Geometry

--William Richardson and Catherine Morgan, Montgomery  
County Public Schools

- 12:00 - 12:30 "Computer Based Instruction: Old Myths and New Realities"  
--Dr. Andrew Molnar, Program Director, Computer Oriented Curricular Activities, National Science Foundation
- 12:30 - 2:00 Lunch (Note: Feather Group Organizational Meetings)
- 2:00 - 2:45 IMPLEMENTATION OF CAI/CMI  
--Michael Allen, presiding
- Controlled Imagery and Directed Fantasy--Interactive Computer Graphics in Education  
--Thomas A. DeFanti, University of Illinois
- Organizational Issues
- 2:45 - 3:00 Coffee Break and Informal Discussion
- 3:00 - 4:25 CONCURRENT SESSIONS - Implementation Group
- Coursewriter Extensions  
--Michael Allen, presiding
- Algebraic Manipulation Routines for the Coursewriter Language  
-- Ruann Pengov, Ohio State University
- The Enhancement of Interactive Computing for CAI Users through Development of a Multilingual Interpreter (or: Three in a Bed)  
--Joan Hayes, Western Washington State University
- CW III Enhancement  
--Stan Zimmer, IBM
- Discussion
- Natural Language Processing
- W. C. Brown Canadian Experience  
--National Research Council
- A High Level CAI Authoring System  
--Marvin Westrum, IBM (Canada)
- General Discussion
- Mini-Computers in CAI
- Educational Time-sharing on a Minicomputer  
--Charles S. Tidball & Bruce B. Bon, George Washington University Medical Center

A Cost-Effective Minicomputer CAI System  
 --E. E. Attala, California Polytechnic State  
 University

General Discussion

- 4:25 - 4:40 Implementation General Assembly
- 4:40 --6:15 General Meeting: Report of Investigating Sub-  
 committees; other concerns
- 8:30 - 10:00 Special Session; New Release Seminar "Student Response  
 Analysis Processor"  
 --Michael Allen, presiding

THURSDAY, AUGUST 9

- 8:30 - 9:15 Institutional Representative Meeting for Voting
- 9:15 - 9:30 General Meeting - Report to Membership
- 9:30 - 11:15 General Papers  
 --Robert Seidel, presiding
- Pedagogical Effectiveness of CAI Branching Methods  
 --Dewey A. Slough, Naval Personnel & Training Research  
 Laboratory
- Learner Control of Instruction Requirements and Potentials  
 --Fred O'Neal, Brigham Young University
- Towards Understanding the Value of Learner Controlled  
 Instructional Sequencing  
 --Robert J. Seidel, Human Resources Research Organization
- Generative CAI: Procedures and Prospects  
 --Betty Weneser, State University of New York at  
 Stony Brook
- 11:15 - 11:45 Coffee
- 11:45 - 12:30 Feather Groups and other meetings
- Topic, Location and Moderators to be posted on  
 bulletin board in coffee area.
- 12:30 - 2:00 Steering Committee Meeting
- Lunch

2:00 - 3:30

"Large-Scale Industrial CAI" - The IBM Field Instruction System

--R. E. Hallman, Manager, Engineering Systems Group,  
Field Engineering Division, International Business  
Machines Corporation

3:30

General Adjournment

ABSTRACTS submitted by presentors follow: Persons wishing further information on any report should contact the author,

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Joint Council on Educational Telecommunications

The National Space and Aeronautics Administration has developed a series of experimental satellites in a program to conduct scientific experiments and to promote the uses of space technology. NASA has invited proposals for investigations in information transfer or information networking via the Communications Technology Satellite it is developing in a joint effort with the Canadian Department of Communications.

The CTS, to be launched in late 1975, will enable broadband communications channels to be established between distant points through the use of small earth stations. Organizations submitting successful proposals for CTS experiments will be allocated time on the satellite according to a schedule mutually agreed upon by the various users and NASA.

The initial deadline for submitting proposals for use of the CTS has passed; NASA can still consider new experiments at this time, however. The Joint Council on Educational Telecommunications, under a contract to NASA, is available to assist interested parties develop their concepts in preparation for making a proposal. We can supply and interpret data on the technical characteristics of the satellite and help in specifying and estimating the cost of required ground equipment. Our background in this field should enable prospective experimenters to reduce their uncertainties and lighten their workload.

The Joint Council on Educational Telecommunications was organized in 1950 to plan and work for the nationwide development of educational television. It has become education's established instrument for dealing with policy and planning in telecommunications. The JCET includes over twenty national and regional non-profit educational organizations. Among its members are the American Council on Education, The American Library Association, The Indiana Higher Education Telecommunications System, the National Association of Educational Broadcasters, the National Educational Association, and the Public Broadcasting System.

A COMPUTER-MANAGED TEST ITEM BANK FOR GRIPE

Donald H. McClain, Ph.D.  
Thomas H. Kent, M.D.  
Stephen W. Wessels, M.S.  
University of Iowa

Faculty members from twelve academic institutions have formed a group called GRIPE, one purpose of which is to share test materials developed for Pathology

courses. Currently, the GRIPE item pool is comprised of approximately 3,000 questions plus descriptive and statistical information for each question derived from previous performance data. The GRIPE test items are classified according to major content areas (MCA) and topic descriptors (TP) within each MCA. To utilize GRIPE fully, a batch PL/1 computer program has been written to create and manage the item bank which is stored as a keyed indexed sequential, variable-length record data set. The computer program permits test questions to be added, deleted, updated, renamed, and listed. Items can be retrieved as follows:

- (1) all questions within an MCA;
- (2) all questions in a TP within a MCA; and
- (3) a specific question.

Employing the GRIPE item bank, faculty members can construct a test by designating specific questions or requesting the computer to randomly select a certain number of questions from a particular MCA. The computer program can generate either a reproducible copy of the selected questions for a paper-and-pencil test or the COURSEWRITER III code for interactive administration of the test.

