A STUDY OF SELECTED MICHIGAN ELEMENTARY AND SECONDARY TEACHERS' AND PRINCIPALS' ATTITUDE TOWARD COMPUTER ASSISTED INSTRUCTION

By

Carlton Porterfield Robardey, Sr.

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ABSTRACT

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The purpose of this study was to examine the relationship between the dependent variable attitude and several independent variables with respect to computer assisted instruction (CAI). These independent variables included: (1) knowledge; (2) age; (3) level in the educational field; i.e., elementary-secondary; (4) classification of the school district employing the sample member; i.e., rural-urban; (5) position in the education field; i.e., principal-teacher; and (6) subject matter taught by secondary teachers; i.e., English/social studies-science/mathematics.

Three instruments were developed to gather data in order to answer questions pertaining to the purpose of the study. The instruments were an attitude scale, an instrument to measure knowledge, and a background questionnaire.

All of the instruments were pretested using subjects similar to the population of the study. In addition, the construct and face validities were established for the attitude instrument and its reliability computed based on the pretest data and the face validity of the modified instrument established.

These instruments were then distributed to a random sample of teachers and all of the principals in the population of interest (Washtenaw County, Michigan). Of the 276 sets of instruments mailed, 256 sets of instruments were returned for a 92.0% response.

Seven null hypotheses were tested in an attempt to answer questions relative to the purpose of the study. All of the hypotheses were tested at the .05 level of significance by either the one-way analysis of variance, Pearson-product moment correlation, or the F-test. In addition, internal consistency reliabilities were calculated for the attitude scale and knowledge instrument.

Thus, it was found that the following statement is supportable:

> There is a statistically significant positive relationship between knowledge and attitude with respect to CAI.

DEDICATION

To Mom and Dad

It was you who instilled in me the courage to always strive for that which is beyond the easy reach and in the reflection of time, the example, you both set as parents will always remain a goal to be achieved in my lifetime. That this dissertation was attempted can be attributed to you both.

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The Ohio State University; Dr. Ivan Wagner, Director of Data Systems, Ann Arbor Public Schools, Ann Arbor, Michigan; Dr. Ronald Arnold, Director of Project INDICOM, Waterford Public Schools, Waterford, Michigan; and Mr. John Grate, Director, CAI Project, Cincinnati Public Schools, Cincinnati, Ohio for giving freely of their time to act as judges for the establishment of face validities for the cognitive and affective instruments used in the study.

The writer also wishes to acknowledge the help and encouragement of all the members of the General Education Services Area of the Michigan Department of Education. However, a special note of thanks is due Mr. Don Goodson (deceased), the late director of E.S.E.A. III, whose help and advice were invaluable in the early stages of the study and to the writer's secretary, Mrs. Carolyn Terrill, who constantly kept him on the "straight and narrow."

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Last but far from least, to my wife Peggy, for contributions far too numerous to recall and many times taken for granted and to my children Michaelle, Port and Millette for their patience, love and understanding in accepting the absence of dad during much of the time the study was in progress, goes my deepest appreciation. Without their support the entire doctoral program would have been impossible.

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CHAPTER I

INTRODUCTION

Education in the United States, true to its philosophy, is being called on to provide for the needs of all its citizens and not just the few. However, in recent years certain critical problems have become evident which makes the pursuit of this philosophy difficult. These problems include the need to lower the drop-out rate, the need to re-educate segments of our adult population, the realization that students learn in different ways, and the demand and right of disadvantaged groups for a quality education are some of the factors that have created a dual problem of increasing enrollments and rising costs.

Increasing costs, the need to educate many more students at all ages, but with different backgrounds, while using limited resources--all of these create demands for a new approach to the problem. Educational technology and computers specifically offer one hope for a solution.

What are the special characteristics of this particular medium which offer some solutions to mass education? The traits of self-pacing, interaction, presentation of instructional sequences based on prior

responses and available past information, diagnosis of weakness in skills and abilities that are often overlooked by human evaluation, and the ability to employ different media for basic and remedial sequences are some primary examples. In addition, the computer, or rather the computer terminal which interfaces the student and machine, is completely neutral toward the learner's race, religion or economic background. This in itself is of prime importance to some disadvantaged groups.[1]

If the computer follows the same growth pattern as television and air conditioning (and there is no reason to think that it will not), the cost will continue to decline.

With all of the potentials that the computer holds for education, it is of prime importance that the computer does not go the way of other highly touted educational media, but rather becomes a vital part of education in the decade of the seventies.

Need for the Study

During the past decade or so the field of instructional technology has grown in importance in education

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[1]This point was emphasized by John Grate, Director of the Computer Assisted Instruction Project, Cincinnati Public Schools, Cincinnati, Ohio, and Dr. Hal Wilson, Director of Instructional Systems, Harcourt, Brace and Jovanovich, Inc., during the course of a conference on computer applications to learning which the present researcher coordinated.

from the use of the tape recorder, 16 mm movie projector, and educational television to the use of computers for administrative data processing and classroom instruction. The rate of growth of instructional technology, unfortunately, has not always been accompanied by sufficient research as to its effectiveness. Yet, the need for research in the area of instructional technology, particularly in computer assisted instruction (CAI), becomes clear when the present use of computers in today's society is realized and, even more so, when the projections for the future use of computers for instruction are taken into account.

The projected importance of the computer in education is almost startling. For example, Dr. Patrick Suppes, Director of the Institute for Mathematical Studies in the Social Sciences of Stanford University, stated that:

> ...both the processing and uses of information are undergoing an unprecedented technological revolution. Not only are machines now able to deal with many kinds of information at high speed and in large quantities, but also it is possible to manipulate these quantities of information so as to benefit from them in entirely novel ways. This is perhaps no more true than in the field of education. One can predict that in a few more years millions of school children will have access to what Philip of Macedon's son, Alexander, enjoyed as a royal prerogative: the personal services of a tutor as well informed and responsive as Aristotle.[2]

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[2]Patrick Suppes, "The Uses of Computers in Education," Scientific American, Vol. 215, No. 3, 1966, p. 207.

Thus, Suppes predicts an "Aristotle" for millions of students in the near future. Further indications of the impact computers will have on the whole establishment of education are indicated by Alexander Schure:

> The use of the computer will alter the face of education, and indeed of civilization. The computer will be imbedded as a prime foundation stone in the schools, education centers, and universities of tomorrow. It will be a tool used locally within the classroom as well as a management device to administer large regional school systems.[3]

Therefore, the question of whether the computer will become a part of education in the United States apparently can no longer be debated.

In support of this statement one has only to converse with the directors of several of these projects and examine statistics on the number of computing installations in the United States in 1950 (10-15) and then compare that number to the number of installations in operation in 1970 (50,000).[4] This increase alone is indeed impressive, but at the present time there are at least 30 operational CAI projects at the public school level in the United

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[3]Robert Marker, ed., Computer Concepts and Educational Administration, University of Iowa: Iowa Educational Information Center, 1968, p. 130.

[4]Computers in Higher Education, Report of the Presidents Science Advisory Committee, Donald F. Hornig, Chairman, Washington, D. C.: Government Printing Office, 1967, p. 58.

States. This number was arrived at by personal conversation with the directors of several of these projects. These directors included Dr. Ronald Carruth of Macomb, Mississippi; John Grate of Cincinnati, Ohio; Dr. Sylvia Charp of Philadelphia, Pennsylvania; Ronald Arnold of Waterford, Michigan; and others. Between 1966 and 1969, at seven universities or related installations, there have been put into operation 34 CAI programs giving instruction in chemistry alone; and this list is by no means comprehensive.[5]

There seems to be no question, then, that the growth of the electronic computer during the past 25 years has been remarkable. However, there are some people who believe that even though the use of the computer in education has grown rapidly over the last few years, its use is still in its infancy when the extent that it will probably be used in the years to come is considered.[6]

The question seems to be, then, not will CAI become a part of education, but what will be the nature of its role in the years to come?[7]

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[5]Fredrick D. Tabbutt, "Computers in Chemical Education," Chemical and Engineering News, Vol. 48, No. 3, pp. 53-54.

[6]Computers in Higher Education, p. 1.

[7]Patrick Suppes and Max Jerman, "Computer-Assisted Instruction," The Bulletin of the National Association of Secondary School Principals, Vol. 54, No. 343, p. 27.

Lawrence Grayson[8] of the National Center for Educational Research and Development, United States Office of Education, has suggested that there are at least five factors that have to be considered before computer assisted instruction can begin to play a really major role in education.

1. Adequate hardware
2. The cost of telephone lines for remote terminals
3. Instructional and computer software
4. Proving the educational effectiveness of CAI
5. The attitudes toward CAI on the part of educators.

This last factor is what this investigator will consider in this study. In other words, the role the computer will play in the future in schools may be very much influenced by the attitude of educators toward it.

The literature indicates that attitudes are related to the acceptance and success of any instructional method.[9, 10, 11] In addition, there is evidence, based

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[8]Lawrence P. Grayson, "A Paradox: The Promises and Pitfalls of CAI," EDUCOM, Vol. 5, No. 2, pp. 2-3.

[9]Equality of Educational Opportunity, Washington, D. C.: U. S. Government Printing Office, 1966, p. 22.

[10]John F. O'Toole, "Teachers' and Principals' Attitudes Toward Programmed Instruction in the Elementary School," A-V Communications Review, Vol. 12, No. 4, p. 431.

[11]Joshi Vidaya, "Attitude Toward Reception of Technology," Journal of Social Psychology, Vol. 58, No. 1, 1962, p. 7.

on research, that indicates the way graduate students learn in a computer assisted instruction course in statistics is influenced by their preconceived attitudes.[12]

The importance of attitudes toward CAI in determining one's acceptance of and success in using computers in education is stressed by the opinions of researchers, experts and professional organizations in the field of computer assisted instruction and education in general. For example, the importance of teacher attitudes toward computer assisted instruction is expressed by Charles F. Hoban:

> The attitude of the classroom teacher toward any instructional innovation--technological or otherwise--is of paramount importance.[13]

The success of students in a CAI situation is also influenced by teacher attitude as is stated by Jerman and Anastasiow:

> The attitude of the teacher is a very important factor in determining the attitudes students will bring to their work on the terminals.[14]

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[12]Paul A. Stieman, A Normative Evaluation of a Computer-Assisted Instruction Laboratory in Statistical Inference, unpublished Master's Thesis, University of Pittsburgh, 1969, p. 45.

[13]"Man, Ritual, The Establishment and Instructional Technology," Educational Technology, Vol. 8, No. 20, p. 6.

[14]Nicholas J. Anastasiow and Max Jerman, "Introduction to Computer Based Drill and Practice in Arithmetic," Handbook, L. W. Singer Co., 1968, p. 13.

Another indication of teacher attitude was pointed out by a participant in a seminar on computer applications to education:

> This haggling about machine failing to substitute for teachers is exactly the kind of attitude I run into all the time with our computer-aided instruction projects. We find two predominant attitudes among the teachers. One, the teachers are afriad that the machine will replace them; or two, they are so concerned about their students performing poorly on this system that they stand over the children and say, "There is the F; push that button."[15]

Grayson has also expressed a concern about acceptance of CAI by educators based on attitude:

> Advocates of CAI must contend with faculty conservatism and their traditional reliance on textbooks and lectures as the principle vehicles of teaching. If computer assisted instruction is to become widely adopted, a change in teacher attitudes will have to occur.[16]

Reaction to CAI isn't limited to the average classroom teacher. Lawrence Stolurow, a noted authority in the area of computer applications to education and the director of the CAI laboratory at Harvard University has stated:

> As a teacher it frightens me to think that the use of CAI will reveal to the

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[15] The Computer in Education, An I/D/E/A Occasional Paper, a publication of the Institute for Development of Educational Activities Inc., Dayton, Ohio: 1970, p. 27.

[16] Grayson, "A Paradox: The Promises and Pitfalls of CAI," p. 3.

> world that I may have been wrong about teaching principles to which I am currently committed and believe in.[17]

This negative reaction isn't voiced by teachers alone. Administrators share some of the same fears. For example, the American Association of School Administrators has concluded that:

> There is considerable fear, anxiety, or an unhealthy sense of awe that suggests that the computer is some kind of all-powerful, incomprehensible, infallible, and independent "superbrain."[18]

Another indication of administrator attitude toward and fear of the computer was brought out by McDonald when he said:

> The fears and negative speculation engaged in by education administrators may not be valid, but they are real at the present time.[19]

If computers and the solution they tend to offer education for the problems outlined in the introduction are to become a reality, CAI must be accepted by the educational community. This lack of understanding and

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[17] Lawrence M. Stolurow, "Computer Assisted Instruction," Education Automation Monograph Series, American Data Processing, Inc., Detroit, 1968, p. 8.

[18] American Association of School Administrators' Committee on Electronic Data Processing, EDP and the School Administrators, Washington, D. C.: 1967, p. 10.

[19] Joseph B. Maroline and Marion R. Misch, Education in the 70's, Final Report of Educational Policy Project, George Washington University, Washington, D. C., Autumn, 1967, p. 289.

mistrust by educators is clearly stated by Dwight Allen and Glenn Hawkes along with the need for education to accept the computer and place it in its proper educational perspective:

> Computers, of course, are a major medium for information storage and retrieval, but unfortunately, educators have not yet learned to treat them (and all that they symbolize in terms of new media) as they should be treated, in their proper place. We remain basically suspicious of the new technology, thus becoming part of an unnecessary "two cultures" self-fulfilling prophecy. We think and act in relation to the computer as if it were some kind of personal foe. We say, "The computer sent me an inaccurate bill last month," or "Look at the mistake that the computer made;" and because we do not see the computer in its place as a tool of human invention for human use, we resist bringing it into our educational process except in the most peripheral ways, like keeping attendance records. We think of the typewriter as a tool, and we utilize it; we do not say, "My typewriter typed an unsatisfactory letter;" rather we say "I made a mistake in typing the letter."[20]

Thus research directed at variables which may be critical in determining whether computer assisted instruction can be successfully implemented is needed. This need was clearly indicated by Tobias.

> In informal conversations with personnel involved in the implementation of automated devices in the classroom, the

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[20]Dwight W. Allen and Glenn W. Hawkes, "Reconstruction of Teacher Education and Professional Growth Programs or How the Third Little Pig Escaped the Wolf," Phi Delta Kappa, Vol. 52, No. 1, p. 10.

> teacher's fear of and resistance to these new devices is frequently noted. It is surprising, therefore, that there is little systematic research regarding such fears among teachers.[21]

Further support for research involving the acceptance of computer assisted instruction is given by Richard T. Bueschel, President of Time Share Corporation, Hanover, New Hampshire:

> Perhaps the biggest problem to be overcome in exploiting time-sharing within the school is the computer mystique. This is usually manifested in a subtle fear of what most laymen and teachers regard as a complex electronic machine--the computer.[22]

In addition, Robert T. Filep, director of three computer assisted instruction projects, Education Systems Projects, System Development Corporation, Santa Monica, California, stated:

> If the technological innovation of computer-aided instruction is to have any impact on the problem of mass education, some feasibility studies will have to be conducted to determine if terminals made available in remote operational locations will be used, and with what results.[23]

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[21]Sigmund Tobias, "Effects of Attitudes to Programmed Instruction and Other Media on Achievement from Programmed Materials," A-V Communications Review, Vol. 17, No. 3, p. 299.

[22]Richard T. Bueschel, "Time-Sharing, A Progmatic Approach in the School," Educational Technology, Vol. 10, No. 3, p. 23.

[23]Robert T. Filep, "Individualized Instruction and the Computer: Potential for Mass Education," A-V Communications Review, Vol. 15, No. 1, p. 109.

A study of this nature is certainly needed when it is realized, also, that very little if any research has been conducted concerning educators' attitudes as they exist in the field rather than in an experimental classroom or demonstration project. O'Toole emphasized this need when he reported a study concerning teaching machines and programmed instruction:

> ...data reported in this study suggest the need for additional research involving faculty attitudes if programmed instruction is to be introduced successfully and used in classroom settings. Based upon the history of other innovations, teachers' acceptance of a new audio-visual aid or teaching method is largely dependent upon their attitude.[24]

In addition to opinions such as those cited above, there are several research studies indicated in the literature which deal specifically with attitudes toward CAI. However, these studies have been concerned with attitude upon completion of a computerized instruction unit. Only three studies have been concerned with

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[24]O'Toole, "Teachers' and Principals' Attitudes Toward Programmed Instruction," p. 438.

attitude before treatment.[25, 26, 27] Yet even these were more concerned with changes in attitude than variables associated with the attitude as originally measured. In other words, very little research has been done in the area of determining attitudes toward CAI before teachers and administrators have been involved in CAI programs.

Since attitudes are related to the acceptance and success of any instructional method, it is important to look at those variables which are associated with attitude.

