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# COMPUTER SUPPLEMENTED INSTRUCTION USING BATCH PROCESSED DELAYED REINFORCEMENT AND FEEDBACK: COMPARED TO TEACHER DIRECTED DISCUSSION FOLLOWING INTERACTIVE MEDIATED INSTRUCTION FOR FRESHMEN COLLEGE LIBRARY ORIENTATION

by

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A DISSERTATION

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Under the Supervision of Professor Wesley C. Meierhenry

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# TITLE

Computer Supplemented Instruction Using Batch Processed Delayed Reinforcement and Feedback: Compared to Teacher Directed Discussion Following Interactive Mediated Instruction for Freshmen College Library Orientation

BY

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William L. Hagerman

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# Chapter 1

# INTRODUCTION

## A Need for Library Orientation

Most entering college freshmen would benefit from an orientation to the college library. Instructors and librarians have recognized the lack of competence displayed by many high school graduates in using the college library (Carey, 1974; Rao, 1970). Yet, most colleges do not have a library staff of sufficient size to instruct all incoming freshmen, while English and speech instructors often feel they must devote their limited time to skills they consider more basic to their own disciplines.

Open admissions at many colleges and universities has meant that students are trying to achieve at academic levels for which they may not be prepared. Instruction in high schools has not improved in proportion to the demand for higher education admissions. In fact S.A.T. scores have fallen notably in recent years (Sanford, 1977).

As society attempts to compensate for the previously unequal opportunities of minorities and the impoverished, remedial and basic skills instruction has become an increasingly important part of the college curriculum.

While admissions criteria have eased, the amount of information needed for success has been increasing at a phenomenal rate. "Education has become an open-ended battle to keep up with what is known" (Thompson, 1969, p. 25).

For the ill-prepared as well as all students, the library offers an opportunity to explore, to catch-up or to keep-up. The ability to function effectively in the college library is probably more important to today's student than ever before. Not only is there more to know, there are also more types of sources from which to acquire knowledge. Many people still think of a library primarily as a repostitory for books; but miniaturized, projected and audio-encoded media are increasingly important as information sources. In addition, the disparate Sudox indexing system is used in most college libraries for the world's largest publisher, the United States government.

A recent study (Corlett, 1974) using *The Library Orientation Test for College Freshmen* (Feagley, et al., 1955) suggests that library knowledge is valid as a predictor of success in college with little direct correlation to general study habits and attitudes.

In 1971 the curriculum development committee of the Nebraska Educational Television Council for Higher Education (NETCHE) consortium recommended that a sequence of library instruction for entering college freshmen be designed and prepared utilizing the electronic media.

## The NETCHE Sequence

### Development

*The College Library* was developed by NETCHE as part of a national instructional design field-testing project

in cooperation with the Great Plains National Video Tape Library (Cavert, 1974). It was designed for slide-tape or closed circuit video tape presentation rather than for broadcast television as are most of NETCHE's materials, the primary differences being that this sequence included response books for student interaction, and did not adhere to the strict time regimen of broadcast television.

The Missed Goal

Using programmed instruction techniques, the goal of *The College Library* was to achieve 90% information retention by 90% of the students as recommended by William Deterline (1968).

Objectives were carefully prepared and preliminary field testing removed the obvious inadequecies. The completion of the report of the Great Plains National project, as well as the report of completed projects for NETCHE's federal funding, dictated that a pre-determined completion date be met.

In addition to the student response books, materials included a detailed instructor's manual and pretest-post-tests. Extensive art work and photography were recorded on slides and video tape. Narration, instruction, discussion, and music were included in the audio portion. The series became available on video cassette with built-in response times, and as a slide-tape presentation according to the schedule in the fall of 1973.

In spite of professional production techniques and determined efforts by all involved, the 90-90 goal was not achieved.

### Redevelopmental Costs Prohibitive

To redesign the instruction would have entailed expense for which no budget had been allowed. All of the "right" techniques seemed to have been used except intensive field testing, which was not possible without the finished instructional materials. The sequence had the general approval of state college librarians (in spite of some evident minor flaws), and was being used by the Nebraska colleges that would be most apt to utilize such a program. So, although failing to meet the desired performance goals, it was fulfilling its intended function, and it was considered not practical to refine programs in the series.

## The Problem and the Proposal

### Computer Programs Coordination

At much the same time NETCHE had also obligated itself to serve temporarily as computer service coordinator for the colleges in Nebraska though without personnel expressly trained or assigned to the task, and with no overt demand from college faculties for computerized instruction. Thus computer instructional coordination was, in effect, a responsibility in name only.

A NETCHE survey (Hagerman, 1974) revealed that much batch process computer capacity at many of the colleges in the state was unused assuming a potential 24 hour operation such as that followed at most large university installations including the University of Nebraska at Lincoln. The availability of batch process computer facilities, and a felt need to improve the student information retention level of the library sequence after failure to meet the 90% retention standard, suggested that individualized computer printouts could help tutor students or reinforce key library utilization points.