### LEARNER-CONTROLLED COURSEWARE ON THE TICGIT SYSTEM

Dr. Victor Bunderson  
ICUE - Brigham Young University

The TICGIT Project (Time-shared, Interactive, Computer-Controlled Information Television) being developed jointly by the MITRE Corporation and Brigham Young University is now installed and operating at BYU with 30 terminals. The software for on-line authoring is being used to input more than six semesters of material in Mathematics and English Instruction for Junior Colleges.

The innovative concepts of learner-controlled courseware are illustrated by means of 35 mm. slides. These include the objectives and status display (MAP), the primary instruction logic of the learner-control command language, and the Advisor program.

The modularity of design for learner-controlled courseware permits differentiated staffing for the production of large volumes of quality material. The production procedures for learner-controlled courseware involving roles of different team members were briefly described.

### COURSEWRITER III: A SUCCESSFUL INSTRUCTIONAL DELIVERY TOOL

Dr. H.S. Long  
G.S. Zimmer  
IBM Corporation

The most extensively used and commercially available instructional system will be discussed. The Coursewriter III System, an IBM Program Product, is a time-sharing system with instructional delivery and development capabilities. The Coursewriter III System, implemented on most 360/370 hardware which supports typewriter and visual display terminals, is presently being used by many universities, schools, and industry sites as an instructional delivery tool.

With a substantial set of Coursewriter curriculum in existence, the system presents an efficient means of moving into productive CAI/GMI activities. The CW System has been actively used since 1965. Function, user references, and system extensions will be the concern of the presentation.

### CAI AND PLATO IV

Donald L. Bitzer  
University of Illinois

In over ten years of growth, the PLATO system has demonstrated the effectiveness of on-line dialogues in the direct educational process. It also has stimulated the development of innovative software and hardware, including the plasma display panel. The system will be discussed and demonstrated, on line, with examples drawn from physics, chemistry, biology, reading, languages, mathematics, and others.

### PROJECT PROPOSAL TO COMMITTEE ON RECERTIFICATION AMERICAN BOARD OF INTERNAL MEDICINE

William F. Harless, Ph.D.  
Pacific Medical Center

Among educational theorists there is widespread agreement that a continuing education effort can be effective for and accepted by a medical practitioner only if it is relevant to his everyday experiences. The dilemma of continuing medical education is: (1) how to establish evaluation procedures which determine the specific educational needs of a practitioner and (2) how to design relevant educational experiences around those needs.

It is proposed that 40 to 50 practicing physicians will be selected in the Bay Area to participate in the study. A survey of the practice of each will be performed by analyzing and categorizing the patients seen by the practitioner. The practice of the physician will, therefore, be described in terms of his patients and their collective predominant characteristics (practice profile). The existing CASE library of the University of Illinois system will be perused for CASE's which satisfy the sample criteria and, in fact, simulate the practice. For those not found, new CASE's will be created using the medical expertise of physicians in the Bay Area and the GENESYS system of the University of Illinois via the terminals located in San Francisco tied to the Lister Hill Biomedical Communications Network.

During some specified time period the physician will use a terminal to interact with those patients which were created to simulate his practice. The scores from the CASE experience will be correlated to those from the quality care assessment to validate the CASE experience. The feedback from the CASE experience will then be used jointly by consultants from Pacific Medical Center and physicians involved to identify deficiency areas and develop an educational prescription that will help him deal with the deficiencies.

The purpose of this proposal is, therefore, to conduct a pilot study which utilizes an existing technological development to establish a continuing education-evaluation model which focuses on the real health care delivery situation of the physician and the needs therein. The study will investigate ways to direct effort towards sharing the diagnosis of educational deficiency and the development of a prescription for the learner--one which he can use to find appropriate resources for educational therapy. In effect, a partnership will be established between practitioner and educator in the pursuit of relevant continuing education and identification of a valid recertification model.

THREE YEARS WITH COMPUTER-ASSISTED INSTRUCTION -  
AN EVALUATION OF THE AGRICULTURAL ECONOMICS EXPERIENCE

John T. Whinnery  
Ohio State University

Computer-Assisted Instruction has been used as part of the teaching of Introductory Principles of Production Economics at Ohio State University since the Spring of 1971.

Two professors in the Department of Agricultural Economics began in 1969 to investigate CAI as new teaching technique to supplement their classroom presentations. They spent one year structuring their course outlines to learn which sequencing of topics, manner of presentation, and methods of evaluation seemed to be most successful in terms of student response and performance.

Joint evaluation and comparison led them to develop an outline of subject-matter that satisfactorily covered the most important course concepts. A graduate assistant in the department was then assigned to refine and format the concepts in this outline.

Concern for attitudes of students led to a study in 1971 of student acceptance of this CAI program. The prime objective was to determine the extent to which students accepted this teaching assist. The study revealed that the CAI program was well received.

A feature of the Coursewriter III language allowed recovery of student's unanticipated responses. These, plus continual evaluation of student comments, led to reworking the program to make it more understandable and relevant. Another graduate assistant with extensive communications experience rewrote most of the text in a lighter style, condensing longer text passages and avoiding a "textbook" approach to economic concepts. This led to many favorable comments from student users.

While informal evaluation has been a continuing process, it was deemed desirable to investigate objectively the performance of students using Computer-Assisted Instruction to supplement regular classroom presentations. To this end, during Spring Quarter of 1973, a study was conducted wherein two experienced instructors each taught one section of students utilizing computer-assisted instruction and one control section on non-CAI students. Student performance was evaluated based upon test scores.

Preliminary findings indicate a significant difference in performance did exist between the sections. The groups utilizing Computer-Assisted Instruction rated higher on test scores than did the control groups.

Complete methodology and results of the study will be presented.