One of the variables that seems to be related to attitude is knowledge. Therefore, it is logical to expect attitudes of teachers and administrators, i.e., principals who have a knowledge of CAI, to be positive in relation to those who do not have this knowledge. There is support for this assumption based on past

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[25]George R. Christopher, The Influence of a Computer Assisted Instruction Experience Upon the Attitudes of School Administrators, unpublished doctoral thesis, The Ohio State University, 1969, pp. 70-71.

[26]Arthur Mathis, Timothy Smith and Duncan Hansen, "College Students' Attitudes Toward Computer-Assisted Instruction," Journal of Educational Psychology, Vol. 61, No. 1, 1970, pp. 46-47.

[27]Stieman, Evaluation of a Computer Assisted Instruction Laboratory, pp. 1-3.

research. Christopher[28] in research conducted at Ohio State University in 1969, indicated that a relationship existed between knowledge of computer applications to education and attitude toward CAI. His findings indicated this relationship to be in a positive direction; i.e., the more knowledge an individual has the more favorable the attitude of the individual.

However, there is some confusion indicated by the literature on this point. Tobias in a study dealing with attitudes of teachers toward teaching machines and programmed instruction indicated that:

> ...the negative reaction to automation appears to be only slightly affected by information the teachers possess concerning programmed instruction.[29]

In addition, Christopher's study was confined to administrators involved in a CAI program as students and not as educators in a typical school setting.

In summary, the need for this research is seen from the following observations.

1. Computers and computer assisted instruction possibly hold the solution to some of the most urgent educational problems. Yet there is

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[28]Christopher, Influence of Computer Assisted Instruction Upon the Attitudes of Administrators, p. 69.

[29]Sigmund Tobias, "Teaching Machines and Programmed Instruction," A-V Communications Review, Vol. 14, No. 1, p. 108.

little research dealing with those variables which could influence the acceptance of this form of instruction.

2. Studies of educators' attitudes toward computer assisted instruction in the on-going educational environment of the school are for the most part nonexistent.
3. Attitudes are important in the acceptance of an instructional method; yet the relationship of knowledge to attitude is unclear in the literature.

Purpose of the Study

In light of the literature, attitudes are important in considering the acceptance and success of computer assisted instruction in the coming years. Therefore, the purpose of this study is to examine the variables that may be related to attitude toward CAI, particularly the variable of knowledge, other variables will, however, be considered as well. These variables are age, position and level held in the education field, the classification of the school district the sample member is employed by (rural-urban) and the subject matter taught in the case of secondary teachers. The specific questions for which answers were sought included:

1. Is there a relationship between knowledge of CAI and attitude toward CAI?

2. Is there a relationship between elementary level educators and secondary level educators with respect to attitude toward CAI?
3. Is there a relationship between urban educators and rural educators with respect to attitude toward CAI?
4. Is there a relationship between educators under 30 years of age and educators over 30 years of age with respect to attitude toward CAI?
5. Is there a relationship between principals and teachers with respect to attitude toward CAI?
6. Is there a relationship between secondary science and mathematics teachers and secondary English and social studies teachers with respect to attitude toward CAI?

Hypotheses

In an effort to find answers to the preceding questions the following research hypotheses were formulated:

1. There is a strong positive relationship between knowledge of CAI and attitude toward CAI.
2. Elementary principals and teachers, as a group, are significantly different in attitude toward CAI when compared to secondary principals and teachers as a group.
3. Urban principals and teachers, as a group, are significantly different in attitude toward CAI when compared to rural principals and teachers, as a group.
4. Principals and teachers under 30 years of age, as a group, are significantly different in attitude

toward CAI when compared to principals and teachers 30 years of age and older, as a group.

5. Elementary and secondary principals, as a group, are significantly different in attitude toward CAI when compared to elementary and secondary teachers as a group.

6. Secondary science and mathematics teachers as a group, are significantly different in attitude toward CAI when compared to secondary English and social studies teachers, as a group.

General Procedures

In order to investigate the preceding hypotheses, it was necessary to carry out the following procedures. Three instruments were constructed. First, a twenty-item attitude scale was developed to measure attitudes toward computer assisted instruction. Second, an instrument to measure knowledge of CAI was developed from a pool of multiple choice items submitted by known experts in the field of CAI. Third, a background questionnaire was developed to gather selected biographical information.

These three instruments were field tested using subjects similar to the sample of the study and modified where necessary. In addition, the validity for both the attitude scale and knowledge instrument were established. These field testing and instrument construction procedures will be discussed in greater detail in Chapter III.

Elementary and secondary teachers and principals in Washtenaw County (Michigan) were selected as the target population of the study. Washtenaw County was selected

because it has all of the attributes that were considered necessary for the study. These attributes included: 1) all five community types of school districts located in the county; 2) no school districts less than K-12; 3) the county was geographically small enough to allow for personal contact with sample members; and 4) lease telephone lines were available for the researchers use.

The sample for this study was selected by random methods in the case of teachers. However, the entire population of principals was included due to their small total numbers in the population.

A packet of materials was sent to the identified sample members. This packet included a background questionnaire, attitude scale, measure of knowledge, and directions for taking and returning the materials.

Follow-up was by letter and telephone call. Thus, the returned responses provided information relevant to the testing of the previously stated hypotheses.

Assumptions

Certain assumptions have been made with regard to this study, as follows:

1. Computer assisted instruction will remain a part of education.
2. Teachers and principals are the key personnel in determining the acceptance and success of CAI in the public schools.

3. Teacher and principal attitudes are important in determining the success or failure of CAI.
4. The instrument (p.133) used to measure knowledge of CAI covers the important aspects of this form of instruction.
5. The instrument used to measure principal and teacher knowledge of CAI will be sufficiently reliable for the purposes of this study.

Delimitations

This study is restricted to:

1. Elementary grades defined as (K-6) and secondary grades defined as (7-12).
2. Principals and teachers.
3. School districts with grades K-12.
4. Public schools.
5. Washtenaw County (Michigan).

Limitations

Readers should be made aware of certain limitations of this study. These limitations include the following:

1. In this study, the attitudes of teachers and principals toward computer assisted instruction are considered of prime importance. However, there is doubt as to what an attitude scale, such as the one used in this study, actually measures. What the scale does measure, at best, is the

expressed reaction of a person responding to written statements. What relationship exists between this expressed reaction and "true" attitude is not known.

2. The traditional classification of rural-urban is based on the livelihood of the population. However, in this study the classification of rural-urban is dependent upon the population, size of a community, and livelihood is not considered.
3. It is possible the the instrument used to measure knowledge of CAI (p. 133) does not cover all of the important aspects of computer assisted instruction.
4. It is possible that the reliability of the measure used to indicate teacher and principal knowledge of computer assisted instruction is not sufficient to be of a high predictive value.
5. All subjects in the survey were from a county that had one out of every six persons in the population enrolled in a program of higher education. Thus, the sample members could have been influenced by particular requirements and experiences in an institution of higher learning.

Definition of Terms

For purposes of this study, these terms are defined:

Attitude: "Attitude entails an existing predisposition to respond to social objects which, in interaction with situational and other dispositional variables, guides and directs the overt behavior of the individual." (Cardno, 1955)[30]

Computer Assisted Instruction: Computer assisted instruction, abbreviated CAI, is usually taken to mean a method of allowing the writer of programmed instruction material to use a computer system as a means of writing and presenting instructional material to a number of students individually.

Hardware: The equipment or "machinery" used in a computer system. This would include the computer itself and any device used to relay instruction to the students.

Interface: The common boundary between the computer and the student; i.e., the terminal.

Remote Terminal: Any device which is not at the actual site where the computer is located but is some distance away connected by some type

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[30]Marion E. Shaw and Jack M. Wright, eds., Scales for the Measurement of Attitudes, New York: Disney, McGraw-Hill Book Co., 1967, p. 2.

of communications system and is used to give instruction to students.

Software: The programs, routines, and other written information used to give instruction. This would also include all of the personnel needed to write and maintain the programs and hardware.

Terminal: Any device used which allows communications between a computer and the student by means of a communication line.

Organization of the Study

This study consists of five chapters, a selected bibliography and an appendix.

Chapter I includes the introduction to the study, the need for the study, purpose of the study, hypotheses relevant to the study, general procedures, assumptions, delimitations, limitations, definition of terms and the organization of the study.

Chapter II contains a review of the literature related to the study undertaken. This includes attitudes, measurement of attitudes, achievement and attitude, pupil achievement in relation to teacher attitudes, attitudes toward computer assisted instruction, computer assisted instruction, potentials of computer assisted instruction and a summary.

Chapter III describes and explains the methods and procedures of the study. In this chapter the following are reviewed: development of the attitude scale, attitude scale validity, attitude scale reliability, development of the test of knowledge of CAI, test validity, development of the background questionnaire, geographic area of the study, description of the sample, sampling procedures, collection of data, analysis and preparation of the data, and a summary.

Chapter IV contains the analysis of the data, the results and a summary.

Chapter V contains the summary, findings, conclusions and implications for further research.

CHAPTER II

REVIEW OF THE LITERATURE

In this chapter is presented a review of selected literature related to the study undertaken. The literature reviewed includes those studies related to attitude, measurement of attitude, pupil achievement in relation to teacher attitude, attitudes toward computer assisted instruction, computer assisted instruction, the potential of computer assisted instruction, and a summary. No attempt has been made to include a large number of studies in this review of literature. Rather, it has been the aim to include only those studies which have a bearing on the problem under study.

Attitude

There are a number of definitions of attitude that may be cited as examples of common usage of the term. English and English define attitude as:

> An enduring learned predisposition to behave in a consistent way toward a given class of objects.[1]

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[1]Horace B. English and Ava C. English, A Comprehensive Dictionary of Psychological And Psychoanalytic Terms: A Guide to Usage, New York: McKay, 1958, p. 50.

Krech feels that attitudes are best defined as:

> An enduring system of positive or negative evaluations, emotional feelings, and pro or con action tendencies with respect to a social object.[2]

Allport gives this definition of attitude:

> A mental and neural state of readiness, organized through experience, exerting a directive or dynamic influence upon the individual's response to all objects and situations with which it is related.[3]

Katz and Stotland[4] consider that attitudes have three major components. The information component forms the foundation on which the attitude is built. The affective component involves feelings, and it is this component which attitude scales attempt to measure. The third component, the action component, represents the extent to which the attitude has habits of action associated with it.

Measurement of Attitudes

One of the first studies on attitude research was by Thurstone and Chave.[5] They developed an attitude scale

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[2]David Krech, Richard S. Crutchfield and Egerton L. Ballachey, Individual in Society, New York: McGraw-Hill, 1962, p. 177.

[3]Gordon W. Allport, "The Historical Background of Modern Social Psychology," Handbook of Social Psychology, Vol. 1, Cambridge, Mass.: Addison-Wesley, 1954, p. 45.

[4]Daniel Katz and Ezra Stotland, "A Preliminary Statement to a Theory of Attitudinal Structure and Change," Psychology: A Study of a Science, Edward S. Koch, New York: McGraw-Hill, 1959, p. 399.

[5]Louis L. Thurstone and Ernest J. Chave, The Measurement of Attitudes, Chicago: The University of Chicago Press, 1929, pp. 16-17.

which consisted of a series of statements of opinion each of which is allocated to a particular point on a continuum, which ranges from an extreme point of view on one end to the opposite extreme on the other end. The method of constructing this scale involves formulating a large number of nonmonotone items related to the object of the attitude in question, i.e., items that will cause diagreement between persons placing the items on the attitude continuum. These items are then sorted by a sizable number of judges into 11 piles or categories which appear to the judges to be equally spaced in terms of the degree to which the items reflect the underlying attitude. The piles thus formed are then numbered from 1 to 11, and a scale value is determined for each item by computing the median of the position given the item by all judges. A interquartile range or Q value, is then computed which is a measure of interjudge variability, and all items for which there is much disagreement are rejected. A small number of items for the final scale are then selected so that they are spread more or less evenly along the attitude continuum. In using the scale, the respondent is asked to check each item with which he agrees. His score is the median of the scale values of all the items checked. Thurstone, thus conceived of attitude in the singular as being a point on the scale and a broader concept of an attitude to be represented by an area along the scale.

This early work by Thurstone removed much doubt about the use of opinions as indices of attitude.

Likert[6] modified the Thurstone procedure for construction of attitude scales by introducing a system of arbitrarily assigning values to the attitude scale. This is commonly known as the method of summated ratings. Scale construction requires the selection of a large number of monotone items, i.e., items having the characteristic that the more favorable the individual's attitude toward the attitude object, the higher his expected score for the item. The multiple response allows a respondent to indicate his reaction to the item by rating it in one of five categories: strongly agree, agree, undecided, disagree, and strongly disagree. The categories are scored by assigning values of 5, 4, 3, 2, and 1, respectively. This scoring procedure is reversed for negatively worded items. Thus one-half of the items are designed in such a way that "agree" would represent a favorable response, while selection of "disagree" in the remaining one-half would also indicate favorability. In using the scale the respondent uses the five-point rating scale to respond to the items in the final scale, and his score is computed as the sum of his individual item scores.

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[6]Rensis A. Likert, "A Technique for the Measurement of Attitudes," Archives of Psychology, Vol. 22, No. 140, 1932, p. 42.

The attitude scale used in this study is of the Likert type, i.e., employing the method of summated ratings.

The Likert and Thurstone scales are probably the most commonly used scales to measure attitude. The advantage of the Likert scale is that it is easier to construct and score. It is difficult to compare these two methods of attitude scale construction, but one study by Edwards[7] indicates that both scales have similar reliabilities.

Achievement and Attitude

There have been a number of studies carried out dealing with attitude as it relates to achievement. Neale, Gill and Tismer[8] report significant positive correlations between attitude and achievement. Their

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[7]Allen L. Edwards, Techniques of Attitude Scale Construction, New York: Appleton-Century-Crofts, 1957, pp. 167-168.

[8]Daniel C. Neale, Noel Gill and Werner Tismer, "Relationship Between Attitudes Toward School Subjects and School Acievement," The Journal of Educational Research, Vol. 63, No. 5, 1970, p. 235.

findings are supported by Buckeye,[9] Young,[10] and Shatlein.[11] However, all of this research deals with attitude and achievement in the specific subject area of mathematics. Doty and Doty[12] show that achievement appears to be related to a series of personality characteristics, one of which they define as attitude. They found a high positive correlation between grade point average and attitude toward the instructional mode. Frey, Shimabukuro and Woodruff[13] found that as the attitude of the pupil became negative, there was a marked decline in

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[9]Donald A. Buckeye, "The Effects of a Creative Classroom Environment on the Creative Ability of Prospective Elementary Mathematics Teachers," Dissertation Abstracts, Vol. 29, No. 6, p. 1801-A.

[10]Norman E. Young, "Effectiveness of Three Approaches to the Teaching of a Methods Course in Mathematics for Pre-Service Elementary Teachers as Related to Understanding and Attitude," Dissertation Abstracts, Vol. 29, No. 9, 1968, p. 2904-A.

[11]Stephen D. Shatlein, "A Study of the Change of Attitudes Toward Mathematics of Prospective Elementary Teachers," Dissertation Abstracts, Vol. 29, No. 9, 1968, p. 2904-A.

[12]Barbara A. Doty and Larry A. Doty, "Programmed Instruction Effectiveness in Relation to Certain Student Characteristics," Journal of Educational Psychology, Vol. 55, No. 6, 1964, pp. 334-338.

[13]Sherman Frey, Shinkichi Shimabukuro and A. B. Woodruff, "Attitude Change in Programmed Instruction Related to Achievement and Performance," A-V Communications Review, Vol. 15, No. 2, 1967, p. 204.

achievement. In a study by Hedlund and Neidt[14] it is reported that attitude becomes more closely related to achievement during the period of instruction. Tobias[15] reported that undergraduate college students' attitudes toward programmed and automated devices, and especially their attitudes toward traditional devices, were highly related to their actual achievement from an instruction program. Thus, persons with highly positive attitudes toward traditional devices, such as exercise books and workbooks, tend not to learn as much from new media, such as programmed instruction.

Contrary findings do exist. Jackson[16] concluded that nearly all investigations of the matter have found no statistically significant relationship between attitudes toward school and school achievement. However, the studies reviewed by Jackson concentrated on measuring general satisfaction with school, while the previous studies measured attitude toward specific school subjects. Thus, while there is some difference in the literature, in general there would seem to exist a positive correlation

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[14]Dalva C. Hedlund and Charles O. Neidt, "The Relationship Between Changes in Attitude Toward a Course and Final Achievement," Journal of Educational Research, Vol. 61, No. 2, 1967, pp. 56-58.

[15]Tobias, "Attitudes to Programmed Instruction," p. 304.