## CSI Project

For the above reasons the Computer Supplemented Instruction project was proposed to fulfill the following purposes: to design a computer program for a batch processing environment that would (1) evaluate the effectiveness of the instruction, (2) tabulate incorrect answers, (3) prepare an evaluation sheet for the instructor, and (4) prepare an individualized printout for the student which would give additional hints, comparisons and insights when answers were incorrect, and reinforcement when responses were correct.

## The Research Questions

The problem posed for investigation was the following based upon Unit I of the five unit library series:

Is computer supplemented instruction equal to or better than traditional forms of instruction in terms of information retention and cost and time efficiency, especially following mediated instruction?

The following research questions were formulated:

(1) Will individualized computer printed reinforcement and instructional supplements increase student learning scores?

(2) Will this computer reinforcement and instructional supplement increase learning scores to an equal or greater extent than equal time spent on classroom discussion or non-individualized computer printed explanatory materials?

(3) Do batch process computer instructional printouts stimulate greater learning as reinforcement or as a primary learning experience?

(4) What are the attitudes of students presented with this individualized wrong-answer-explanation feedback towards this teaching method?

(5) What are the implications for current instructional design practices and for future research in electronically mediated instruction?

## Delimitation of the Study

As with most such studies, this investigation had certain delimitations. The study was not intended to specifically differentiate costs, comparing instructor salaries, other forms of computerized instructional utilization or computer operational costs. The cost factor was to be considered only in a general way by comparing such broad categories as (1) student study time efficiency, (2) student-faculty ratio requirements, and (3) computer capacity required and available without additional capital

outlay. Student time tabulations were necessarily based on student reported data.

Although the conclusions may have application on a broader basis, this study dealt only with library orientation for students at the freshmen level for the general requirement, Fundamentals of Speech classes at Wayne State College.

Another limitation was the time factor, the posttest being administered to all groups on the fifth day. Subject information retention can only be assumed on this short term basis.

The attitude survey was not intended to be cumulative. No attempt was made to assign a composite label to respondents or to assign other than ordinal value to the responses.



## Justification

In spite of its limitations, this study seemed justified not only on the basis of the need for library skills by entering students as a way of coping with the information explosion, but also on the basis of utilization of existing unused computer capacity to increase the efficiency of tertiary education without increased cost after the initial implementation.

## Definition of Terms

Computer supplemented instruction (CSI), as the term is used in this study, refers to a process in which students

are tested on a lesson using computer readable testing forms. The computer program evaluates the student responses and supplies the correct information for reinforcement, and provides further explanations in response to incorrect answers on an individualized computer printout returned to the student at the next class session.

CSI used as reinforcement follows mediated instruction and is based on the criterion test items of that instruction.

CSI as a primary learning experience covers information in the testing and subsequent individualized computer printout that may be referenced in the preceding mediated instruction but is not part of the interactive instruction or considered a criterion objective.



## Assumptions

In the design of this study it was necessary to make the following assumptions:

(1) Since random selection of subjects was not possible, it was assumed that the class assignment process served a similar function, and that random assignment of treatment groups would serve to remove the possibility of bias from the comparison of groups given different treatments.

(2) Although it is recognized that not all sutdents in a freshmen level class are freshmen, it was assumed that all would be equally motivated to perform well, and that distribution would be proportionate among the various groups.

(3) It was assumed that the best way to increase the average score of the discussion group was to consider most intently those test items missed by the greatest number of students in that group.

(4) It was also assumed that students would be objective in recording out-of-class study time and that any inflation of figures created by students' wishful thinking or attempts to better their chances for a good grade would be consistent throughout the population, so as to allow appropriate comparisons between groups.

(5) The attitude survey reflected in most cases the opinions of students after only one encounter with the mediated instruction-response book teaching method. In the computer printout treatment groups, it represented a first encounter with any kind of computer printout instruction. So, while the psychology of students like-what-they-are-accustomed-to is probably a factor in the student evaluation of the methodology, it was assumed that the force of the Hawthorne effect was an equal contervailing influence.

## Related Literature

The review of the literature will include a brief consideration of the development of the computer as an educational tool, and a comparison of the various functions of the computer as it is used today in education. Related research literature also will include summation of findings as they appear to apply to mediated instruction in general, to mediated instruction in combination with other forms of instruction, and to instruction where reinforcement use has been explored. In each case, results will be shown to relate to the use of computer supplemented instruction, and in many cases to help establish the criteria for the evaluation of CSI.

## Procedures

The purpose of this study was to determine the effectiveness of the technique of computer supplemented instruction which entails the utilization of batch processing to

provide feedback to students in the form of computer print-out sheets. The evaluation was accomplished through the implementation of a quasi-experiment utilizing students in freshmen level speech classes at Wayne State College.

## The Design

The design called for the mediated instruction followed by the pretest to be administered in four groups, each group the same day in a Monday class, the treatment on Wednesday, and posttest and attitude questionnaire on Friday.