### CAI - COMPUTER ASSISTANCE FOR INDIVIDUALS

Thomas M. Kemper  
Ohio State University

QBOL, a Quick course in COBOL, is written in IBM Coursewriter III for use on an IBM 370 system. QBOL was designed for graduate students with knowledge of basic programming concepts and in Business Administrative Programs. A Pre-test is given to determine that the student has the proper level of knowledge.

Two additional programs are utilized in QBOL--IBM's Time Sharing Option (TSO) and Waterloo COBOL (WATBOL) developed at the University of Waterloo, Waterloo, Ontario, Canada.

The WATBOL compiler provides for faster turnaround runtime diagnostics, and permits minor format errors to pass. Using WATBOL's option for selectively suppressing source listings, the author is able to "hide" statements which have not been covered in the course. The student, therefore, is able to write program segments and then compile these segments in a complete program environment.

TSO allows the student to input source statements directly to the computer. Thus the tedious and time consuming jobs of keypunching a deck of cards and submitting those cards for compilation are eliminated. TSO also provides the ability for the author to control the environment in which the individual student is running.

The CAI portion of QBOL is in three parts--main stem, debug, and advanced concepts. The main stem includes DIVISION definitions and DIVISION requirements, basic variable definitions, and Sequential I/O statements, arithmetic statements, transfer statements. The debug module includes additional error descriptions based on other students' problems. Advanced concepts include table setup and table processing, and sort statements.

A student will be able to compile and run programs after 2 half-hour segments. The main stem will include approximately 10 half-hour segments. Advanced concepts are optional to the student and will be 3-6 half-hour segments.

Thru the combination of CAI, WATBOL, and TSO, the student no longer has to wait '3 weeks' before he is presented sufficient material necessary for a complete COBOL program. In QBOL the student gets not only Computer Assisted Instruction, but he also receives Computer Assistance for the Individual.

AN ANALYSES OF DEVELOPMENT/USE TIME RATIOS  
FOR A COMPUTER ASSISTED INSTRUCTION UNIT  
ON BASIC HOUSEHOLD ELECTRICITY

Francis Gailey  
 Ohio State University

A computer Assisted Instruction project has recently been completed which required two distinct but related activities. First, a four module unit in basic household electricity was designed, used, and evaluated. Second, during the activity described above, the author collected data through which she could ascertain time ratios involved between a/ author hours vs. student on-line hours, b/ author and support personnel hours vs. student on-line hours, and c/ time ratio relationship between author/support personnel hours and the mode of instruction.

Three of the four modules in the unit are tutorial while one module is in the simulation mode. Students' average time to complete the unit is  $3\frac{1}{2}$  hours. Approximately 110 students have used the program.

This study was undertaken to provide data relative to the development time vs. student use time ratios which, although often expressed in the CAI literature, are seldom substantiated through controlled research.

In the process a satisfactory unit on basic household electricity was developed and some valuable data acquired.

Complete results will be reported.

A MATHEMATICAL MODEL FOR PROJECT PLANNING AND  
COST ANALYSIS IN COMPUTER ASSISTED INSTRUCTION

William F. Fitzgerald, Ph.D.  
 University of Michigan

A mathematical model has been developed to provide 1) a framework within which project planning parameters may be manipulated to identify effects on other variables when one variable is changed, and 2) a method of quantifying various aspects of a computer instructional environment to identify overt and hidden costs. The rationale and development of the model are presented and sample calculations and their interpretation are presented.

This method is an initial version of a model being developed and tested in the CAIDENT Project in the School of Dentistry at the University of Michigan.

The presentation of the model is preceded by a discussion of the advantages and pitfalls of quantifying aspects of this environment.

## COST SAVINGS THROUGH CAI

John Heavey  
United Airlines

Industrial training is not only imperative, but must be accomplished as effectively and inexpensively as possible. A comparative study has recently been completed wherein a self-contained CAI instructional program was compared to a traditional training approach.

In each course, objectives were specified, mastery criterion established, and students were required to demonstrate mastery through use of computer terminals. Although these common elements existed, the course content was different.

The objectives of this study were to determine the feasibility of CAI and to analyze the cost ramifications. The feasibility dimension was positively established since over 1500 students each used an average of 10 hours of on-line computer time and reached the specified objectives.

The cost dimension comparison between the 'traditional training' approach and CAI dramatically revealed the superiority of the CAI approach, i.e., considerable cost savings. There was a decrease in cost favoring CAI of over 80%. Actual dollar savings reached \$128,572. Although not included in this figure, two other factors, if considered would reveal another \$91,000 saved by the CAI approach.

The factors considered, the nature of the materials, and some other benefits to our training effort will be explained.

## CMI EFFECTIVENESS AND COST SAVINGS IN GEOMETRY

William M. Richardson  
Catherine E. Morgan  
Montgomery County Public Schools

During the summer of 1968, Montgomery County, Maryland, mathematics teachers began developing behavioral objectives, hierarchies, and criterion test questions and gathering reference materials for a projected ten-unit geometry course. The course was pilot tested and revisions were made during the two subsequent school years and summers. Originally, the intention was to individualize this course for all students, but the paperwork and logistics of classroom management made individualization impractical.

In the spring of 1969, the CAI Program began adapting this course into a computer-managed instructional mode in which the assessment tasks, diagnostic elements and prescriptive ingredients were examined, revised, and coded for use on the IBM 1500 Instructional System. Instruction is provided off-line with diagnostic assessment and unit tests occurring at the computer terminals.

The findings of a year-long study showed that despite the 40% greater class size, the achievement of the 67 students in two individualized CMI classes was not significantly different from the achievement of 70 students in three regular classes. The advantages of a program which provides for individual differences are obvious. In addition, in this particular learning situation, the costs are offset by larger class sizes.