[16]Philip W. Jackson, Life in Classrooms, New York: Holt, Rinehart and Winston, 1968,p. 177.

between attitude and academic achievement, at least in specific subject areas.

Pupil Achievement in Relation to Teacher Attitudes

There is conflicting research as reported in the literature on the effect of teacher attitude on pupil achievement. Pinetz[17] and Cheikin[18] report no significant relationship between teachers' attitude and the academic achievement of pupils. However, Mastin[19] found that elementary teachers with a positive attitude toward their pupils and the subject matter being taught brought about a positive attitude in their pupils and enhanced their ability to acquire factual knowledge. Also, Tobias[20] suggests that teacher attitudes are likely to affect pupil achievement. Further, O'Toole[21] reports that in a

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[17]Midlred C. Pinetz, "The Relationship Between Teachers' Attitudes and Effectiveness in the Classroom," Dissertation Abstracts, Vol. 24, No. 6, 1963, p. 2340.

[18]Martin L. Cheikin, "An Investigation of the Effect of Measured Teacher Attitude on Selected Eight Grade Students," Dissertation Abstracts, Vol. 28, No. 10, 1967, p. 4042-A.

[19]Victor E. Mastin, "Teacher Enthusiasm," Journal of Educational Research, Vol. 56, No. 7, 1963, pp. 385-386.

[20]Tobias, "Attitudes to Programmed Instruction," p. 305.

[21]O'Toole, "Teachers' and Principals' Attitudes Toward Programmed Instruction," p. 431.

field study using programmed mathematics textbooks, programmed materials without the teacher was found to be superior to programmed material used by the teacher with a negative attitude.

Although the literature fails to show a causal relationship between teacher attitude and pupil achievement, it does reveal that teacher attitude is significantly related to pupil attitude. This would suggest that positive teacher attitude is important in developing positive pupil attitude. The significance of this is seen from the research dealing with the relationship of achievement and attitude cited earlier.

Attitude Toward Computer Assisted Instruction

It is evident from the literature that studies concerned with attitude toward computer assisted instruction are not abundant. However, there are some studies in existence. Christopher[22] found that public school administrators, when exposed to a Computerized Instruction Unit (CIV), exhibited a favorable attitude toward computer assisted instruction. In addition, Christopher found a relationship existing between knowledge of computer applications in education and favorable attitude

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[22]Christopher, Influence of Computer Assisted Instruction Upon the Attitudes of Administrators, pp. 70-71.

toward computer assisted instruction. Mathis, Smith and Hansen[23] report that college students involved in computer assisted instruction were more positive in attitude toward computer assisted instruction than the control group. This study also emphasized the fact that those individuals whose attitudes tended to be negative were those students who made many errors while being instructed by the computer.

Suydam and Mitzel[24] reported that the attitude of Applachia elementary teachers toward mathematics was generally positive after seven weeks of mathematics instruction by computer. In this same report, Borman[25] found that an overwhelming majority of all the Applachia elementary teachers completing the computer assisted instruction course of in-service mathematics education obtained scores which indicated that they were favorably disposed toward computer assisted instruction.

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[23]Mathis, Smith and Hansen, "College Students' Attitudes," pp. 50-51.

[24]Marilyn N. Suydam and Harold E. Mitzel, "Evaluation of Attitudes Toward Mathematics" in Inservice Mathematics Education via Computer-Assisted Instruction for Elementary Schools Teachers in Appalachia, Final Report No. R-26, University Park, Pennsylvania: Computer Assisted Instruction Laboratory, The Pennsylvania State University, January, 1970, pp. 15-18.

[25]Karl G. Borman, "Expressed Student Opinion Toward Computer-Assisted Instruction," Inservice Mathematics Education via Computer-Assisted Instruction for Elementary School Teachers in Appalachia, Final Report No. R-26, University Park, Pennsylvania: Computer Assisted Instruction Laboratory, The Pennsylvania State University, January 1970, p. 31.

Stieman[26] found that college students exposed to a computer assisted instruction laboratory in statistical inference showed measurable positive change in attitude toward the computer. What is more significant in this study is evidence showing that preconceived attitudes seemed to have a bearing upon the way an individual learns from the course.[27] Long[28] found that high school through college age students who were taught computer programming via the computer had positive attitudes toward the course, the hardware and the system environment.

In general, the literature indicates that exposure to the computer and computer assisted instruction tends to foster a positive attitude toward this mode of instruction.

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[26]Stieman, Evaluation of a Computer Assisted Instruction Laboratory, p. 37.

[27]Ibid., p. 45.

[28]Harvey S. Long, A Determination of the Relation of the Total Time for Course Completion to the Duration of the Study Interval in Teaching Via Computer Assisted Instruction, unpublished Doctor of Philosophy Thesis, New York University, 1968, pp. 86-90.

Computer Assisted Instruction

Feldhusen and Syabo[29] credit the teaching machines and programmed instruction movement, which grew out of the work of B. F. Skinner,[30] as being the major new educational development of the late 1950's and early 1960's. They also believe that the corresponding major development of the late 1960's and early 1970's will be computer assisted instruction. The increasing numbers of published reviews of the literature[31, 32] readily attest to the rapid development of computer assisted instruction.

Atkinson and Wilson[33] attribute the rate of growth of computer assisted instruction to the following: 1) the potential of computer assisted instruction to individualize instruction; 2) the development of

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[29]John Feldhusen and Michael Syabo, "The Advent of the Educational Heart Transplant, Computer-Assisted Instruction: A Brief Review of Research," Contemporary Education, Vol. 40, No. 6, 1969, p. 265.

[30]B. F. Skinner, The Technology of Teaching, New York: Appleton-Century-Crofts, 1968.

[31]Helen A. Lekah, Ed., Index to Computer-Assisted Instruction, Milwaukee: Instructional Media Laboratory, University of Wisconsin, 1969.

[32]Albert E. Hickey, Computer-Assisted Instruction: A Survey of the Literature, Newburyport: ENTELEK Inc., 1968.

[33]Richard C. Atkinson and Hal A. Wilson, Computer-Assisted Instruction: A Book of Readings, New York, London: Academic Press, 1969, pp. 3-4.

programmed instruction; 3) the tremendous growth of electronic data processing in general; and 4) the increasing aid to education by the federal government.

Stolurow[34] has identified five basic modes of instruction using the computer which are:

1. Problem solving. This mode allows a student to use the computer as a tool. He writes a program and enters the data. The computer then processes the data for the correct solution to the problem.
2. Drill and Practice. The computer presents learning materials such as spelling or arithmetic drills utilizing the same sequence and format giving the student repeated opportunities for response. The student uses his natural language with the objective being to build skills.
3. Inquiry Mode. The student uses his natural language as in Drill and Practice to address questions to the computer. The computer, using key words and search algorithms will retrieve an answer.
4. Simulation and Gaming. Using his natural language the student is given the option of varying

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[34]Lawrence M. Stolurow, "Some Factors in the Design of Systems for Computer-Assisted Instruction," In Computer-Assisted Instruction: A Book of Readings, eds. Richard C. Atkinson and Hal A. Wilson: New York, London: Academic Press, 1969, pp. 81-82.

the input with the computer quickly reporting the outcome of his decision.

5. Tutorial. This mode not only involves dialogue but also other modes. For example, the response to a student's question might be Drill and Practice or Simulation and Gaming. In addition a number of variations are possible within the various modes. In other words the system will not only have to select the proper mode as well as variation but do so depending upon the particular student and his past performance. According to Stolurow, this mode can be viewed as a form of artificial intelligence.

Gerard[35] identified these five benefits that computer assisted instruction will bring to the student. They are: 1) better and faster learning since the student can time his learning at his own convenience, go at his own pace, and catch up missed time; 2) better teaching at many levels and in many areas; 3) automatic measurement of progress; 4) personalized tutoring; and 5) the opportunity to work with rich materials and sophisticated problems.

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[35]R. W. Gerard, "Computers: Their Impact Upon Society," Journal of American Information Processing Societies, Vol. 27, No. 1, 1965, pp. 33-40.

Hansen and Harvey[36] predict the role of the teacher in a computer assisted instruction environment. They based their predictions on a pilot study by Hill and Furst[37] and the development pattern of computer assisted instruction. They predict that:

1. The teacher will perform much less of the information presentation function presently found in the classroom. The teacher will become more involved in the managerial and strategy functions found in the sequencing and evaluation of instruction.
2. Teachers will play less of the corrective role in terms of their questioning and evaluative behaviors. This undoubtedly will offer a significant step forward in teacher-student relationships in that much of the negative verbal behavior observed in classrooms will now be shifted to a more individualized and private interaction within CAI.

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[36]Duncan N. Hansen and W. L. Harvey, "Impact of CAI on Classroom Teachers," Educational Technology, Vol. 10, No. 2, 1970, pp. 47-48.

[37]Russell A. Hill and Norma Furst, "Teacher Behavior in CAI Classrooms," Educational Technology, Vol. 9, No. 2, 1969, pp. 60-62.

3. Teachers will become much more concerned with the host of individual characteristics important in designing an instructional strategy; thus the array of instructional resources and the decision making found in employing these resources will become more complex and also more frequent in terms of teacher behaviors.
4. The teacher will have a greater involvement in guiding individual students rather than in maintaining classroom discipline. With the computer relieving the teacher of the information presentation tasks, she will be able to devote the time usually expended in group communication to individual counseling and advising.
5. Teachers will have to perform a wider range of discussion techniques involving a richer opportunity to affect the social and emotional behavior of students. Teachers will have to have greater skill and understanding of human behavior, viewed in the broadest terms. This requirement may in part be aided by CAI system's information retrieval capability, which may monitor the patterns and rates of student development.
6. It is clear that the teachers will have a greater array of differentiated professionals joining

them in the team effort to provide optimal instruction. Some teachers may become experts in the guidance process, while others may become more competent in the application of technological procedures and functions for the fullest employment of computer technology.

7. Teachers may take on many more of the diagnostic assessment and prescriptive functions presently assigned the school psychologist. Teachers may, in fact, utilize more group interactive procedures in an attempt to develop latent social and creative talents within their students.

As Hansen and Harvey point out, these predicted professional roles of the classroom teacher offer a more creative and interesting world. However, they also challenge the teacher training institutions to anticipate the changing role of the teacher rather than following behind the classroom practice. Hansen[38] emphasized that the cost of the machinery is not nearly as important as the training of professionals to use this very powerful resource in a wise way.

Thus, it is clear that for computer assisted instruction to reach its full potential a new concept of the

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[38]Duncan N. Hansen, "Myths That Need to be Destroyed and Myths That We Ought to Create," Speech given at the National Conference on Computer Applications to Learning, Bloomfield Hills, Michigan, July 9, 1970.

teacher will have to emerge. It is also apparent that if there is to be any direction to the emerging role of the teacher in a CAI environment it will have to come from the institutions of teacher training.

According to Long,[39] the large numbers of articles appearing in the literature discussing computer assisted instruction suggest that this form of instruction has been in existence for a long period of time. Further he indicates this would also imply that computer assisted instruction has been subjected to extensive research, but this has not been the case. The review of the literature dealing with CAI tends to support Long's statement and this investigator could only identify the following studies dealing with this instructional method.

Uttal[40] identifies Gustave Roth and Nancy Anderson[41] as being the first researchers to use the computer for an

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[39]Long, Study Interval in Teaching via Computer Assisted Instruction, p. 21.

[40]William R. Uttal, "My Teacher Has Three Arms!!!" I.B.M. Research Report RC-788, 1962.

[41]Gustave J. Roth, Nancy S. Anderson and R. C. Brainerd, The IBM Research Center Teaching Machine Project in Automated Teaching: The State of the Art, Ed., E. Galanter, New York: John Wiley and Sons, 1959, pp. 117-130.

instructional tool. According to Long[42] this activity, which occurred in 1958, was not much different than the more sophisticated research which has been carried out to date.

Schwartz and Long[43] report that field engineers receiving required training through remote computer assisted instruction completed the course of instruction in considerably less time than a self-study group. This was also supported by Schwartz and Haskell.[44]

Feldman and Sears[45] in an exploratory study found that learners in a computer assisted instruction classroom became more academic in their classroom behavior, while the non-CAI children increased their nonacademic behavior the course of the year. Gilman and Moreau[46]

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[42]Long, Study Interval in Teaching via Computer Assisted Instruction, pp. 21-22.

[43]H. A. Schwartz and H. S. Long, "A Study of Remote Industrial Training," Journal of Applied Psychology, Vol. 51, No. 1, 1967, p. 11.

[44]H. A. Schwartz and R. J. Haskell, "A Study of Computer-Assisted Instruction in Industrial Training," Journal of Applied Psychology, Vol. 50, No. 5, 1966, p. 360.

[45]David H. Feldman and P. S. Sears, "Effects of Computer-Assisted Instruction on Children's Behavior," Educational Technology, Vol. 10, No. 3, 1970, p. 13.

[46]D. A. Gilman and N. A. Moreau, "Effects of Reducing Verbal Content in Computer-Assisted Instruction," A-V Communication Review, Vol. 17, No. 3, 1969, p. 297.

reported that by reducing the verbal content of a CAI program, the learning by the student did not decrease. However, it was found that the instructional time was reduced. They also reported a lower correlation between intelligence and learning on the part of the students who studied the low verbal content program.

O'Neil, Spielberger and Hansen[47] used a CAI program on complex numbers and compound fractions which could be completed in one sitting with 26 students who were given anxiety-inducing messages when they arrived. The program was divided into a hard and easy part. They found that students responded to difficult CAI materials with an increase in self-reported and physiologically measured anxiety (blood pressure). High-anxiety students also made more errors on the difficult portion of the program than low anxiety students, while low-anxiety students made more errors on the easy part of the program.

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[47]H. F. O'Neil, C. D. Spielberger and D. N. Hansen, "Effects of State Anxiety and Task Difficulty on Computer-Assisted Learning," Journal of Educational Psychology, Vol. 60, No. 5, 1969, pp. 345-350.

Hall, Adams and Tardibuono[48] studied the effects of providing feedback in the form of the full correct response when an error was made or of pointing out matching letters of the alphabet between the correct answer and that given by the student. College undergraduate students learned states and capital cities. The group that received full response feedback took significantly less time to complete the program, but the amount learned did not differ significantly between groups.

Diamond[49] reported that no difference in learning was found between high school and junior high school students taught biology by CAI and students in traditional classes. However, Scrivens[50] reported that fourth and fifth grade students receiving English lessons by CAI during a four-month period showed a gain of seven months while the control groups showed a gain of three months.

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[48]Keith A. Hall, Marilyn Adams and John Tardibuono, "Gradient- and Full-Response Feedback in Computer-Assisted Instruction," Experimentation With Computer-Assisted Instruction in Technical Education, Semi-annual Progress Report R-6, University Park, Pennsylvania: Computer Assisted Instruction Laboratory, The Pennsylvania State University, June, 1967, p. 11.

[49]James J. Diamond, A Report on Project Grow: Philadelphia's Experimental Program in Computer-Assisted Instruction, Philadelphia, Pennsylvania: Office of Research and Evaluation, The School District of Philadelphia, August, 1969, p. 11 of Section 2.

[50]Robert W. Scrivens, Evaluation Monograph No. 1, Waterford, Michigan: U.S.O.E. Grant 67-04301-0, Waterford Township School District, February, 1970, p. 59.

In this same report it was noted that significant gains were recorded in mathematics for grades three and four. Probably a more significant result was that students' attitudes toward mathematics appeared to have been enhanced by CAI.

Schurdak[51] found that college students taught the computer language FORTRAN by CAI scored significantly higher on achievement tests than equal groups taught either by programmed test or a conventional textbook-workbook combination.

Bitzer and Boudreaux[52] reported that student nurses instructed by the PLATO system did not show significant gains in learning over the control group, but there was a significant reduction of instruction time. They also report that favorable student response to CAI seemed to increase with exposure to the system.

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[51]John J. Schurdak, "An Approach to the Use of Computers in the Instructional Progress and an Evaluation," The American Educational Research Journal, Vol. 4, No. 1, 1967, pp. 71-73.

[52]Maryann D. Bitzer and Martha C. Boudreaux, "Using a Computer to Teach Nursing," Reprint from Nursing Forum, Vol. 8, No. 3, 1969.

Potentials of Computer Assisted Instruction

Alpert and Bitzer[53] provide an excellent discussion of advances in the field of computer assisted instruction. They point out that not only is the computer a powerful tool for drill and practice in basic courses in well-defined content areas, but the PLATO II and III systems have also demonstrated the feasibility of using a diversity of strategies in a variety of courses.