## The Sample

Because of the design, only those classes in the target population meeting Monday, Wednesday and Friday could be utilized. It was unnecessary to otherwise select the subjects since all Monday-Wednesday-Friday speech sections were used. (Other speech sections met Tuesday-Thursday for extended time periods.) The study was conducted during the winter term of 1975 when Wayne State was on the trimester calendar which allowed a full hour class period for three hour credit courses meeting three times a week such as these Fundamentals of Speech classes.

## Instrumentation

The criterion test of the library sequence unit used as the primary instrument of evaluation was prepared in consultation with librarians and NETCHE design consultants.

The mediated instruction used in the study was developed from the instruction with care made to select only those items of supplementary information to which only passing reference was made in the instruction. The attitude survey sought to determine opinions as to the viability of the instructional method. All instruments were developed by the author. Validity and reliability of the primary instrument were confirmed, and two consecutive testings were conducted to evaluate the non-criterion test and the attitude questionnaire.

## Data Collection and Treatment

Student responses to the pretest, posttest and attitude questionnaire were entered by the students on mark-sense computer cards which were in turn mechanically encoded on Hollerith cards for computer analysis. The initial data processing was by the CSI program which determined subject scores and provided the feedback to groups receiving the computer printout treatments.

Analysis of responses was done for each subject, for each treatment group, and in comparing all treatment groups. Findings of the study were reported in tables as seemed appropriate and compared for significance using the statistical program *Univariate and Multivariate Analysis of Variance, Covariance, and Regression* (National Educational Resources, Inc., 1972).

## Concluding Chapters

Chapter II of this study will review the related literature in the fields of mediated and computerized education previously discussed. Chapter III describes in detail the procedures followed in this study. Chapter IV delineates the findings and makes data comparisons between groups, and Chapter V assesses the findings, and derives conclusions. Further, recommendations are made for future research.

# Chapter II

# REVIEW OF THE LITERATURE

## Growth and Development of Computers in Education

### Early Research

Although certain historians suggest that the Chinese abacus was the first digital computer about 500 B.C., and imply that Charles Babbage's "analytical engine" (circa 1823) was the progenitor of the modern digital computer (Whitmore, 1953), it seems probable that direct lineage must be rejected. For while the Babbage machine (which was never constructed), did employ many of the concepts found in the modern device, the data concerning Babbage's machine were lost until 1937 (Sippl, 1974) and not brought to the attention of the builders of the modern digital instrument until the project was nearly completed (Aiken, 1964).

Modern computer technology can more logically be traced to Herman Hollerith who adapted the French Jacquard loom punched card control concept to accelerate the compilation of the 1890 United States census. In 1911 he helped form a company which was to become International Business Machines, the world's foremost producer of computers for many years.

Development

As long as there have been computers in the modern sense, they have been associated with education. American colleges and universities have been instrumental in their development and utilization.

Perhaps the first successful computer, as the term is generally conceived, was developed by Vanevar Bush in 1931 at the Massachusetts Institute of Technology. The "differential analysizer," as it was called, was an analog computer, which would become the forerunner of devices used to direct guns in World War II.

The Harvard Mark I in 1944 was the first digital computer. It was developed by Howard Aiken, an instructor in applied mathematics at Harvard, who had his doctorate in physics. This electrical-mechanical contrivance evolved with the aid of IBM engineers.

The University of Pennsylvannia introduced the first electronic digital computer in 1946. It used some 18,000 vacuum tubes and was called ENIAC, the Electronic Numerical Integrator and Computer.

John von Neumann and his associates made a major contribution to computer advancement in the same year with the proposal of the addition of an internal memory.

> While at the Institute of Advanced Study in Princeton, New Jersey in 1946, von Neumann with Arthur W. Burks and Herman H. Goldstine, published a paper that became a landmark in the history of computer sciences, if not in the history of human thought. In "Preliminary Discussion of the Logical Design of an Electronic

> Instrument," [these scientists presented proposals that were] a substantial departure from anything hitherto proposed (Sipl, 1974, p. 1047).

These proposals were embodied in a computer subsequently built at Princeton with the aid of IBM.

The idea of computer languages was first realized in the fifties. FORTRAN (1956) and ALGOL (1958) were designed to handle scientific problems and COBOL (1960) for business data processing (Alt, 1975). The advent of computer languages meant it was possible to use a series of specific English language commands to program a computer rather than using a highly structured assemblage of mathematical symbols. One of the most universally adopted languages is BASIC developed at Dartmouth College for student use in 1964 (Kemeny, 1972).

The time sharing concept--allowing many persons to use one computer simultaneously--added greatly to efficiency of utilization. It was developed by the Rand Corporation in the late fifties, though universities and colleges were also in the vanguard with Dartmouth's system initiated in 1963.



## Acceptance

Colleges and universities have led the way in the use of computers though acceptance and utilization has been slower in the less scientific disciplines. As more people discover the benefits of the computer, as more students learn to make computers do their bidding, and as prices