COMPUTER-BASED INSTRUCTION:  
OLD MYTHS AND NEW REALITIES

Dr. Andrew R. Molnar  
National Science Foundation

During the last decade, academic computing has grown at such a phenomenal rate that all major universities and most colleges now provide computing services. In that time, yearly expenditures have increased tenfold, from 50 million dollars in 1963 to over 540 million in 1972. One-third of that yearly amount is currently spent on computing for instructional purposes. Similarly, the quantity of computer-based curricula has grown from less than 100 packages prior to 1965 to an estimated 6,000 packages in 1972--an increase by a factor of 60. While great strides have been made in instructional technology and new concepts have evolved in both science and education which take advantage of the computer, many myths, formed in the early 60's, still persist and hamper development. New realities demand new approaches to the organization and development of computer-based instruction if it is to raise above the status of an expensive cottage industry.

CONTROLLED IMAGERY AND DIRECTED FANTASY--  
INTERACTIVE COMPUTER GRAPHICS IN EDUCATION

Thomas A. DeFanti  
University of Illinois

As the result of recent work at the Ohio State University, the production of animated educational film by computer has become not only possible but practical. The tedious manipulations of traditional animation equipment are now handled electronically to the degree that the standard problems of controlling images are largely solved. In other words, once the instructor, filmmaker or artist inputs an object outline, its metamorphoses and motions and conversions to half-tone solids are done by computer--generally in real-time.

To provide this capability and minimize the many problems inherent in computer graphics, a special programming language was developed to aid the user in describing and using his animation sequences. A major contribution of this language to computer graphics (and computer science) is its tactile orientation--that is, sensitivity to devices like dials, joysticks, data tablets and buttons. As a result, significant film can be made quickly without resorting to user-specified algorithms or equations, if desired. All the motions can derive from tactile interactions.

The design principles of this system may be of great use to other systems using interactive graphics. Accordingly, the discussion will take on the orientation of integrating computer graphics and CAI/CMI.

A 16mm film will visually portray results.

ALGEBRAIC MANIPULATION ROUTINES FOR  
THE COURSEWRITER LANGUAGE

Ruann E. Pengov, M.S.  
Ohio State University

Since its inception, the COURSEWRITER Language has been totally inadequate in providing mathematical capabilities to students and to authors. To meet this difficulty, the Ohio State University College of Medicine, over the past few years, has developed a series of functions which:

1. Give students limited access to the mathematical capabilities of the computer within a CAI course ('calc' routine).
2. Give authors the ability to handle algebraic computations using variable and numeric values with up to 15 significant digits and seven decimal places (functions "set", "unset", and "setret").

The effects of these developments have been most significant at the Ohio State University College of Medicine. With them, courses involving maintenance of variables, evaluation of algebraic expressions, testing of values, and acceptance of variable expressions as valid student input have all become possible. Furthermore, traditional COURSEWRITER analysis of student inputs has become simpler and much more accurate in cases where numeric and/or algebraic expressions are anticipated as responses. No longer is it necessary for the author to anticipate a numeric response (i.e. 100) and all of its algebraically equivalent responses (100.0, 100., 1000/100, etc.). Via the 'fn set' he can accept any answer algebraically 'equal to' 100. Alternatively, he can accept any response within a given range of a value (i.e.  $100 \pm 10$  etc.).

Similarly, if the author wishes to accept an algebraic expression involving variables as input, (i.e.,  $x-x+100$ ), he may do so, evaluate the expression, and compare it with the numeric value(s) he is expecting.

The student access to the mathematical routines is a bit more limited than the author access. To the student taking a course, the 'calc' capability is a very fast calculator complete with trigonometric functions, which can be readily accessed when needed.

THE ENHANCEMENT OF INTERACTIVE COMPUTING FOR CAI USERS  
THROUGH DEVELOPMENT OF A MULTILINGUAL INTERPRETER  
(OR: THREE IN A BED)

Joan Hayes  
Larry Kheriaty  
Western Washington State College

A MULTILINGUAL INTERPRETER has been developed at Western Washington State College which satisfies the needs of three types of users interested in interactive computing: student programmers, production users, and CAI authors. The

multilingual interpreter makes it possible to run PL/I BASIC, and COURSEWRITER III on a single terminal system in 84 K of a 360/40. The configuration of the language processor is such that programs can be prepared in more than one source language. The main purpose of this development is to enhance the system for CAI programmers who requested advanced programming capabilities and for CAI users who requested curriculum available in BASIC.

The paper describes features of the system from the user's point of view:

1. Text-presentation, answer-processing and automatic sequencing which free authors from programming concerns.
2. Ease of programming of functions.
3. Execution-efficient capabilities for computation and string-manipulation within a course unit.
4. Compatability with previously written COURSEWRITER III and BASIC programs.
5. User control over supervisory functions through standard utility programs.
6. Availability of scratch pad of student-designated variables, arrays, or strings.

The system has been running successfully with the inclusion of BASIC since March, 1973.

#### A HIGH LEVEL CAI AUTHORIZING SYSTEM

Marvin Westrum  
IBM Canada

Dissatisfaction with the assembler-like appearance, and other short-comings of currently available authoring languages has led to the specification of a high level syntax for a CAI authoring system. The system (or language) features the following:

1. Natural language syntax structure.
2. Separation of course structure from content.
3. Free-format data entry.
4. Replaceable keywords and commands.

The first feature makes it easy to learn and provides a high degree of self-documentation. The second--Separating course structure from course content--means that the two components of the teaching process, namely strategy and content, can be treated separately. Since the same strategy can be used with a

variety of different materials, substantial savings in coding effort can be realized. The third feature--Free-format data entry--also saves coding time and restrictions, while the fourth feature--Replaceable keywords--permits an author to "tailor" the syntax to his own preferences and needs, e.g., substitute French or Spanish keywords, or use abbreviations of the original English keywords.