Slavens[54] has utilized the computer to develop and test materials to train reference librarians. Author-controlled linear programmed exercises were tested via the computer. These programs were then revised, validated and transferred to a standard printed format for student use. In addition to these programs, the computer simulated a library user and the student acted as a reference librarian. Thus, the computer terminal acted as a means of communication or interface between the student and computer. The student librarian interacted with the computer as in a real life situation or in other words as a problem was presented by the computer, the student

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[53]D. Alpert and D. L. Bitzer, "Advances in Computer-Based Education," Science, Vol. 167, No. 3917, 1970, pp. 1582-1590.

[54]Thomas Slavens, Development and Testing of Materials for Computer-Assisted Instruction in the Education of Reference Librarians, U. S. Department of Health, Education and Welfare, Project No. 80560, 1970.

librarian would proceed to ask questions which would classify the user's problem. In the final outcome, the student librarian would recommend the best reference work for the user's particular need.

The use of games and simulation has been developed by Wing[55] to teach economics to sixth grade students. Castleberry and Lagowski[56] report the simulation of laboratory experiments in chemistry at the University of Texas. Mortensen and Penick[57] have also developed simulation games for chemistry. These programs enable the student to take part in experiences that would be impossible in a normal school setting because of the factors of time and/or safety.

Kemeny and Kurtz[58] describe how the Dartmouth Time-Sharing system utilizes the computer effectively in college teaching. This system can serve many users at the same time, at many locations, on and off campus, by

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[55]R. L. Wing, "Two Computer-Based Economics Games for Sixth Graders," American Behavioral Scientist, Vol. 10, No. 1, 1966, pp. 31-36.

[56]S. Castleberry and J. J. Lagowski, "Individualized Instruction Using Computer Techniques," Journal of Chemical Education, Vol. 47, No. 2, 1970, pp.91-96.

[57]Earl M. Mortensen and Ronald J. Penick, "Computer Animation of Molecular Vibrations: Ethane," Journal of Chemical Education, Vol. 47, No. 2, 1970, pp. 102-104.

[58]John G. Kemeny and Thomas C. Kurtz, "Dartmouth Time-Sharing," Science, Vol. 162, No. 3850, 1968, pp. 223-228.

means of ordinary telephone lines. In addition, students and faculty are able to learn how to write and correct their own programs in a short period of time and with little inconvenience. This is primarily due to the simple interactive BASIC language used by the system. Another interesting feature of the system is the ability of the computer to check the program as it is written by the student or faculty member and give him hints when errors are made.

Another application of the computer to education is in the management of instruction. In this mode the computer is not limited to the role of an interactive device for the student but rather controls all aspects of his education. This would range from working out an individual daily schedule for the student, keeping track of all his learning activities and informing him as to what particular learning sequence he should start next in mathematics based on his past performance in this area, to giving him instruction using one of the instructional strategies as outlined by Stolurow.[59] At this time most studies utilizing the computer to manage instruction are still being evaluated. However,

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[59]Stolurow, "Systems for Computer-Assisted Instruction," pp. 81-82.

Gallagher[60] has reported that student selected sequence groups demonstrated superior performance over computer assigned sequence groups.

It should be emphasized that the list of computer applications to education are growing, and these examples are but a small part of the total. Nevertheless, the examples do serve to show the wide range of subject matter and instructional strategies to which the computer can be applied.

Summary

Although the computer, and especially computer assisted instruction, has not been in existence for very long, it is evident from the literature that the growth of this instructional strategy is accelerating. It would also seem that in general there exists a positive correlation between attitude and academic achievement, at least in specific subject areas. While no causal relationship between teacher attitudes and pupil attitudes has been found the relationship does seem to be positive. It is also evident that exposure to a computer and CAI tends to foster a positive attitude toward them.

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[60]Paul D. Gallagher, An Investigation of Instructional Treatments and Learner Characteristics in a Computer-Managed Instruction Course, Tech. Report No. 12, Tallahassee, Florida: Computer-Assisted Instruction Center, Florida State University, 1970, pp. 56-59.

The present research on computer assisted instruction would lead to the conclusion that CAI can do as well for better than traditional teaching methods, but in less time. This in itself may be a significant factor in the near future with education's problem of an expanding population and a corresponding need for extended education.

There can be no doubt that a redefining of teacher roles will be necessary to insure that computer assisted instruction will become an effective and efficient tool of education. This, in turn, stresses the importance for institutions of higher learning to recognize the challenge of teacher education for tomorrow and meet the challenge today.

CHAPTER III

METHODS AND PROCEDURES

In this chapter the procedures and methods used in conducting the study are presented. This includes construction of the measures used to indicate teacher and principal knowledge of and attitude toward computer assisted instruction. Also the methods used to establish the reliability and validity of these two measures are discussed. In addition the development of the background questionnaire, a description of the geographic area of the study, a description of the sample, sampling procedures, methods used to collect and analyze the data, and a summary are presented.

Development of the Attitude Scale

A twenty-item attitude scale (Appendix A) was constructed to determine teacher and principal attitude toward computer assisted instruction. The items making up this instrument were taken from two previously constructed attitude scales. Thirteen items were chosen from an attitude scale constructed by G. R. Christopher[1]

[1]Christopher, Influence of Computer Assisted Instruction Upon the Attitudes of Administrators, pp. 111-114.

to measure public school administrator attitudes toward computer assisted instruction. The original scale contained forty-seven items. However, only thirteen items were used from the instrument and not the entire questionnaire for the following reasons: Christopher's original instrument was designed for administrators in the public schools. However, the thirteen items selected by this researcher were considered to be appropriate to both teachers and principals who constitute the sample of this study. Also research has shown that the return rate for surveys increases as an instrument decreased in length.[2] Thus, since in the present study, a sufficiently large response was needed, it seemed important to use as short an instrument as possible to increase the return rate.

The remaining seven items were taken from a twenty-item attitude scale developed by H. A. Pearson.[3] The Pearson instrument was designed to measure attitude toward programmed instruction, therefore, only some of the items of this instrument were applicable to the present study,

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[2]Larry L. Leslie, "Increasing Response Rates to Long Questionnaires," The Journal of Educational Research, Vol. 63, No. 8, 1969, pp. 347-350.

[3]Harry A. Pearson, Programmed Instruction for Groups of Teachers in Remote Locations: Prototype Development, unpublished doctoral thesis, Michigan State University, 1969, pp. 176-177.

and these items could be made appropriate to the present study only with minor modifications, such as changing the word "programmed" to "computer assisted." The rationale for selecting these seven items from the Pearson instrument was that these particular items covered areas not included in the Christopher instrument. Further, these seven items were considered appropriate to both teachers and principals who constitute the sample of this study. The rationale for changing the word "programmed" to "computer assisted" was that since this study focuses specifically on CAI rather than programmed instruction, the term "programmed" would not be appropriate. This change was made under the assumption that this is acceptable on the basis of consultation with Dr. William Schmidt of the Educational Psychology Department, Michigan State University, and also on the basis of research reported by Mathis, Smith and Hansen,[4] where an attitude scale was modified in a very similar way to obtain data for that study.

Ten of the items selected reflected negative or unfavorable attitudes toward computer assisted instruction such as: computer assisted instruction is an impersonal teaching approach. The remaining ten items reflect a

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[4]Mathis, Smith and Hansen, "College Students' Attitudes Toward Computer Assisted Instruction," pp. 46-51.

positive or favorable attitude toward computer assisted instruction such as: computer assisted instruction will improve instructional programs.

Attitude Scale Validity

The face validity of each item and the whole scale was estimated by asking three persons with experience in computer assisted instruction to rate the face validity of each item and the whole scale on a five-point scale from 0 for "no apparent validity" through 4 for "very high face validity." An index for each item and the whole scale was calculated by adding all ratings for each item and the whole scale and dividing by twelve. This divisor of twelve was derived by multiplying the maximum rating possible by the total number of judges. Thus, the maximum face validity index possible was 1.00 and the minimum was 0.00.

The face validity index computed for the whole scale was .750. The item indices for the attitude scale are given in Table 1 below.

Table 1. Face Validities of the Attitude Scale Items*

Item Number	Face Validity
1	.500
2	.750
3	.917
4	.583
5	.833
6	.833
7	.750
8	.583
9	.500
10	.583
11	.667
12	.917
13	.750
14	.583
15	.917
16	.667
17	.667
18	.667
19	.667
20	.750

*Calculated from rating by three persons on a five-point scale with a validity index of:
1.000 = very high face validity
0.750 = high face validity
0.500 = medium face validity
0.250 = low face validity
0.000 = very low face validity

Thus, it can be seen that according to this procedure, the constructed scale, as a whole, had "high face validity."

To establish construct validity, a variation of the known-groups technique was employed. This technique assumes that two or more groups should hold different attitudes toward a given object. It would also be expected that a valid scale to measure the attitude in question

should produce different scores for these groups. Thus, one might validate a scale to measure attitude toward Sunday observance by showing that Baptists score higher (have a more positive attitude toward Sunday observance) than do Seventh Day Adventists.[5]

The details of the variation of the known-groups technique used in this study are given in the following paragraphs.

It was necessary to identify two groups with which to validate the attitude instrument: one group would be assumed to have positive attitudes with respect to CAI, the other group would be assumed to have a variety of attitudes ranging from the positive to the negative.

Assuming the attitude instrument does reflect attitudes toward CAI, the first group should score higher on the instrument than the second group. It would also be expected that the range of scores for the first group to be less than the range of scores for the second group.

The first group, identified for this purpose, consisted of fifty-two participants in a pre-conference seminar held at Mott Riverside High School, Waterford, Michigan. These participants were considered similar to the target population, however, there were more

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[5]Shaw and Wright, eds., Scales for the Measurement of Attitudes, p. 19.

administrators in this group than teachers. The conference itself was one dealing with computer applications to learning with the main theme being computer assisted instruction (CAI). This seminar was designed to provide basic information to those participants who had indicated prior to the conference that they had no knowledge of CAI. As part of the pre-conference registration all participants were asked to indicate place of employment; i.e., elementary, secondary or higher education, and position held; i.e., administrator or teacher. This information was used to insure that no participant employed by a school district in the target population of this study would be included in this validation procedure. However, considering the technique used to establish construct validity, nine of these participants were excluded from the testing. These individuals were employees of the Michigan Department of Education who were attending the seminar on assignment, and not voluntarily. Therefore, no assumption could be made in regard to their attitude toward CAI. This left forty-three subjects to be tested in this group. In addition, all instruments were administered and collected prior to conducting the seminar.

The second group to which the attitude scale was administered consisted of two general curriculum classes of ten and twenty-eight graduate students each at Michigan

State University. Care was taken to insure that members of either class employed by any of the schools in the target population of interest were not included in the validation procedure. This was done by consulting with the instructors of the classes prior to testing. Both instructors had collected some biographical information about their students which included teaching or administrative experience and place of employment. These precautions were taken with both groups for the following reasons: first, this insured the validity of the field testing procedure, and second, this insured that the population of this study would not be contaminated. Thus, the assumption was made that the pre-conference seminar group would have more favorable attitudes toward CAI than the general curriculum group and this difference would be significant. This assumption was stated in the form of a null statistical hypothesis such that:

> There will be no difference between mean attitude scores for the seminar group and the mean attitude scores for the curriculum group
>
> Symbolically: Ho: $\mu_1 = \mu_2$
> Hi: $\mu_1 \neq \mu_2$
>
> Legend: μ_1 = seminar group mean
> μ_2 = curriculum group mean
>
> Decision rule: Reject Ho if $t > 2.33$ at $\alpha = .01$

It was also assumed that the range of scores for the pre-conference group would be less than for the general curriculum group.

In order to test this hypothesis and assumption and attempt to establish construct validity, the attitude scales were scored for each individual in both groups. For scoring purposes the attitude scales were weighted *a priori* by the researcher so that items reflecting a favorable attitude had a weight of 5 for strongly agree to 1 for strongly disagree and items reflecting a negative attitude had a weight of 1 for strongly agree to 5 for strongly disagree. Thus, the possible range of scores was from 20 to 100 with the higher the individual score the more positive the attitude. After scoring the attitude scales, the t-test, as given by Hays,[6] for unequal variances and sample sizes, was used to determine if the null hypothesis could be rejected. The results are given in Table 2 below.

Table 2. Attitude Scale Construct Validity Statistics

Pre-conference mean score	75.49
General curriculum mean score	64.90
Estimated standard deviation	2.76
Corrected number of degree of freedom	58
Computed t statistic	3.84*

*Significant at the .01 level

[6]William L. Hays, Statistics, New York, Chicago, San Francisco, Toronto, London: Holt, Rinehart and Winston, 1963, pp. 317-322.

The computed t statistic indicates that the difference between the mean scores for the two groups is certainly significant. Therefore, the null hypothesis was rejected and the alternative hypothesis accepted. In addition, as Table 3 indicates, the range of scores for the pre-conference seminar group is much more narrow than the general curriculum group, having a spread of 36 points as compared to 62 points for the second group. This would agree with the previously stated assumption. Thus, on the basis of the t statistic and range of scores computed for both groups, the attitude scale is considered to have construct validity.

Table 3. Range of Scores for Two Groups Given a CAI Attitude Scale (Possible Range 20-100)

Group	N	Range
Pre-conference	43	57-93
General Curriculum	38	36-98

Attitude Scale Reliability

In order to establish the reliability of the instrument, subjects that were as similar as possible to the subjects to be sampled from the target population were used. The two curriculum classes of ten and twenty-eight students each that were used to establish construct validity were considered appropriate for this task. These students were all practicing or experienced teachers

and administrators. Also, both the secondary and elementary levels of instruction were represented by both groups. In addition, the previously described precautions were taken to insure that none of the individuals were employed by any of the schools in the geographic area delimited to this study.

The same *a priori* weighting procedure previously discussed in establishing construct validity was employed. The weighted responses were key punched and verified. These responses were then analyzed by the Control Data Corporation's (CDC) 3600 computer at the Michigan State University Computer Center using the FORTAP program[7] which computed the Hoyt's reliability coefficient.[8] The attitude scale reliability statistics are given in Table 4 below.

Table 4. Attitude Scale Reliability Statistics (N = 38)

Standard Error	3.2553
Hoyt's Reliability Coefficient	.9487

[7]David J. Wright, FORTAP: A Fortran Test Analysis Package by F. B. Baker and T. J. Martin, Occasional Paper No. 10, East Lansing: Office of Research Consultation, Michigan State University, 1970, pp. 8-13.

[8]Cyril J. Hoyt, "Test Reliability Estimated by Analysis of Variance," in Principles of Education and Psychological Measurement: A Book of Selected Readings, ed. by William Mehrens and Robert L. Ebel, Chicago: Rand McNally & Co., 1967, pp. 108-111.

This reliability is considered adequate for the purpose of the study.

Development of the Test for Knowledge of CAI

A test to measure knowledge of computer assisted instruction was developed from a pool of multiple choice test items submitted by known experts in this field. The researcher also modified submitted items to meet the criterion of multiple choice. This group of experts was identified by the University of Wisconsin listing of computer assisted instruction project directors.[9] The majority of these identified experts were contacted by mail. The letter (Appendix B) included a statement of the purpose of this study and a stamped, self-addressed envelope to be used for their reply. One hundred and one letters were mailed to these identified experts on computer assisted instruction in the United States and Canada. A total of twenty-one people responded for a return of 20.8%. From these twenty-one responses a total of twenty-seven test items were submitted. All twenty-seven items were of the true-false type which were then changed to the multiple choice form.

Personal contact was made with some practitioners in the field of CAI. This was possible because of the work

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[9]Lekan, Index to Computer Assisted Instruction, pp. 283-295.

that the researcher was engaged in as an interm with the E.S.E.A. Title III Office of the Michigan Department of Education. The primary responsibility of this internship was the coordinating of a national conference on computer applications to learning, the main theme of which was computer assisted instruction. This conference was held in cooperation with project INDICOM,[10] a computer assisted instruction project in the Waterford Public Schools, Waterford, Michigan. This afforded the researcher an opportunity to become acquainted with the entire staff, as well as with Mr. Ronald Arnold, the director of the project. At the request of the researcher, Mr. Arnold and twelve staff members selected by him were asked to submit multiple choice test items to be used in the construction of the final test instrument. These staff members were selected by Mr. Arnold on the basis of experience and expertise with computer assisted instruction. A total of forty-five items of a multiple choice form were submitted by this group.

From this total pool of seventy-two items, forty items were selected to be field tested. These items were selected because they were judged by the writer to represent a range of important aspects about CAI and no two questions pertained to the same aspect. These forty

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[10]Computer Based Individualized Instruction Program

items were put into two separate test forms, A and B, for purposes of field testing. The reason for using two forms was due to the time constraint imposed by the nature of the groups available for field testing. The same groups that were used to establish the attitude scale validity and reliability were also used to field test the two forms of the knowledge instrument. In addition, all groups were administered both the attitude scale and the instrument to measure knowledge concurrently. Since the groups used for field testing were gathered for other reasons, the time allocated for this purpose was limited. Therefore, two short forms of the test were necessary rather than one long form.