Other features will be discussed and related to currently used languages. Also, the state of implementation and support will be discussed.

### EDUCATIONAL TIME-SHARING ON A MINICOMPUTER

Charles S. Tidball

Bruce B. Bon

George Washington University Medical Center

We have developed MTS-12, a Multi-language, Time-sharing System for the FDP-12, a popular laboratory computer manufactured by the Digital Equipment Corporation. This low-cost, core-resident, time-sharing system features program storage on LINCtape (3/4" magnetic tape on a 4" reel), access to the high-level, interpreted, language FOCAL, and special variable storage in the user buffer area which permits string handling as well as answer storage and other housekeeping functions. Although less convenient than special purpose CAI languages, FOCAL has a direct command capability which is easy for the student to learn and provides full mathematical support. No specific author mode is available but FOCAL is quite simple and can be used directly by faculty members without requiring programmer assistance. A powerful Modify command provides on-line program correction; file protection is available to control the use of this feature. With this system, sophisticated teaching programs can be presented to three simultaneous users in only 12K of 12 bit core. The system can be expanded to more users but is especially suited for small-scale use with the mainframe unattended, on evenings and weekends when the FDP-12 might ordinarily not be in use.

### A COST EFFECTIVE MINICOMPUTER CAI SYSTEM

E. E. Attala

California Polytechnic State University

As CAI matures new systems must be designed to achieve the goals of CAI at a cost comparable to Traditionally-Administered Instruction (TAI). Cost effectiveness becomes more and more the guidelines in developing the software and hardware of a successful system. Reliability, flexibility and adaptability are also factors to be considered when designed a CAI System.

With the above guidelines in my mind, I designed a CAI System using a NOVA minicomputer and other learning resources such as slide projectors and cassette tape recorders. The system is reliable and flexible enough to be easily integrated into the overall educational system wherever it is used.

The expenses of the NOVA System are:

1. NOVA 1220 with 12 K Core Memory	\$12,000
2. System Interface	2,000
3. Four Teletypes	5,000
4. Audio-Visual	<u>1,000</u>
TOTAL	\$20,000

As far as the software is concerned Data General (maker of the NOVA) offers time-sharing BASIC with string manipulation at no extra cost.

I would like to present at your conference the software and techniques we developed on that CAI Mini-computer System.

#### PEDAGOGICAL EFFECTIVENESS OF CAI BRANCHING METHODS

Dewey A. Slough

Naval Personnel and Training Research Laboratory

A variety of branching techniques were developed and experimentally evaluated as part of a four-year project in computer assisted instruction conducted by the Naval Personnel and Training Research Laboratory. These techniques included applications to remedial pretraining, initial instruction, remediation, drill and practice, and review. It was found that branched remedial pretraining on prerequisites produced marked increases in achievement in difficult subject matter areas while permitting minimum remediation time for knowledgeable students. Large reductions in training time were achieved by appropriate branching techniques applied during learning and during drill and practice. It was also shown that student control of bypassing of instruction was just as effective as program control of bypassing based on pretests. Some conditions for effective branching are discussed.

#### LEARNER CONTROL OF INSTRUCTION: REQUIREMENTS AND POTENTIALS

Fred O'Neal

Brigham Young University

Recent advances in technology promise the means for economically putting the learner in control of his education with instructional resources and interactive learning environments never before available. A body of empirical data is accumulating that indicates that individual learners, may benefit from different individual teaching and learning strategies. The task of education, that is to say its purpose or role in society, is changing as society changes. It becomes probable that the task of education in the coming years will be to help each learner to find and effectively use his own individual optimum learning strategy, and to provide him with the necessary opportunities and resources to use it.

This paper suggests a working taxonomy of Learner Control (LC) dimensions and outlines some requirements for their implementation. The state of the art and economics of implementation relative to these requirements are discussed. The paper concludes with a look at the implications of LC and suggests some important questions which must be answered.

TOWARDS UNDERSTANDING THE VALUE  
OF LEARNER CONTROLLED INSTRUCTIONAL SEQUENCING

Robert J. Seidel, Ph.D.  
Human Resources Research Organization

The key to optimal allocation of learner controls in the instructional decision process would seem to be for basic research in human learning to (a) identify those components of strategy selection and use, of which students are capable, (b) relate these components to individual characteristics, and (c) determine where program control can or cannot handle the same components. Finally, in an educational environment we could then arrive at a cost/effective justification for optimally allocating components of instructional decision making to student or program in an adaptive teaching system. The research to be reported on is directed towards answering some of these questions.

Eighty experimental subjects completed a version of HumRRO's COBOL course in which the amount and kind of learner control of instructional material sequencing was systematically varied. Four learner-control features were made available to students in varying combinations: three of them, REVIEW, RECAP, and QUIZ, control remedial activity and acceleration; the fourth, ROUTE, controls topic sequencing at specified points in the course.

Measures taken on each student comprise three types: entry characteristics, including aptitude and biographical data; learning strategies, including type and frequency of control usage and the circumstances under which they are used; and acquisition and other performance-related measures, including quiz scores, transit times, programming errors, and opinions of course topics.

Analyses were conducted to identify relationships between entry characteristics on the one hand and learner control features and performance measures on the other hand. Several multivariate techniques will be employed in this part of the effort. The descriptive findings from these analyses will be discussed in terms of their relevance to design of prescriptive models for instructional decision making.

GENERATIVE CAI: PROCEDURES AND PROSPECTS

David W. McMullen  
State University of New York

Generative CAI distinguishes data bases from decision procedures. Programs generate learning tasks by operating upon data structures that are separate from the decision structure, unlike programmed instruction in which frames are a

blend of both. Much of CAI, however, has remained frame oriented, largely because authoring languages like Coursewriter were not designed from a generative point of view.

A family of generators is described that use PL-I to transform data structures and decision parameter values into executable code for generative CAI. These programs currently output code for an IBM 1500 but are designed to be adaptable to other CAI system environments. The parent generator, CLUEG, uses a prompting strategy to shape target responses by providing a variety of hints or clues. It evolved from a special purpose German generator. Modifications of CLUEG produced both Quiz Generator, which has become Concept Generator, and List Generator, which permits confidence testing as well as expanded CLUEG capabilities. More recently, CLOZE Generator has been developed for testing and supporting the reading of text.

Advantages of generative CAI and recurrent problems are discussed in the context of future research.

BUSINESS MEETING, G. RONALD CHRISTOPHER, PRESIDING

INSTITUTIONAL MEMBERS PRESENT AND VOTING, SEE APPENDIX A

TREASURER'S REPORT, SEE APPENDIX B

The meeting was called to order at 8:40 a.m. on August 9, 1973, by Peter Dean, Secretary-Treasurer. During the discussion of the first item on the agenda G. Ronald Christopher, President, assumed the responsibility for the meeting.

Hosts for the 1974 summer meeting were requested. Invitations were received from (1) Joan Hayes, jointly for Western Washington State College and Simon Frazer University, (2) Robert Tannenbaum, CUNY, New York, (3) Karen Duncan, Medical Center of the University of South Carolina and, (4) Emile Attala, California Polytechnic State University. Western Washington State College at Bellingham, Washington was selected.

Nominations for Newsletter Editor were sought. Alan Smith was nominated by Robert Tannenbaum and seconded by Ruann Pengov. Nominations were closed and Alan Smith continues as Newsletter Editor.

Peter Dean, after submitting the financial statement which showed a balance of \$6,700.70, presented a budget for the coming year. This budget would include in addition to all normal expenses three new items: \$1,250 travel and accommodations for 9 officers to conferences, \$500 project fund, and \$560 telephones for institutional representatives' demonstrations.

During the discussion relative to travel funds, Robert Tannenbaum presented an amendment such that travel expenses would be available only if the institution

will not pay. Application for such expenses will be required. Alan Smith moved the question, Charles Tidball seconded. The budget with amendment was approved.

A committee to study the feasibility of establishing a ADCIS journal was moved by Robert Tannenbaum, seconded by Ruann Pengov. Approved by vote. Michael Allen was appointed as committee Chairman.

Becky Willis, SEGOS, submitted the papers, attached as Appendix C, which present information and policies for CIRCUIT, contributor instructions, and a form for submitting information relative to the available course materials. The meeting authorized Mrs. Willis to establish the mechanism, costs, and other pertinent information and to report back at the next meeting.

The procedure used for judging abstracts for this meeting was discussed and the representatives decided to continue in the same manner for the next meeting.

The Feather Group on Networks presented a proposal asking ADCIS to endorse the Lester Hill Center for Bio-Medical Communication. The proposal is attached as Appendix D. The representatives voted to make this endorsement.

A new interest group, Implementation, was formed with Michael Allen as Chairman. No secretary has been voted by the group.

Robert Tannenbaum moved that a letter be prepared to formally thank William Fitzgerald for serving as host for the meeting. Ben Stevens suggested that the general session be made part of the regular program. The meeting was adjourned at 9:40 a.m.

APPENDIX AINSTITUTIONAL MEMBERS PRESENT  
AND VOTING

Emile Attala  
California Polytechnic State  
University

Christopher Brigham  
CMDNJ - Rutgers Medical School

C. Victor Bunderson  
Brigham Young University

Ronald Christopher  
Ohio State University

Ronald Cody  
Educational Information Services

Ralph Cutler  
University of Washington

Peter Dean  
IBM

James DeNio  
University of Kansas Medical Center

Herbert Diamond  
SUNY - Downstate Medical Center

Karen Duncan  
University of South Carolina

Barbara Farquhar  
Massachusetts General Hospital and  
Harvard Medical School

William Fitzgerald  
University of Michigan

Gerald Fleischli  
University of Nebraska Medical Center

Jack Gillikin  
Department of Defense

Frank Giunti  
U.S. Army Signal Center and School

Jean Gross  
Rutgers University

William Harless  
University of Pacific

Tom Hartley  
Kansas Public Schools

Joan Hayes  
Western Washington State College

Martin Kamp  
University of California

Harvey Long  
IBM

Catherine Morgan  
Montgomery County Schools

Howard Nusbaum  
Hostos Community College CUNY

Ruann Pengov  
Ohio State University

Walter Petersen  
University of Oregon Medical School

K. G. Pollock  
College of Petroleum and Minerals

John Price  
Hewlett-Packard

Daniel Reeves  
Loma Linda University

Gene Romaniuk  
University of Alberta

John Schurdak  
Fiarfield University

Bob Seidel  
Human Resources Research Organization

Ted Sjoerdsma  
University of Iowa

Alan Smith  
University of Maine

Tim Smith  
University of Kentucky

Marianne Snodgrass  
Ohio State University

C. B. Stevens  
University of Florida

Robert Tannenbaum  
Hunter College CUNY

Charles Tidball  
George Washington University

Betty Weneser  
SUNY at Stony Brook

Rebecca Willis  
SECOS

APPENDIX B

## ADCIS FINANCIAL STATEMENT

Statement of Receipts and Expenses  
For the Period of September 1, 1972 - July 31, 1973

BANK BALANCE SEPTEMBER 1, 1972 \$ 5,213.23

INCOME

Dues	\$3,428.00	
Institutional (\$2,300)		
Associate (\$200)		
Individual (\$769)		
Mailing List (\$159)		
Miscellaneous	14.67	
Quebec Conference	2.00	
San Francisco Conference	1,870.53	
Ann Arbor Conference	<u>15.00</u>	
TOTAL INCOME	\$5,330.20	<u>\$ 5,330.20</u>
		\$10,543.43

EXPENSES

Quebec Conference	\$ 28.05	
San Francisco Conference	1,859.29	
Ann Arbor Conference	500.00	
Miscellaneous	251.72	
Telephone	472.76	
Postage	61.23	
Supplies	<u>669.68</u>	
TOTAL EXPENSES	\$3,842.73	<u>\$ 3,842.73</u>
CASH ON HAND JULY 31, 1973		<u>\$ 6,700.70</u>

APPENDIX C

## CIRCUIT

Catalog of Instructional Resources  
for  
Computer Utilization In Teaching

The Shared Educational Computer System, Inc. (SECOS) in cooperation with the Association for Development of Computer Based Instructional Systems (ADCIS) will operate a distribution center and index of available educational materials in APL, Coursewriter III and Coursewriter II.