In all, three separate groups were used to field test the knowledge instrument, the fifty-two participants to the pre-conference seminar and the thirty-eight graduate students in the general curriculum classes at Michigan State University, previously described. Out of this total number of ninety subjects, forty-six individuals were administered form A and forty-four individuals received form B. However, the responses of two persons receiving form B were discarded because of their being incomplete. In addition, precautions which have been previously described were taken to insure that none of the individuals involved in the field testing were employed by any of the school districts that were part of this study.

The eighty-eight response sets resulting from the field testing were divided into two groups according to test form. The individual responses for each group were coded onto optical scanning forms in preparation for scoring and item analysis by the Office of Evaluation Services, Michigan State University. The tests were scored by the IBM 1230 Optical Scanner with the individual scores and item responses stored on magnetic tapes. These tapes were then sent to the Data Processing Department of Michigan State University where the item analysis was computed by an IBM 360/40 computer using a program written for this purpose by the Office of Evaluation Services.

The selection of items to be included in the final instrument was made on the basis of the index of difficulty and the index of discrimination resulting from the item analysis. The index of difficulty reported in this study is the proportion of the total group who got the item wrong. Thus, a high index indicates a difficult item and a low index indicates an easy item. The index of discrimination reported in this study is the difference between the proportion of the upper 27% of the total group who got an item right and the proportion of the lower 27% of the total group who got the item right. Those items which had the highest index of discrimination and an indix of difficulty as close to 50 as possible were selected. In addition, some of the selected items were

modified on the basis of the operation of the item distractors as determined by the item analysis. For example, if an item had four responses or distractors, ideally the respondents who answered the item incorrectly should select each incorrect option in roughly equal proportions rather than concentrating on a single incorrect option.[11] Those selected items which had distractors which were judged as ineffective were changed in an attempt to correct this weakness.

Test forms A and B along with item difficulty and discrimination indices can be found in Appendix C. Based on the procedures described, the final instrument used to measure knowledge of computer assisted instruction in this study was derived from the original forty selected items. This instrument has twenty-three items each of which has four distractors with only one being considered correct (Appendix D).

Test Validity

It is assumed that the items used in constructing the instrument have content validity by virtue of the experts who submitted them.

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[11] Item Analysis, East Lansing: Office of Evaluation Services, Michigan State University, Mimeographed, October, 1970, p. 2.

The face validity of each item and the whole scale was estimated by asking three persons with experience in computer assisted instruction to rate the face validity of each item and the whole scale on a five-point scale from 0 for "no apparent validity" through 4 for "very high face validity." An index for each item and the whole scale was calculated by adding all ratings for each item and the whole scale and dividing by twelve. Twelve is equal to the maximum rating possible multiplied by the number of judges. Thus, the maximum face validity index possible was 1.00 and the minimum was 0.00. The face validity index computed for the whole knowledge instrument was .750. The item indices for the knowledge instrument are given in Table 5 below.

Table 5. Face Validities of Knowledge Test Items*

Item Number	Face Validity
1	.750
2	.833
3	.583
4	.750
5	.833
6	.833
7	.750
8	.500
9	.667
10	.750
11	.667
12	.917
13	.833
14	.667
15	.917
16	.833
17	.667
18	.750
19	.667
20	.750
21	.750
22	.750
23	.417

*Calculated from rating by three persons on a five-point scale with a validity index of:
1.000 = very high face validity
0.750 = high face validity
0.500 = medium face validity
0.250 = low face validity
0.000 = very low face validity

Thus, it can be seen that according to this procedure, the scale, as a whole, has "high face validity."

Development of the Background Questionnaire

A background questionnaire (Appendix E) was developed in order to gather selected bibliographical information

about the respondents sampled. This information was used to determine if the variables of age, professional position (teacher-principal), educational community type (rural-urban), subject matter responsibility if a secondary teacher, and educational level (secondary-elementary) are related to attitude toward computer assisted instruction.

This background questionnaire was reviewed by several teachers and administrators and the format modified based on their criticism.

The rural-urban classification system used in this study is based upon the one used by the Michigan Department of Education in the state assessment program.[12] This program categorizes Michigan school districts on the basis of the following community types:

Type 1

Metropolitan Core: One or more adjacent cities with a population of 50,000 or more which serve as the economic focal point of their environs.

Type 2

City: Community of 10,000 to 50,000 that serves as the economic focal point of its environs.

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[12] Activities and Arrangements for the Michigan Assessment of Education, Assessment Report Number Two, Prepared in the Bureau of Research, Michigan Department of Education, December, 1969, pp. 10-11.

Type 3

Town: Community of 2,500 to 10,000 that serves as the economic focal point of its environs.

Type 4

Urban Fringe: A community of any population size that has as its economic focal point a metropolitan core or a city.

Type 5

Rural Community: A community of less than 2,500.

For the purposes of this study, the Type 1, 2, and 4 school districts were treated collectively as urban, and Type 3 and 5 districts were treated collectively as rural. However, it should be recognized that the classification of rural and urban used in this study is a far cry from what is usually characterized as such. According to Webster:

> The test whether a tenement is rural or urban is not the place where the property is situated, but the use to which it is devoted.[13]

The report used by this writer used the criteria of population and economic focal point of the inhabitants to establish the community type to which the school district bebngs. In this respect, the classification system used

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[13] Webster's New International Dictionary of the English Language, Second Edition, 1956.

in this study is limited to the definition of rural-urban used by the Michigan Department of Education state assessment report number 2.[14]

For the purpose of this study, administrators and teachers who worked with students in grades K-6 were classified as elementary while secondary educators were classified as individuals who worked with students in grades 7-12.

Geographic Area of the Study

Washtenaw County, Michigan (Appendix F), was selected as the geographic unit to which this study was delimited. This county was considered as having all of the attributes necessary for the study. There were all five community types of school districts in the county none of which are less than K-12. The county was geographically small enough to allow the researcher to make personal contact with the sample members and lease telephone lines, which were available to the researcher, were connected to all of the target schools in the study for follow-up.

Washtenaw County is a member county in Michigan's southeastern economic region. This region is the state's population center. On an area representing only 8% of

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[14] Activities and Arrangements for Michigan, pp. 10-11.

Michigan's land mass, the southeastern region supports over 55% of the state's total population.

Washtenaw County has a semi-independence from metropolitan Detroit. There is considerable industry directly related to Detroit's manufacturing activities, but the product, not the workers, travel to Detroit.

Within Washtenaw County, between 1954 and 1964, both farm and farm incomes were becoming larger. However, the number of farms was declining. The breakdown of occupations for the county, based on the 1960 census, reveals that the job structure is predominantly non-agriculture with professional and technical occupations constituting the largest group in the population (23%). Thus, higher education is the county's predominant product. In 1966 one out of every five persons living in the county was a student following an education program beyond the high school level.[15]

Description of the Sample

The sample of this study was delimited to randomly selected secondary and elementary teachers and all of the principals from the ten school districts located in Washtenaw County, Michigan (see Table 6). The sample members worked with kindergarten through twelfth grade

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[15]Washtenaw County Planning Commission, Recent Economic Trends in Washtenaw County, Ann Arbor, Michigan, July, 1966, pp. 1-29.

students. Thus, teachers and principals whose primary responsibility were grades K-6 were considered as elementary, and a secondary person was considered as an individual whose primary responsibility was working with students in grades 7-12.

Table 6. School Districts Included in the Study*

School District	Location
U1. Ann Arbor Public Schools	Ann Arbor, Michigan
R2. Chelsea Schools	Chelsea, Michigan
R3. Dexter Community Schools	Dexter, Michigan
R4. Lincoln Consolidated Schools	Ypsilanti, Michigan
R5. Manchester Public Schools	Manchester, Michigan
R6. Milan Area Schools	Milan, Michigan
R7. Saline Area Schools	Saline, Michigan
R8. Whitmore Lake Public Schools	Whitmore Lake, Michigan
U9. Willow Run Public Schools	Ypsilanti, Michigan
U10. Public Schools of Ypsilanti	Ypsilanti, Michigan

*Those schools whose name is preceded by the symbol U were treated as urban while those with the symbol R preceding their name were treated as rural.

Sampling Procedures

In order to carry out the study, it was necessary to obtain lists of teachers and principals by school districts and educational level (secondary-elementary). The writer obtained these lists by calling each of the respective school districts included in this study. The writer was very fortunate in being employed by the Michigan Department

of Education at the time this study was conducted. The director of E.S.E.A. Title III, Don Goodson, gave the researcher permission to make this request under the title of his office. This made the process of getting teacher and principal lists by level within the school districts relatively easy. In addition, this insured cooperation by the ten school districts involved.

On the advice of Dr. Maryellen McSweeney of the Educational Psychology Department, Michigan State University, it was decided to stratify the sample on the variables of position and level held in education as well as community type. Age was not included because this information would not be available until the data had been gathered and the background questionnaire analyzed. The other variables were taken from the teacher lists that were furnished by the ten local districts and the state assessment report number 2.[16]

In regard to the sample size needed to determine if a relationship existed between knowledge and attitude, it was determined that if 25% of the estimated variance of attitude was accounted for by knowledge, then a correlation of .50 would be significant at the .05 confidence level using a sample size of 40.

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[16] Activities and Arrangements for Michigan, pp. 10-11.

The technique of proportional sampling of teachers was employed in this study. Thus, 10% of the teachers that were classified under each variable on which the sample was stratified were randomly selected. All of the principals were included in the sample because of their small number in the total population of interest. This procedure gave a sample size that was considered adequate to test all of the hypotheses of this study.

The lists of teachers from those school districts classified in this study as urban were randomly put together and those lists from districts considered rural were also randomly compiled. The researcher then consecutively numbered from 1 through X those teachers who were classified as elementary and the same procedure was used for those teachers considered as secondary. This method was employed for both the rural and urban classified schools. Then using a table of random numbers,[17] proportional numbers of teachers were selected based on the variables used to stratify the sample. The matrices below show the numbers of principals and teachers by category in the sample of this study.

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[17]Sidney J. Armore, Introduction to Statistical Analysis and Inference, New York, London, Sidney: John Wiley and Sons, Inc., 1966, pp. 498-499.

	TEACHERS	
	Rural	Urban
Elementary	30	76
Secondary	32	68

	PRINCIPALS	
	Rural	Urban
Elementary	11	38
Secondary	12	11

Thus, the total number of subjects in the sample of this study was 278, or 206 teachers and 72 principals.

Collection of Data

The final seventy-two packets of materials were mailed to the principals in the study. The questionnaires were then distributed by the principals to the teacher(s) in their schools who were part of the study. In addition, a questionnaire was included for each principal with instructions to complete and return it with the others from his school.

In some cases, due to the random selection procedure, a principal would not have any teacher(s) in his building who were part of the sample of this study. In that case he would receive only one questionnaire to be completed and returned by him. Each packet contained the following:

1. Cover letter to the principal*
2. Self-addressed, stamped, return envelope

*This letter varied somewhat, dependent upon whether there were teachers who were part of the sample in the principals' building or not.

3. List of teachers to receive the questionnaire(s)**
4. Questionnaire(s) which included
   A. Cover letter
   B. Background instrument
   C. Attitude scale
   D. Test of CAI knowledge

In an effort to increase the number of responses, the following additional techniques were employed:

1. The responses were requested to be returned to the E.S.E.A. Title III Office, Michigan Department of Education.
2. Each cover letter to the principal was personally signed.
3. A date for the return of the forms was given in the letters for both teachers and administrators.
4. Follow-up letters were mailed promptly to those principals who had not returned the forms by the designated date.
5. A week after the follow-up letter was sent, those principals who had not responded were contacted by phone.
6. The respondents were requested to remain anonymous.

**Inclusion of this list was dependent upon the random sampling procedure used.

7. The results of the study were promised to those schools and individuals involved in the study.

A copy of the cover letters and the follow-up letter are included in Appendix G.

Of the 278 survey instruments mailed, 256 instruments were returned for a 92.0% response rate. Four of these instruments were eliminated from the analysis because they were incomplete. Therefore, 252 instruments were used for the analysis of the data which represented a 90.6% response. The breakdown of this return by categories is given below in Table 7.

Table 7. Numbers and Percentages of Questionnaires Returned by Categories

Category	Number Mailed	Number Returned	Percent Returned
Secondary urban teachers	68	67	98.6
Secondary rural teachers	32	32	100
Elementary urban teachers	76	65	85.5
Elementary rural teachers	30	28	90.3
Secondary urban principals	11	10	90.0
Secondary rural principals	12	10	83.3
Elementary urban principals	38	30	78.9
Elementary rural principals	11	10	90.3

Analysis and Preparation of the Data

Each of the returned sets of instruments was prepared for analysis in the following way. All of the returned

instruments were checked for completeness. Incomplete instruments were not considered usable and were discarded.

The background instrument had a section that was marked for data processing. This consisted of a series of boxes along the right side of the questionnaire arranged vertically. Those boxes that corresponded to a particular question were placed directly across from that question.

Under each of these boxes were printed numbers which corresponded to columns on an eighty-column data processing card. Thus, the information could be coded by hand from the background questionnaire onto the box or boxes corresponding to that question. For example, if a school was classified as urban, a 2 would be placed in the corresponding box or a 1 if rural. The keypunch operator could then punch the code written in the box(es) onto the column in the card identified by the number under each box. In addition, there were boxes for identification number, attitude score, and knowledge test score, i.e., total number of correct responses. This procedure provided for most of the data to be keypunched directly from the background questionnaire.

There were six research hypotheses of the study that made predictions as to possible relationships that existed between the dependent variable attitude and several independent variables. The acceptance or rejection of

these research hypotheses depended on the acceptance or rejection of their underlying null statistical hypotheses. Thus, data gathered from the statistical hypotheses were used to determine if the research hypotheses were accepted or rejected. These research hypotheses, along with their underlying null statistical hypotheses, are listed below.

Research Hypothesis 1: There is a strong positive relationship between knowledge of CAI and attitude toward CAI.

Statistical Hypothesis 1: The correlation between the dependent variable attitude and independent variable knowledge will be less than or equal to 5.

Symbolically: Ho: $r \leq .50$
Hi: $r > .50$

Legend: r = Pearson-product moment correlation coefficient.

Research Hypothesis 2: Elementary principals and teachers, as a group, are significantly different in attitude toward CAI when compared to secondary principals and teachers, as a group.

Statistical Hypothesis 2: There will be no difference between mean attitude scores for elementary principals and teachers and mean attitude scores for secondary principals and teachers.

Symbolically: Ho: $\mu_1 = \mu_2$
$\mu_1 \neq \mu_2$

Legend: μ_1 = elementary group mean; μ_2 = secondary group mean.

Research Hypothesis 3: Urban principals and teachers, as a group, are significantly different in attitude toward CAI when compared to rural principals and teachers, as a group.

Statistical Hypothesis 3: There will be no difference between mean attitude scores for urban principals and teachers and mean attitude scores for rural principals and teachers.

Symbolically: Ho: $\mu_1 = \mu_2$
Hi: $\mu_1 \neq \mu_2$

Legend: μ_1 = urban group mean; μ_2 = rural group mean.

Research Hypothesis 4: Principals and teachers under 30 years of age, as a group, are significantly different in attitude toward CAI when compared to principals and teachers 30 years of age and older, as a group.

Statistical Hypothesis 4: There will be no difference between mean attitude scores for principals and teachers under 30 years of age and mean attitude scores for teachers and principals 30 years of age and older.

Symbolically: Ho: $\mu_1 = \mu_2$
Hi: $\mu_1 \neq \mu_2$

Legend: μ_1 = young (age $<$ 30) group mean; μ_2 = old (age $\geq$ 30) group mean.

Research Hypothesis 5: Elementary and secondary principals, as a group, are significantly different in attitude toward CAI when compared to elementary and secondary teachers, as a group.

Statistical Hypothesis 5: There will be no difference between mean attitude scores for elementary and secondary principals and mean attitude scores for elementary and secondary teachers.

Symbolically: Ho: $\mu_1 = \mu_2$
Hi: $\mu_1 \neq \mu_2$

Legend: μ_1 = principals' group mean; μ_2 = teachers' group mean.

Research Hypothesis 6: Secondary science and mathematics teachers, as a group, are significantly different in attitude toward CAI when compared to secondary English and social science teachers, as a group.

Statistical Hypothesis 6: There will be no difference between mean attitude scores for secondary science and mathematics teachers and mean attitude scores for secondary English and social studies teachers.

Symbolically: Ho: $\mu_1 = \mu_2$
Hi: $\mu_1 \neq \mu_2$

Legend: μ_1 = science-mathematics group mean; μ_2 = English-social studies group mean.