The center will be operated on a non-profit basis. Recipients of materials will be charged a handling fee to cover the expense of distribution. A catalog of information about materials which are available will be maintained. This catalog will list materials which are available directly from CIRCUIT and those which are available from the other sources.

## \*\*\*\*CIRCUIT INFORMATION &amp; POLICIES\*\*\*\*

1. CIRCUIT will maintain on-line a catalog of available materials in the three languages. This catalog will be updated whenever items are entered or deleted. Printed copies of the catalog will be made available on a periodic basis.
2. The catalog will list materials which can be distributed directly by CIRCUIT and list material confirmed to be available from other source agencies.
3. SECOS, ADCIS and the contributing agency will assume no responsibility for the quality of the materials or the consequence of the use of the materials.
4. All fees charged for distribution are to cover administrative cost of distribution and are not refundable. CIRCUIT will be operated on a non-profit, self-supporting basis. Expenses will be defrayed by charges for the catalog and distribution. The cost of the catalog will depend on size and reproduction expenses. An initial estimate is for between \$5 and 15.
5. A copy of the catalog will be given without charge to each contributor who submits programs to be distributed directly by CIRCUIT.
6. When requested by the contributor, signed agreements will be obtained from the recipients of materials agreeing not to further distribute the materials and/or not to make changes in the materials. A standard agreement form will be used when this is agreeable to the contributor. If the contributor finds the standard form inadequate, a special agreement form meeting the contributor's specification will be used.
7. A minimum distribution charge will be charged for each transaction. Initially the minimum distribution charge will be \$50. This fee will cover as much material as will fit on one tape. A numeric code will be listed in the catalog to allow calculation of how many materials can be obtained for the minimum fee.
8. If the contributor wishes to make a charge for the materials, this amount will be collected and forwarded to the contributor. A small handling charge will be charged to the contributor for this service.
9. The contributor of materials will be informed by letter each time a request is processed for his materials.
10. A complete record of all distributions will be maintained.
11. Each contribution agency will be contacted at the end of one year to confirm that the most up-to-date version of the program is available for distribution. Materials may be dropped if there is no demand for them and/or no response from the author.
12. Assembly language functions for Coursewriter will also be listed and distributed.
13. Materials to be distributed by CIRCUIT will be placed on the SECOS system when compatible with the system. They may be previewed by dialing into the system.

\*\*\*\*CATALOG OF AVAILABLE PROGRAMS\*\*\*\*

1. The catalog will list only materials which are available for distribution.
2. The primary listing of materials will be by subject area.
3. The listing will be cross-referenced by the following indices:
  - a. Language, by version and level
  - b. Contribution agency
  - c. Program name
4. Any special cross-index listing can be produced upon special request.
5. A copy of the standard non-distribution agreement, and the non-change agreement will be included in the catalog so that they can be filled out and submitted with the order for materials.
6. Order blanks will also be bound with the catalog.

\*\*\*\*SUBJECT AREA LISTING\*\*\*\*

1. Program name and catalog number.
2. Availability from SECOS or from the contribution agency.
3. Contribution agency and reference code
4. Author(s)
5. Language, level and version
6. Functions required, if so list.
7. Level of materials
  - General
  - Elementary (specify grade)
  - Secondary
  - College
  - Graduate
  - Other
8. Cost beyond distribution charge and code for distribution cost.
9. Instructional logic
  - Tutorial
  - Drill and practice
  - Problem solving
  - Simulation
  - Texting
  - Inquiry
  - Other

10. Description
11. Contents, Index of subtopics
12. Completion time range
13. Documentation available from SEGOS or contributor Y N
14. Supplemental materials available from SEGOS or from contributor
  - Slides
  - Printed materials
  - Audition tapes
  - Video te cassetts
  - Film loops
  - Others
15. Agreement forms required
  - Non-distribution
  - Non-change
  - Special agreement
16. Present use at contributing agency Y N
  - Credit offered
  - Supplemental instruction
  - Testing
  - Other

\*\*\*CONTRIBUTOR LISTING\*\*\*

1. Name of agency
2. Director
3. Author's name
4. Hardware configuration
5. List of program package names with catalog numbers

\*\*\*SECONDARY CROSS-REFERENCE LISTINGS\*\*\*

1. Two secondary cross-fererence listings
  - a. Language, version and level
  - b. Program name, alphabetical list
2. Both listings will list only catalog number for reference to Subject Area Listing.

## CIRCUIT

## CONTRIBUTOR INSTRUCTIONS

The following quote from the CIRCUIT order blank specifies the terms and conditions under which programs may be ordered.

1. SECOS, ADGIS, and the contributing agency assume no responsibility for the quality of the materials, or for the consequence of their use.
2. All fees charged are to cover the cost of distribution, and are not refundable.
3. All programs listed above with the distribution agreement indicated are for use only on one central processing unit. Copies of the program are not to be distributed in any form for the purpose of running on another central processing unit, or for the purpose of publication.
4. All programs listed above with the modification agreement indicated are not to be modified in any way without the written consent of the author or the contributing agency.
5. All programs listed above with optional agreement indicated must have an additional agreement form signed before the materials can be distributed. The necessary forms will be forwarded upon receipt of the order blank.

Complete one catalog registration form for each program submitted for distribution or for catalog listing.

Programs are to be submitted on 800 or 1600 bpi 9-track magnetic tape.

## APL WORKSPACES

Record length must be less than 10,000 bytes and evenly divisible by four.  
Please specify workspace size.  
Include a copy of TVERIFY.

## COURSEWRITER

Send a course off tape.

## ASSEMBLY LANGUAGE FUNCTIONS

Source only.  
Specify OS or DOS.

## C I R C U I T

Catalog of Instructional Resources  
for Computer Utilization in Teaching

## ASSEMBLY FUNCTIONS FORM

FOR EACH ASSEMBLY FUNCTION SUBMITTED FOR DISTRIBUTION, EITHER AS SUPPORT TO A COURSEWRITER PACKAGE OR FOR INDEPENDENT DISTRIBUTION, YOU SHOULD SUPPLY THE DOS OR OS SOURCE LISTING AND ALSO THE FOLLOWING INFORMATION:

FUNCTION NAME \_\_\_\_\_

AUTHOR(S) NAME(S) \_\_\_\_\_

AGENCY NAME \_\_\_\_\_

TO BE DISTRIBUTED INDEPENDENTLY?

NO

TO BE DISTRIBUTED ONLY WITH PROGRAM PACKAGE:

YES

PLEASE COMPLETE THE FOLLOWING:

ARGUMENTS USED \_\_\_\_\_

DESCRIPTION OF PURPOSE:

SYNTAX OF FUNCTION CALL \_\_\_\_\_

USED WITHIN THE FUNCTION:

BUFFERS \_\_\_\_\_

COUNTERS \_\_\_\_\_

SWITCHES \_\_\_\_\_

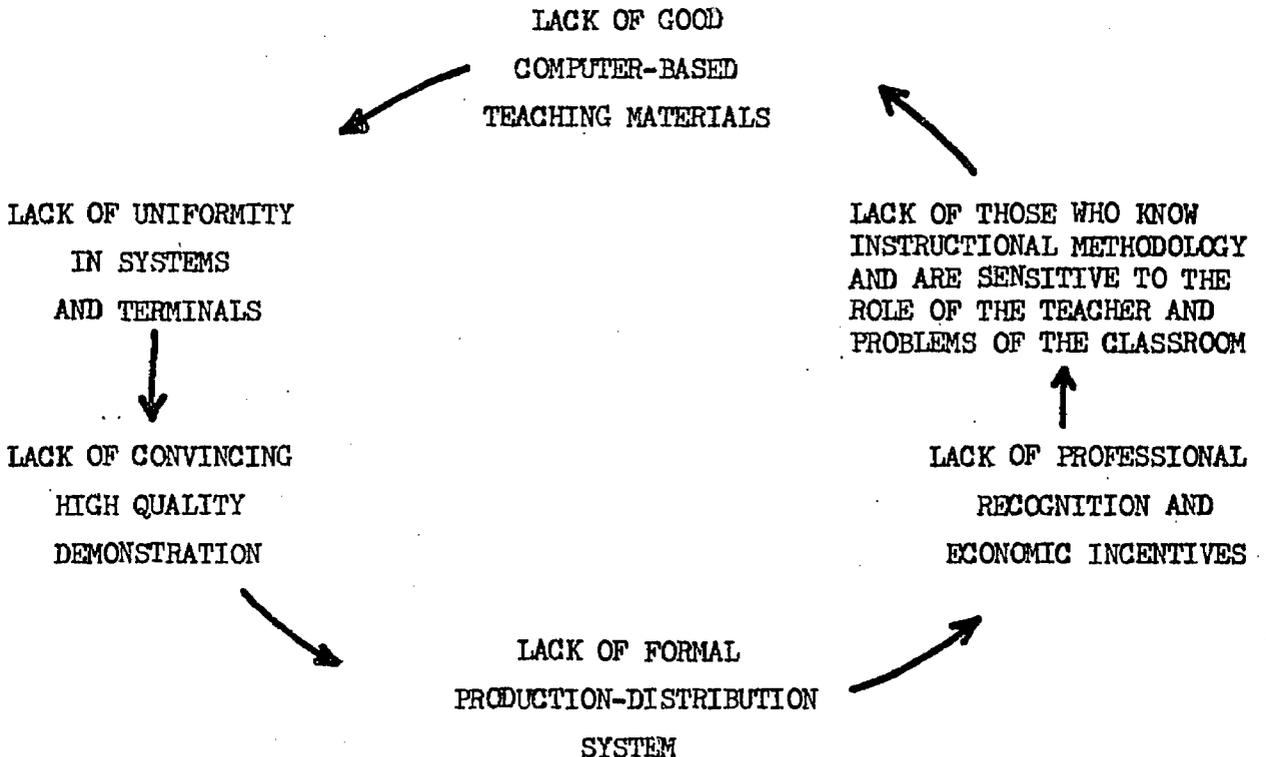
REGISTERS \_\_\_\_\_

RESULTS RETURNED \_\_\_\_\_

PLEASE ATTACH THIS FORM TO THE REGISTRATION FORM FOR CONTRIBUTORS.

APPENDIX D

Whereas a recent study (1) has identified a vicious status quo cycle of factors which inhibit wide spread use of computer-based instructional systems as shown below



and Whereas the Educational Component of the Lister Hill Center for Bio-medical Communications has made a significant contribution in eliminating the above deficits

BE IT RESOLVED by the Association for the Development of Computer-based Instructional Systems that the leadership of the National Library of Medicine be encouraged to sustain this important activity to the fullest extent possible. (Additional supporting information is contained in the Appendices attached.)

1 Anastasio and Morgan, EDUCOM (1972)