To analyze the data collected during the study, the researcher, in consultation with members of the Research Consultation Office, Michigan State University, selected the following statistical treatments as appropriate for purposes of testing the statistical hypotheses stated above.

The Pearson-product moment correlation coefficient was computed using the BASTAT[18] program. This coefficient was used to determine whether a significant relationship existed between the dependent variable, attitude, and the independent variable knowledge. Statistical Hypothesis 1 was tested in this way.

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[18] BASTAT, East Lansing: Agricultural Experiment Station, Michigan State University, Mimeographed, October, 1969, pp. 2-5.

The one-way analysis of variance as given by Finn[19] was used to determine if the mean attitude scores were significantly different for: elementary teachers and principals as compared to secondary teachers and principals, rural teachers and principals as compared to urban teachers and principals, teachers and principals under 30 years of age as compared to teachers and principals over 30 years of age, principals as compared to teachers, and secondary science and mathematics teachers as compared to secondary English and social studies teachers. Statistical Hypotheses 2 through 6 were tested in this way.

The use of the analysis of variance in this study assumes that the individuals have been selected on the basis of random sampling from a normally distributed population. It is also assumed that the variance of each group is homogeneous and the individuals comprising each group are independent.

A confidence level of .05 was selected as the critical level for statistical significance of the hypotheses investigated in this study. Thus, a hypothesis was rejected when an F-test or correlation coefficient

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[19]David J. Wright, Jeremy D. Finn's Multivariance-Univariate and Multivariate Analysis of Variance and Covariance: A FORTRAN IV Program, Occasional Paper No. 89, East Lansing: Office of Research Consultation, Michigan State University, 1970, pp. 1-8.

indicated that the results obtained could occur by chance alone no more than five times in one hundred.

The reliability of the attitude scale was determined by the procedure explained previously in the section on attitude scale reliability. The reliability and item analysis of the instrument to measure knowledge was computed by the Office of Evaluation Services, Michigan State University. The reliability coefficient computed is the Kuder-Richardson #20.

Statistical treatments of the data in this study were conducted through the use of the facilities of the Computer Laboratory and the Office of Evaluation Services, Michigan State University. The data were processed through the use of the Control Data Corporation (CDC) 3600, and the International Business Machine (IBM) 360/40 computers.

Summary

The purpose of this study was to examine the relationship between the dependent variable attitude and several independent variables with respect to computer assisted instruction (CAI).

All of the teachers and principals working in the ten public school districts located in Washtenaw County (Michigan) were chosen for the population of this study.

Three instruments were developed to gather data in order to answer questions pertaining to the purpose of the study. These instruments were: an attitude scale, an instrument to measure knowledge, and a background questionnaire.

All of the instruments were pretested using subjects similar to the population of the study. In addition, the construct and face validities were established for the attitude instrument and its reliability computed based on the pretest data.

The A and B forms of the knowledge instrument underwent an item analysis and a final instrument devised on the basis of this analysis. The face validity of this final instrument was also established.

These instruments were then distributed to a random sample of teachers and all of the principals in the population of interest.

The Pearson-product moment correlation and the one-way analysis of variance were used to analyze the survey data. The assumptions underlying the one-way analysis of variance model were examined and found appropriate for this study.

CHAPTER IV

ANALYSES OF THE DATA

Presented in this chapter are the analyses of the data gathered from the responses of 60 principals and 192 teachers to the three instruments that were developed for the study. These three instruments include a twenty-item attitude scale, a twenty-three-item instrument to measure knowledge, and a six-item background questionnaire.

There were six research hypotheses formulated by the researcher that made predictions as to the relationships that existed between the dependent variable attitude and several independent variables. Whether the six research hypotheses were accepted or rejected depended on whether the statistical hypothesis of each was accepted or rejected.

All of the null statistical hypotheses were tested at an alpha level of .05 by either the Pearson-product moment correlation, the one-way analysis of variance, or the F-test.

Analysis of Hypotheses

Research Hypothesis 1: There is a strong positive relationship between knowledge of CAI and attitude toward CAI.

Statistical Hypothesis 1: The correlation between the dependent variable attitude and the independent variable knowledge will be less than or equal to .50.

Symbolically: Ho: $r \leq .50$
Hi: $r > .50$

Legend: r = Pearson-product moment correlation coefficient.

Decision rule: Reject Ho if $r > .50$ at $\alpha = .05$

Table 8. Pearson-product Moment Correlation Between Knowledge and Attitude with Respect to CAI

Variable	$\bar{X}$	SD	N	Pearson-r
Knowledge	9.80	3.04	252	.19
Attitude	63.29	12.29		

On the basis of the computed statistic, the null hypothesis was not rejected. Although the correlation between knowledge and attitude is positive, it is not of a sufficient magnitude to be considered significant in this study. Therefore, the research hypothesis is not supported.

However, it was considered desirable to further test the computed correlation coefficient in order to determine if the relationship between knowledge and attitude was statistically significant. Thus, the following hypotheses

were formulated and an F-test run on the correlation to determine if it was significantly different from zero.[1] If the probability was small that chance variations might have produced the results, then the null hypothesis would be rejected.

Research Hypothesis 1A: There is a statistically significant relationship between knowledge and attitude with respect to CAI.

Statistical Hypothesis 1A: The correlation between the dependent variable attitude and the independent variable knowledge will be equal to or less than zero.

Symbolically: $H_o: r \leq 0$
$H_i: r > 0$

Legend: r = Pearson-product moment correlation coefficient.

Decision Rule: Reject Ho if $F > 3.89$ at $\alpha = .05$
$F = 9.03$

On the basis of the computed statistic, the null hypothesis was rejected. The alternative hypothesis was accepted, suggesting a statistically significant relationship between knowledge and attitude. In addition, the computed F statistic was also found to be significant at the .01 level of confidence.

Research Hypothesis 2: Elementary principals and teachers, as a group, are significantly different in attitude toward CAI when compared to secondary principals and teachers, as a group.

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[1]Bernard Astle, Statistics in Research, Ames, Iowa: The Iowa State University Press, 1963, pp. 174-176.

Statistical Hypothesis 2: There will be no difference between mean attitude scores for elementary principals and teachers and mean attitude scores for secondary principals and teachers.

Symbolically: Ho: $\mu_1 = \mu_2$
Hi: $\mu_1 \neq \mu_2$

Legend: μ_1 = elementary group mean; μ_2 = secondary group mean.

Decision Rule: Reject Ho if $F > 3.84$ at $\alpha = .05$

Table 9. Table of Means of Attitude Scores for Elementary-Secondary Teachers and Principals

	N	Attitude
Elementary	133	62.74
Secondary	119	63.89
Pooled Mean		63.32
Pooled S. D.	252	12.49

Table 10. One-Way Analysis of Variance on Attitude Scores of Elementary-Secondary Teachers and Principals

Source	MS	OF	F-Ratio
Between	82.54	1	0.5289
Within	156.06	250	

On the basis of the computed statistic, the null hypothesis was not rejected. Therefore, the research hypothesis is not supported.

Research Hypothesis 3: Urban principals and teachers, as a group, are significantly different in attitude toward CAI when compared to rural principals and teachers as a group.

Statistical Hypothesis 3: There will be no difference between mean attitude scores for urban principals and teachers and mean attitude scores for rural principals and teachers.

Symbolically: Ho: $\mu_1 = \mu_2$
Hi: $\mu_1 \neq \mu_2$

Legend: μ_1 = urban group mean; μ_2 = rural group mean.

Decision Rule: Reject Ho if $F > 3.84$ at $\alpha = .05$

Table 11. Table of Means of Attitude Scores for Rural-Urban Teachers and Principals

	N	Attitude
Rural	80	63.96
Urban	172	62.97
Pooled Mean		63.47
Pooled S. D.	252	12.50

Table 12. One-Way Analysis of Variance on Attitude Scores of Rural-Urban Teachers and Principals

Source	MS	DF	F-Ratio
Between	53.69	1	0.3438
Within	156.18	250	

On the basis of the computed statistic, the null hypothesis was not rejected, therefore, the research hypothesis is not supported.

Research Hypothesis 4: Principals and teachers under 30 years of age, as a group, are significantly different in attitude toward CAI when compared to principals and teachers 30 years of age and older, taken as a group.

Statistical Hypothesis 4: There will be no difference between mean attitude scores for principals and teachers under 30 years of age and mean attitude scores for teachers and principals 30 years of age and older.

Symbolically: Ho: $\mu_1 = \mu_2$
Hi: $\mu_1 \neq \mu_2$

Legend: μ_1 = young (age < 30) group mean;
μ_2 = old (age $\geq$ 30) group mean

Decision Rule: Reject Ho if F > 3.84 at α = .05

Table 13. Table of Means of Attitude Scores for Young (Age < 30) - Old (Age $\geq$ 30) Teachers and Principals

	N	Attitude
Young (age < 30)	101	61.80
Old (Age $\geq$ 30)	151	64.28
Pooled Mean		63.04
Pooled S. D.	252	12.45

Table 14. One-Way Analysis of Variance on Attitude Scores of Young (Age < 30) - Old (Age $\geq$ 30) Principals and Teachers

Source	MS	DF	F-Ratio
Between	371.07	1	2.3955
Within	154.91	250	

On the basis of the computed statistic, the null hypothesis was not rejected, therefore, the research hypothesis is not supported.

Research Hypothesis 5: Elementary and secondary principals, as a group, are significantly different in attitude toward CAI when compared to elementary and secondary teachers taken as a group.

Statistical Hypothesis 5: There will be no difference between mean attitude scores for elementary and secondary principals and mean attitude scores for elementary and secondary teachers.

Symbolically: Ho: $\mu_1 = \mu_2$
Hi: $\mu_1 \neq \mu_2$

Legend: μ_1 = principal group mean; μ_2 = teacher group mean.

Decision Rule: Reject Ho if $F > 3.84$ at $\alpha = .05$

Table 15. Table of Means of Attitude Scores for Principals and Teachers

	N	Attitude
Principal	60	64.95
Teacher	192	62.77
Pooled Mean		63.86
Pooled S. D.	252	12.47

Table 16. One-Way Analysis of Variance on Attitude Scores of Principals and Teachers

Source	MS	OF	F-Ratio
Between	218.13	1	0.2375
Within	155.52	250	

On the basis of the computed statistic, the null hypothesis was not rejected, therefore, the research hypothesis is not supported.

Research Hypothesis 6: Secondary science and mathematics teachers, as a group, are significantly different in attitude toward CAI when compared to secondary English and social studies teachers as a group.

Statistical Hypothesis 6: There will be no difference between mean attitude scores for secondary science and mathematics teachers and mean attitude scores for secondary English and social studies teachers.

Symbolically: Ho: $\mu_1 = \mu_2$
Hi: $\mu_1 \neq \mu_2$

Legend: μ_1 = science and mathematics group mean,
μ_2 = English and social studies group mean.

Decision Rule: Reject Ho if $F > 3.84$ at $\alpha = .05$

Table 17. Table of Means of Attitude Scores for Secondary, Science/Mathematics-English/Social Studies Teachers

	N	Attitude
Science/Mathematics	44	63.30
English/Social Studies	45	60.80
Pooled Mean		62.05
Pooled S. D.	89	13.48

Table 18. One-Way Analysis of Variance on Attitude Scores on Secondary Science/Mathematics-English/Social Studies Teachers

Source	MS	OF	F-Ratio
Between	138.54	1	0.7623
Within	181.73	250	

On the basis of the computed statistic, the null hypothesis was not rejected, therefore, the research hypothesis is not supported.

Table 19. Summary of Hypothesis

Research Hypotheses	Level at which the null hypothesis was accepted or rejected	Statement of accept or reject
1. There is a strong positive relationship between knowledge of CAI and attitude toward CAI.	r = .19	The research hypothesis was not supported.
1A. There will be a statistically significant relationship between knowledge and attitude with respect to CAI.	F = 9.03	The research hypothesis was supported.
2. Elementary principals and teachers, as a group, are significantly different in attitude toward CAI when compared to secondary principals and teachers as a group.	F = 0.53	The research hypothesis was not supported.

Table 19 (Cont'd)

Research Hypotheses	Level at which the null hypothesis was accepted or rejected	Statement of accept or reject
3. Urban principals and teachers, as a group, are significantly different in attitude toward CAI when compared to rural principals and teachers as a group.	F = 0.34	The research hypothesis was not supported.
4. Principals and teachers under 30 years of age, as a group, are significantly different in attitude toward CAI when compared to principals and teachers 30 years of age and older as a group.	F = 2.40	The research hypothesis was not supported.
5. Elementary and secondary principals, as a group, are significantly different in attitude toward CAI when compared to elementary and secondary teachers taken as a group.	F = 0.24	The research hypothesis was not supported.
6. Secondary science and mathematics teachers, as a group, are significantly different in attitude toward CAI when compared to secondary English and social studies teachers as a group.	F = 0.76	The research hypothesis was not supported.

Analysis of the Knowledge Instrument

The instrument used to measure knowledge in this study underwent an item analysis based on the responses to the instrument taken from the survey data. In addition, the Kuder-Richardson #20 reliability coefficient was computed. The summary statistics for the knowledge instrument are given in Table 20 below, while the detailed item analysis can be found in Appendix H.

Table 20. Knowledge Instrument Summary Statistics (N = 252)

Mean	9.80
Standard deviation	3.04
Variance	9.26
Mean item difficulty	57.00
Mean item discrimination	32.00
Kuder-Richardson reliability #20	.4605

Analysis of the Attitude Scale

The sample data was analyzed to determine the attitude instrument's reliability coefficient, to derive a set of optimum weights for each item, and to establish the item response pattern based on the sample of the study. The RAVE section of the FORTAP[2] program, using a

[2]Wright, FORTAP, A Fortran Test Analysis Package, pp. 8-13.

method of reciprocal averages as given by Wright and Porter,[3] gave an optimum weighting scale for each item from 0 through 5. The assigned weights and item response pattern can be found in Appendix I and J respectively. Table 21 contains the summary statistics of the attitude scale obtained from the sample data.

Table 21. Attitude Scale Summary Statistics (N = 252)

Mean	63.2850
Standard deviation	12.4806
Standard error	3.0982
Hoyt's reliability coefficient	0.9332

Summary

Seven null hypotheses were tested in an attempt to answer questions pertaining to the relationship between attitude and other variables with respect to computer assisted instruction.

All of the hypotheses were tested at the .05 level of significance. The findings are summarized in Table 19, which lists the hypothesis, the level at which it was accepted or rejected, and a rejection or acceptance statement.

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[3]David J. Wright and Andrew C. Porter, An Adaptation of Frank B. Baker's Test Analysis Package, Occasional Paper No. 1, East Lansing: Office of Research Consultation, Michigan State University, 1968, p. 13.

Thus, it is concluded that the following statement is supportable:

> There is a statistically significant positive relationship between knowledge and attitude with respect to CAI.

The instrument to measure knowledge was analyzed to determine its reliability and to compute an item analysis based on the sample data.

The instrument to measure attitude toward CAI was analyzed to determine its reliability, item response pattern, and a set of optimum weights for each item based on the sample data.

CHAPTER V

SUMMARY AND CONCLUSIONS

Summary

The purpose of this study was to examine the relationship between the dependent variable attitude and several independent variables with respect to computer assisted instruction (CAI). These independent variables included: (1) knowledge; (2) age; (3) level in the educational field; i.e., elementary-secondary; (4) classification of the school district employing the sample member; i.e., rural-urban; (5) position in the education field, i.e., principal-teacher; and (6) subject matter taught by secondary teachers, i.e., English/social studies-science/mathematics.

Three instruments were developed to gather data in order to answer questions pertaining to the purpose of the study. The instruments were an attitude scale, an instrument to measure knowledge, and a background questionnaire.

All of the instruments were pretested using subjects similar to the population of the study. In addition, the construct and face validities were established for the attitude instrument and its reliability computed based on

the pretest data and the face validity of the modified instrument established.

These instruments were then distributed to a random sample of teachers and all of the principals in the population of interest (Washtenaw County, Michigan). Of the 276 sets of instruments mailed, 256 sets of instruments were returned for a 92.0% response.

Seven null hypotheses were tested in an attempt to answer questions relative to the purpose of the study. All of the hypotheses were tested at the .05 level of significance by either the one-way analysis of variance, Pearson-product moment correlation, or the F-test. In addition, internal consistency reliabilities were calculated for the attitude scale and knowledge instrument.

Thus, it was found that the following statement is supportable:

> There is a statistically significant positive relationship between knowledge and attitude with respect to CAI.

Findings

Ho_1: The correlation between the dependent variable attitude and the independent variable knowledge will be less than or equal to .50. Hypothesis accepted.

Ho_2: There will be no difference between mean attitude scores for elementary principals and teachers and mean attitude scores for secondary principals and teachers. Hypothesis accepted.

Ho_3: There will be no difference between mean attitude scores for urban principals and teachers and mean attitude scores for rural principals and teachers. Hypothesis accepted.

Ho_4: There will be no difference between mean attitude scores for principals and teachers under 30 years of age and mean attitude scores for teachers and principals 30 years of age and older. Hypothesis accepted.

Ho_5: There will be no difference between mean attitude scores for elementary and secondary principals and mean attitude scores for elementary and secondary teachers. Hypothesis accepted.

Ho_6: There will be no difference between mean attitude scores for secondary science and mathematics teachers and mean attitude scores for secondary English and social studies teachers. Hypothesis accepted.

It was decided to further analyze the data in an attempt to clarify the findings with regard to the relationship between knowledge and attitude since there is some confusion indicated in the literature in this regard (see page 14). Thus, the following additional hypothesis was formulated and tested:

Ho: The correlation between the dependent variable attitude and the independent variable knowledge will be equal to or less than zero. Hypothesis rejected.

Deliminations of the Study

This study is restricted to:

1. Elementary grades defined as (K-6) and secondary grades defined as (7-12).
2. Principals and teachers.
3. School districts with grades K-12.

4. Public schools.
5. Washtenaw County (Michigan).

Limitations of the Study

1. In this study, the attitudes of teachers and principals toward computer assisted instruction are considered of prime importance. However, there is doubt as to what an attitude scale, such as the one used in this study, actually measures. What the scale does measure, at best, is the expressed reaction of a person responding to written statements. What relationship exists between this expressed reaction and "true" attitude is not known.
2. The traditional classification of rural-urban is based on the livelihood of the population. However, in this study the classification of rural-urban is dependent upon the population size of a community, and livelihood is not considered.
3. It is possible that the measure for knowledge does not cover all of the important aspects of computer assisted instruction.
4. It is possible that the reliability of the measure used to indicate teacher and principal knowledge of computer assisted instruction is not sufficient to be of a high predictive value.

5. All subjects in the survey were from a county that had one out of every six persons in the population enrolled in a program of higher education. Thus, the sample members could have been influenced by particular requirements and experiences in an institution of higher learning.

Conclusions

Within the limitations and delimitations of this study, the following conclusions were supported with respect to computer assisted instruction:

1. The correlation between knowledge and attitude was less than .50.
2. There was no significant difference between mean attitude scores for elementary principals and teachers and mean attitude scores for secondary principals and teachers.
3. There was no significant difference between mean attitude scores for urban principals and teachers and mean attitude scores for rural principals and teachers.
4. There was no significant difference between mean attitude scores for principals and teachers under 30 years of age and mean attitude scores for principals and teachers 30 years of age and older.
5. There was no significant difference between mean attitude scores for elementary and secondary principals and mean attitude scores for elementary and secondary teachers.

6. There was no significant difference between mean attitude scores for secondary science and mathematics teachers and mean attitude scores for secondary English and social studies teachers.
7. There was a statistically significant positive correlation between knowledge and attitudes.

Discussion

In summary, this study revealed that many assumptions that have been made with respect to computer assisted instruction should possibly be questioned. In talking with individuals using CAI, the writer has been told that:

A. Science and mathematics teachers would be more positive in attitude toward CAI than English and social studies teachers.
B. Secondary educators would be less positive in attitude toward CAI than elementary educators.
C. Young educators (age < 30 years) would be more positive in attitude toward CAI than older educators (age $\geq$ 30 years).

In addition, the writer assumed that:

D. Principals would be more positive in attitude toward CAI than teachers.
E. Rural principals and teachers would be less positive in attitude toward CAI than urban principals and teachers.

However, on the basis of this study, these assumptions have not been justified. In fact, the mean attitude score for teachers and principals whose age is less than 30 years, ($\bar{x}$ = 61.80), is lower than the mean attitude score for principals and teachers whose age is 30 years or greater, ($\bar{x}$ = 64.28). While this difference is not statistically significant, it is nevertheless interesting in that the means are contrary to expectations in light of the assumption.

With regard to the attitude of principals and teachers in the field toward CAI, the findings of this study indicate that it is generally favorable. This is reflected in Table 21 which shows a mean attitude score of 63.29.

In general, however, the knowledge of teachers and principals concerning CAI was found to be quite low. In looking at Table 20, one can see that the mean knowledge score was 9.80.

While the relationship between knowledge and attitude was not as strong as expected; i.e., r = .50, further analysis of the data supported the notion that this relationship is both positive and statistically significant. Thus, the findings of this study tend to support the research reported by Christopher.[1]

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[1]Christopher, Influence of Computer Assisted Instruction Upon the Attitudes of Administrators, p. 69.

The general conclusion made from the study is that of the six variables taken into consideration, only knowledge seems to be related to attitude; i.e., knowledge in relation to the specific attitude object.

Implications for Further Research

Some of the questions posed in this study for future research are:

1. Would a study replicating the present study verify the findings obtained?
2. Would the results from this survey study be supported by an experimental study, with subjects randomly assigned to treatment and control groups where the treatment would be designed to increase knowledge?
3. In schools involved with CAI, what is the relationship between teacher attitude, the variables investigated in this study, and pupil achievement with respect to CAI?
4. What effect does the type of administrative leadership, sex, years of teaching and/or administrative experience, and type of degree held have on teacher-principal attitude with respect to CAI?

BIBLIOGRAPHY

BIBLIOGRAPHY

Books

Armore, Sidney J., Introduction to Statistical Analysis and Inference, New York, London, Sidney: John Wiley and Sons, Inc., 1966.

Atkinson, Richard C. and Wilson, Hal A. eds., Computer-Assisted Instruction: A Book of Readings, New York, London: Academic Press, 1969.

Edwards, Allen L., Techniques of Attitude Scale Construction, New York: Appleton-Century-Crofts, 1957.

English, Horace B. and English, Ava C., A Comprehensive Dictionary of Psychological and Psychoanalytic Terms: A Guide to Usage, New York: McKay, 1958.

Hays, William L., Statistics, New York, Chicago, San Francisco, Toronto, London: Holt, Rinehart and Winston, 1963.

Hickey, Albert E., Computer-Assisted Instruction: A Survey of the Literature, Newburyport: ENTE LEK, Inc., 1968.

Jackson, Philip W., Life in Classrooms, New York: Holt, Rinehart and Winston, 1968.

Krech, David, Crutchfield, Richard S. and Ballachey, Egerton L., Individual in Society, New York: McGraw-Hill, 1962.

Lekan, Helen A., Index to Computer-Assisted Instruction, Milwaukee: Instructional Media Laboratory, University of Wisconsin, 1969.

Marker, Robert, ed., Computer Concepts and Educational Administration, University of Iowa: Iowa Educational Information Center, 1968.

Ostle, Bernard, Statistics in Research, Ames, Iowa: The Iowa State University Press, 1963.

Roth, Gustave J., Anderson, Nancy S. and Brainerd, R. C., The IBM Research Center Teaching Machine Project in Automated Teaching: The State of the Art, ed., E. Galanter, New York: John Wiley and Sons, 1959.

Shaw, Marvin E. and Wright, Jack M., eds., Scales for the Measurement of Attitudes, New York: Disney, McGraw-Hill Book Co., 1967.

Skinner, B. F., The Technology of Teaching, New York: Appleton-Century-Crofts, 1968.

Thurstone, Louis L. and Chave, Ernest J., The Measurement of Attitudes, Chicago: The University of Chicago Press, 1929.

Articles

Allen, Dwight W. and Hawkes, Glenn W., "Reconstruction of Teacher Education and Professional Growth Programs or How the Third Little Pig Escaped the Wolfe," Phi Delta Kappan, Vol. 52, No. 1, 1970.

Allpart, Gordon W., "The Historical Background of Modern Social Psychology," in Handbook of Social Psychology, Vol. 1, Cambridge, Mass.: Addison-Wesley, 1954.

Alpert, D. and Bitzer, D. L., "Advances in Computer-Based Education," Science, Vol. 167, No. 3917, 1970.

Anastasiow, Nicholas J. and Jerman, Max, "Introduction to Computer-Based Drill and Practice in Arithmetic," in Handbook, L. W. Singer Co., 1968.

Bitzer, Maryann D. and Boudreaux, Martha C., "Using a Computer to Teach Nursing," Reprint from Nursing Form, Vol. 8, No. 3, 1969.

Borman, Karl G., "Expressed Student Opinion Toward Computer-Assisted Instruction," in Inservice Mathematics Education Via Computer-Assisted Instruction for Elementary School Teachers in Appalachia, Final Report No. R-26,

Bueschel, Richard T., "Time-Sharing, A Programatic Approach in the School," Educational Technology, Vol. 10, No. 3, 1970.

Castleberry, S. and Lagowski, J. J., "Individualized Instruction Using Computer Technqies," Journal of Chemical Education, Vol. 47, No. 2, 1970.

Doty, Barbara A. and Doty, Larry A., "Programmed Instruction Effectiveness in Relation to Certain Student Characteristics," Journal of Educational Psychology, Vol. 55, No. 6, 1964.

Feldhusen, John and Szabo, Michael, "The Advent of the Educational Heart Transplant, Computer-Assisted Instruction: A Brief Review of Research," Contemporary Education, Vol. 40, No. 6, 1969.

Feldman, David H. and Sears, P. S., "Effects of Computer-Assisted Instruction on Children's Behavior," Educational Technology, Vol. 10, No. 3, 1970.

Filep, Robert T., "Individualized Instruction and the Computer: Potential for Mass Education," A-V Communications Review, Vol. 15, No. 1, 1967.

Frey, Sherman, Shimabukure, Shinkichi and Woodruff, A. B., "Attitude Change in Programmed Instruction Related to Achievement and Performance," A-V Communications Review, Vol. 15, No. 2, 1957.

Gerard, R. W., "Computers: Their Impact Upon Society," Journal of American Information Processing Societies, Vol. 27, No. 1, 1965.

Gilman, D. A. and Moreau, N. A., "Effects of Reducing Verbal Content in Computer-Assisted Instruction," A-V Communications Review, Vol. 17, No. 3, 1969.

Grayson, Lawrence P., "A Paradox: The Promises and Pitfalls of CAI," EDUCOM, Vol. 5, No. 2, 1970.

Hall, Keith A., Adams, Marilyn and Tardibuono, John, Gradient and Full Response Feedbacks in Computer-Assisted Instruction," in Experimentation With Computer-Assisted Instruction in Technical Education, Semi-Annual Progress Report R-6, University Park, Pennsylvania: Computer-Assisted Instruction Laboratory, The Pennsylvania State University, June, 1967.

Hansen, Duncan N. and Harvey, W. L., "Impact of CAI on Classroom Teachers," Educational Technology, Vol. 10, No. 2, 1970.

Hedlund, Dalva C. and Neidt, Charles O., "The Relationship Between Changes in Attitude Toward a Course and Final Achievement," Journal of Educational Research, Vol. 61, No. 2, 1967.

Hill, Russell A. and Nurst, Norma, "Teacher Behavior in CAI Classrooms," Educational Technology, Vol. 9, No. 2, 1969.

Hoyt, Cyril J., "Test Reliability Estimated by Analysis of Variance," in Principles of Education and Psychological Measurement: A Book of Selected Readings, ed. by William Merhrens and Robert L. Ebel, Chicago: Rand McNally & Co., 1967.

Katz, Daniel and Stotland, Ezra, "A Preliminary Statement to a Theory of Attitudinal Structure and Change," in Psychology: A Study of a Science, ed. by Edward S. Koch, New York: McGraw-Hill, 1959.

Kemeny, John C. and Kurtz, Thomas C., "Dartmouth Time-Sharing," Science, Vol. 162, No. 3850, 1968.

Leslie, Larry L., "Increasing Response Rates to Long Questionnaires," The Journal of Educational Research, Vol. 63, No. 8, 1969.

Likert, Rensis A., "A Technique for the Measurement of Attitudes," Archives of Psychology, Vol. 22, No. 140, 1932.

"Man, Ritual, the Establishment and Instructional Technology," Educational Technology, Vol. 8, No. 20, 1968.

Mastin, Victor E., "Teacher Enthusiasm," Journal of Educational Research, Vol. 56, No. 7, 1963.

Mathis, Arthur, Smith, Timothy and Hansen, Duncan, "College Students' Attitudes Toward Computer-Assisted Instruction," Journal of Educational Psychology, Vol. 61, No. 1, 1970.

Mortensen, Earl M. and Penick, Ronald J., "Computer Animation of Molecular Vibrations: Ethane," Journal of Chemical Education, Vol. 47, No. 2, 1970.

Neale, Daniel C., Gill, Noel, and Tismer, Werner, Relationship Between Attitudes Toward School Subjects and School Achievement," Journal of Educational Research, Vol. 63, No. 5, 1970.

O'Neil, H. F., Spielberger, C. D. and Hansen, D. H., "Effects of State Anxiety and Task Difficulty on Computer-Assisted Learning," Journal of Educational Psychology, Vol. 60, No. 5, 1969.

O'Toole, John F., "Teachers' and Principals' Attitudes Toward Programmed Instruction in the Elementary School," A-V Communications Review, Vol. 12, No. 4, 1964.

Schurdak, John J., "An Approach to the Use of Computers in the Instructional Progress and an Evaluation," The American Educational Research Journal, Vol. 4, No. 1, 1967.

Schwartz, H. A. and Haskell, R. J., "A Study of Computer-Assisted Instruction in Industrial Training," Journal of Applied Psychology, Vol. 50, No. 5, 1966.

Schwartz, H. A. and Long, H. S., "A Study of Remote Industrial Training," Journal of Applied Psychology, Vol. 51, No. 1, 1967.

Stolurow, Lawrence M., "Computer-Assisted Instruction," Education Automation Monograph Series, Detroit: American Data Processing Inc., 1968.

_____, "Some Factors in the Design of Systems for Computer-Assisted Instruction," in Computer-Assisted Instruction: A Book of Readings, ed. by Richard C. Atkinson and Hal A. Wilson, New York, London: Academic Press, 1969.

Suppes, Patrick, "The Uses of Computers in Education," Scientific American, Vol. 215, No. 3, 1966.

_____, and Jerman, Max, "Computer-Assisted Instruction," The Bulletin of the National Association of Secondary School Principals, Vol. 54, No. 343, 1970.

Suydan, Marilyn N. and Mitzel, Harold E., "Evaluation of Attitudes Toward Mathematics," in Inservice Mathematics Education via Computer-Assisted Instruction for Elementary School Teachers in Appalachia, Final Report No. R-26, University Park, Pennsylvania: Computer-Assisted Instruction Laboratory, The Pennsylvania State University, January, 1970.

Tabbutt, Frederick D., "Computers in Chemical Education," Chemical and Engineering News, Vol. 48, No. 3, 1970.

Tobias, Sigmund, "Effects of Attitudes to Programmed Instruction and Other Media on Achievement from Programmed Materials," A-V Communications Review, Vol. 17, No. 3, 1969.

_____, "Teaching Machines and Programmed Instruction," A-V Communications Review, Vol. 14, No. 1, 1966.

Vidaya, Joshi, "Attitude Toward Reception of Technology," Journal of Social Psychology, Vol. 58, No. 1, 1962.

Wing, R. L, "Two Computer-Based Economics Games for Sixth Graders," American Behavioral Scientist, Vol. 10, No. 1, 1966.

Dissertation Abstracts

Buckeye, Donald A., "The Effects of a Creative Classroom Environment on the Creative Ability of Prospective Elementary Mathematics Teachers," Dissertation Abstracts, Vol. 29, No. 6, 1968.

Cheikin, Martin L., "An Investigation of the Effect of Measured Teacher Attitude on Selected Eighth Grade Students," Dissertation Abstracts, Vol. 28, No. 10, 1967.

Pinety, Mildred C., "The Relationship Between Teachers' Attitudes and Effectiveness in the Classroom," Dissertation Abstracts, Vol. 24, No. 6, 1963.

Shatlein, Stephen D., "A Study of the Change of Attitudes Toward Mathematics of Prospective Elementary Teachers," Dissertation Abstracts, Vol. 29, No. 9, 1968.

Young, Norman E., "Effectiveness of Three Approaches to the Teaching of a Methods Course in Mathematics for Pre-Service Elementary Teachers as Related to Understanding and Attitude," Dissertation Abstracts, Vol. 29, No. 9, 1968.

Theses

Christopher, George R., The Influence of a Computer Assisted Instruction Experience Upon the Attitudes of School Administrators, Unpublished doctoral thesis, The Ohio State University, 1969.

Long, Harvey S., A Determination of the Relation of the Total Time for Course Completion to the Duration of the Study Interval in Teaching Via Computer Assisted Instruction, Unpublished doctoral thesis, New York University, 1968.

Pearson, Harry A., Programmed Instruction for Groups of Teachers in Remote Locations: Prototype Development, Unpublished doctoral thesis, Michigan State University, 1969.

Stilman, Paul A., A Normative Evaluation of a Computer-Assisted Instruction Laboratory in Statistical Inference, Unpublished masters thesis, University of Pittsburgh, 1969.

Reports

Activities and Arrangements for the Michigan Assessment of Education, Assessment Report No. 2, Prepared in the Bureau of Research, Michigan Department of Education, December, 1969.

American Associated of School Administrators Committee on Electronic Data Processing, EDP and the School Administrators, Washington, D. C.: 1967.

Computers in Higher Education, Report of the President's Science Advisory Committee, Donald F. Hornig, Chairman, Washington, D. C.: Government Printing Office, 1967.

Diamond, James J., A Report on Project Grow: Philadelphia's Experimental Program in Computer-Assisted Instruction, Philadelphia, Pennsylvania: Office of Research and Evaluation, The School District of Philadelphia, August, 1969.

Equality of Educational Opportunity, Washington, D. C.: U. S. Government Printing Office, 1966.

Gallagher, Paul D., An Investigation of Instructional Treatments and Learner Characteristics in a Computer-Managed Instruction Course, Tech. Report No. 12, Tallahassee, Florida: Computer-Assisted Instruction Center, Florida State University, 1970.

Maroline, Joseph B. and Misch, Marion R., Education in the 70's, Final Report on Educational Policy Prject, George Washington University, Washington, D. C.: Autumn, 1967.

Scrivens, Robert W., Evaluation Monograph No. 1, Waterford, Michigan: U.S.O.E. Grant 67-04301-0, Waterford Township School District, February, 1970.

Slavens, Thomas, Development and Testing of Materials for Computer-Assisted Instruction in the Education of Reference Librarians, U. S. Department of Health, Education and Welfare, Project No. 80560, 1970.

Uttal, William R., "My Teacher has Three Arms!!!" I.B.M. Research Report RC-788, 1962.

Washtenaw County Planning Commission, Recent Economic Trends in Washtenaw County, Ann Arbor, Michigan, July, 1966.

Others

BASTAT, East Lansing: Agricultural Experiment Station, Michigan State University, Mimeographed, October, 1969.

Hansen, Duncan N., "Myths that Need to be Destroyed and Myths that we Ought to Create," Speech given at the National Conference on Computer Applications to Learning, Bloomfield Hills, Michigan, July 9, 1970.

Item Analysis, East Lansing: Office of Evaluation Services, Michigan State University, Mimeographed, October, 1970.

The Computer in Education, Dayton, Ohio: an I/D/E/A Occasional Paper, a publication of the Institute for Development of Educational Activities, Inc., 1970.

Webster's New International Dictionary of the English Language, Second Edition, 1956.

Wright, David J., FORTAP: A Fortran Test Analysis Package by F. B. Baker and T. J. Martin, Occasional Paper No. 10, East Lansing: Office of Research Consultation, Michigan State University, L970.

_____, Jeremy D. Finn's Multivariance-Univariate and Multivariate Analysis of Variance and Covariance: A FORTRAN IV Program, Occasional Paper No. 89, East Lansing: Office of Research Consultation, Michigan State University, 1970.

_____, and Porter, Andrew C., An Adaptation of Frank B. Baker's Test Analysis Package, Occasional Paper No. 1, East Lansing: Office of Research Consultation, Michigan State University, 1968.

APPENDICES

Appendix A

Attitude Scale

Appendix A

Attitude Scale

In the Attitude Scale, the term "Computer Assisted Instruction" refers to a method of instruction in which subject matter is presented by a computer. The person is instructed to make responses by means of a "terminal"; usually a device similar to an electric typewriter.

There are 20 statements about Computer Assisted Instruction. Consider each statement separately and indicate the extent to which you agree or disagree with it by circling the appropriate symbol to the right of the statement.

The symbols used are:
SA - Strongly agree
A - Agree
N - No opinion
D - Disagree
SD - Strongly disagree

All responses will be treated confidentially.

Appendix A (Cont'd)

1. I am very interested in learning about computer assisted instruction.	1. SA A N D SD
2. Teaching machines can individualize instruction more effectively than other methods.	2. SA A N D SD
3. Computer assisted instruction is an impersonal teaching approach.	3. SA A N D SD
4. Computer assisted instruction will improve instructional programs.	4. SA A N D SD
5. Computer assisted instruction challenges the student to do his best.	5. SA A N D SD
6. I would prefer to take a course by computer rather than by conventional instruction.	6. SA A N D SD
7. Use of teaching machines causes students to feel isolated.	7. SA A N D SD
8. Use of the computer for data processing activities is more important than use of the computer for instruction.	8. SA A N D SD
9. Computer assisted instruction is based on the same principles as good classroom teaching.	9. SA A N D SD
10. I am uneasy about the use of computers for teaching youth.	10. SA A N D SD
11. Computer assisted instruction can develop problem-solving techniques.	11. SA A N D SD
12. Teaching machines are inflexible mediums.	12. SA A N D SD
13. Most elementary students would be adversely affected by computerized instruction.	13. SA A N D SD
14. I would prefer to take a course by conventional instruction rather than by computer assisted instruction.	14. SA A N D SD
15. Teaching by machine will tend to dehumanize the curriculum.	15. SA A N D SD

Appendix A (Cont'd)

16. The advocates for computer assisted instruction should press harder for its adoption.	16. SA A N D SD
17. By using computer assisted instruction, a teacher will probably become a better teacher.	17. SA A N D SD
18. Computer assisted instruction threatens the teacher's role.	18. SA A N D SD
19. Educators will find computer assisted instruction techniques successful.	19. SA A N D SD
20. Computer assisted instruction hinders the social development of the student.	20. SA A N D SD

Appendix B

Letter to CAI Experts

Appendix B

Letter to CAI Experts

May 4, 1970

Dear Sir:

Literature indicates that attitudes are important for the success of failure of any new instructional method.

With a new expensive instructional strategy such as CAI, attitudes of the educators and people involved may be critical to the project's success. If attitudes can be influenced by some variable, then it may be possible to create positive attitudes by manipulating this variable.

In view of this, I am in the process of developing a test to measure knowledge of CAI. This test will be used in combination with an attitude scale measuring attitudes toward CAI.

The purpose of the test and attitude scale will be two-fold: (1) to evaluate part of a national conference and (2) to gather information for my dissertation.

I am sure you are aware of the national conference to be held in Michigan this summer, which I hope you will attend. It is at this conference that I propose to field test these instruments using those Michigan educators present.

It was suggested by Ron Arnold, the director of INDICOM, that I gather as many test items as possible from experts in the field.

I know from working with Ron and the project that your schedule is very crowded, but if you could find a moment either to submit some test items of a multiple choice type or give me information concerning where I might find these kinds of items, it would be very much appreciated.

Since time is extremely critical to the study and your response is equally vital, I have enclosed a self-addressed, air mail envelope to insure a quick return.

Appendix B (Cont'd)

I am looking forward to seeing you this summer at the conference.

Sincerely,

Carlton P. Robardey, Sr.
Coordinator for: National Conference on
"Computer Applications to Learning"

Encl.

Appendix C

Indices of Difficulty and Discrimination for Knowledge Instruments A and B

Appendix C

Indices of Difficulty and Discrimination
for Knowledge Instruments A and B

Form A

In this test select the best possible answer for each question. Place the letter of the correct answer (found under each question) in the blank to the left of the number of that question.

There is only one best answer for each question.

PLEASE ANSWER ALL OF THE QUESTIONS

If you are in doubt as to the correct answer, put down the response that you think is best.

Appendix C (Cont'd)

DIFF 68 DISC 50 _____ 1. In terms of instruction the most efficient method for storing Computer Assisted Instruction curriculum, as students interact with the computer, is by means of:

*A. Magnetic disc
B. Magnetic tape
C. Magnetic card
D. Punched card

DIFF 33 DISC 33 _____ 2. Computer Assisted Instruction is considered by many experts as a part of:

A. Computer Assisted Testing
*B. Computer Managed Instruction
C. Computer Based Vocational Guidance
D. Computer Managed Administration

DIFF 61 DISC 50 _____ 3. Most Computer Assisted Instruction systems use:

A. Student terminals real time
B. Student terminals up time
*C. Student terminals on line
D. Student terminals off line

DIFF 8 DISC 33 _____ 4. In a tutorial Computer Assisted Instruction program, a student knows if his response is correct:

A. By the time he completes his lesson
*B. Within a few seconds
C. As soon as the teacher informs him
D. Within a few minutes

DIFF 32 DISC 33 _____ 5. Computer Assisted Instruction can be used to individualize instruction:

A. If the programs are of a branching type
B. If the programs are of the Skinnerian type
*C. If the curriculum writer plans for individualization
D. If there are enough terminals for each student

*Indicates the correct response

Appendix C (Cont'd)

DIFF 85 _____ 6. The best classification of Computer
DISC 9 Assisted Instruction programs is:

A. Linear
B. Branching
C. A and B
*D. None of the above

DIFF 67 _____ 7. At the present time, which of the following
DISC 33 can't a Computer Assisted Instruction system do:

A. Analyze typed responses
*B. Analyze spoken responses
C. Analyze tactil responses
D. Analyze optical responses

DIFF 76 _____ 8. Most languages used for Computer Assisted
DISC 0 Instruction curriculum production do not have:

*A. Efficient computational modes
B. Adequate vocabulary
C. Adequate response time
D. The ability to produce branching programs

DIFF 59 _____ 9. Cathode Ray Tubes are used:
DISC 17

A. In the operation of the Buffer Storage Unit
*B. For the display of information
C. In the operation of the Data Reduction Unit
D. A and C

DIFF 54 _____ 10. Effective Computer Assisted Instruction
DISC 25 programs are very difficult to construct:

A. Because they are very expensive
B. Because very little is known about how students learn
*C. Because they require detailed planning by the author
D. Because of the tremendous problem of coding them into machine language

Appendix C (Cont'd)

DIFF 9
DISC 6 _____ 11. In its best application Computer Assisted Instruction is a:

A. Testing and evaluation tool
*B. Supplement to classroom instruction
C. Replacement for classroom instruction
D. Record keeping system for the teacher

DIFF 33
DISC 17 _____ 12. From the standpoint of effective learning, the greatest advantage to the student of using the computer is:

A. The repetition gained in drill and practice
B. The creative use of programmed instruction
*C. The immediate feedback to the student
D. The automatic sequencing of instructional frames

DIFF 62
DISC 34 _____ 13. Which of the following is most often true of students taking lessons from a computer:

A. They have a difficult time learning to use the complex equipment
*B. They get bored quickly with poor instruction
C. They tend to vandalize the equipment
D. It takes a long time for them to adjust to the new instructional situation

DIFF 72
DISC 33 _____ 14. When students are working at the terminals their teacher:

A. Is usually present supervising and assisting the students with the material
B. Can be present but usually is not
C. Is present but acts only as a supervisor for social control
*D. No generalization can be made

DIFF 16
DISC 25 _____ 15. Which of the following types of programs is the easiest for curriculum writers to construct:

*A. Drill and Practice
B. Simulation
C. Tutorial
D. Dialogue

Appendix C (Cont'd)

DIFF 37 _____ 16. One of the primary advantages of Computer
DISC 16 Assisted Instruction curriculum design to the teacher is:

A. Teachers have a chance to become better acquainted with each learner
B. Instruction is automatically individualized
C. It is not as much work as regular classroom unit design
*D. It forces teachers to look carefully at purposes and procedures of instruction

DIFF 28 _____ 17. Computer Assisted Instruction, in its
DISC 17 present form, is able to present material to students by means of:

A. Printed information on paper
B. Projected information on a screen or by a television type device
C. Auditory information
D. A and B
*E. All of the above

DIFF 57 _____ 18. Which of the following types of Computer
DISC 25 Assisted Instruction programs is designed to allow the learner to manipulate the machine rather than the machine manipulating the learner:

A. Simulation
B. Tutorial
*C. Problem solving
D. Drill and Practice

DIFF 34 _____ 19. In a well designed instructional program
DISC 17 to be given by computer, a person could follow the sequence of steps the learner could go through by looking at the:

A. Address registers
B. Autochart
*C. Flowchart
D. Flow direction

Appendix C (Cont'd)

DIFF 59 _____ 20. If a computer for a Computer Assisted
DISC 33 Instruction project is said to have 35,000 positions of core storage, this would be referring to the:

A. Buffer storage unit
*B. Central processing unit
C. Data reduction unit
D. External storage unit

Appendix C (Cont'd)

Form B

In this test select the best possible answer for each question. Place the letter of the correct answer (found under each question) in the blank to the left of the number of that question.

There is only one best answer for each question.

PLEASE ANSWER ALL OF THE QUESTIONS

If you are in doubt as to the correct answer, put down the response that you think is best.

Appendix C (Cont'd)

DIFF 60 _____ 1. The time it takes a computer to respond
DISC 0 to a student's inquiry is affected by:

*A. The sophistication of the program
B. Cycling time per student
C. Differential analysis reaction time
D. Frequency response analysis

DIFF 33 _____ 2. The objective of a good Computer Assisted
DISC -9 Instruction program is to:

A. Standardize instruction in each school district
*B. Individualize instruction
C. Compensate for poor instruction
D. All of the above

DIFF 34 _____ 3. Computer Assisted Instruction is an effec-
DISC 37 tive means of instruction because:

A. Large segments of learning can be covered quickly
B. A student's assignment can be predetermined by his past performance on given concepts
C. Instruction can be individualized
*D. All of the above

DIFF 31 _____ 4. At this point in time the greatest dis-
DISC 55 advantage of the computer in terms of instruction is:

A. The computer can only communicate with the student by typed words or projected images
B. The computer can only be used to teach supplementary materials
*C. The limited curriculum materials available for use in a Computer Assisted Instruction program
D. The absence of direct teacher observation makes it difficult to determine pupil progress

*Indicates the correct response

Appendix C (Cont'd)

DIFF 73 _____ 5. Instructional programs which are loaded
DISC 28 into the computer:

A. Can be constructed by the teacher
B. Can be purchased from a commercial company
C. Are furnished by the manufacturer of the computer
*D. All of the above
E. A and B

DIFF 76 _____ 6. Which of the following computer languages
DISC 18 is not used for Computer Assisted Instruction as a curriculum author language:

A. Basic
B. Focal
C. Mentor
*D. RPG

DIFF 46 _____ 7. The largest operational Computer Assisted
DISC 37 Instruction system can serve at the same time:

A. A maximum of 150 student terminals
B. A maximum of 100 student terminals
*C. More than 150 student terminals
D. Less than 100 student terminals

DIFF 31 _____ 8. At this point in time, the single most
DISC 64 common type of Computer Assisted Instruction program, in terms of numbers of students served, is:

A. Problem solving
*B. Drill and Practice
C. Tutorial
D. Simulation

DIFF 74 _____ 9. The lack of curriculum exchange between
DISC 37 users of Computer Assisted Instruction can be attributed for the most part to:

A. A fear of standardizing the curriculum across the country
*B. Absence of the same kind of computer and/or author language
C. The tremendous cost which prohibits such an exchange
D. No generalization can be made at this time.

Appendix C (Cont'd)

DIFF 65 _____ 10. In a Computer Assisted Instruction project
DISC -9 total software is considered to be:

A. Curriculum or instructional programs
B. System programs to operate the curriculum
C. Teacher, administrators, and technical personnel involved in the project
*D. All of the above
E. A and B

DIFF 43 _____ 11. In a Computer Assisted Instruction pro-
DISC 55 ject involving many students at the same time, the computer:

A. Has to be at the location of the student user
B. Can be miles away or at the location of the student user
C. Has to have time-share capabilities
*D. B and C

DIFF 53 _____ 12. The fastest response to a student's
DISC 73 question or answer by the computer occurs when the curriculum is stored on:

*A. Magnetic disc
B. Magnetic tape
C. Magnetic card
D. Punched card

DIFF 35 _____ 13. Most Computer Assisted Instruction systems
DISC 55 use a computer of the:

A. Analog type
B. Hybrid type
*C. Digital type
D. Special purpose type

DIFF 57 _____ 14. Computer Assisted Instruction involving
DISC 18 many students at the same time was not possible until the advent of:

*A. Time-share computers
B. Third generation computers
C. Analog computers
D. Frequency response analysis

Appendix C (Cont'd)

DIFF 7
DISC 9 _____ 15. At this point in time, Computer Assisted Instruction is most widely used in the subject area of:

A. English
B. History
*C. Mathematics
D. Science

DIFF 91
DISC 9 _____ 16. Which of the following computer languages would be best for mathematical computation by students in a Computer Assisted Instruction program:

A. Autocoder
B. Simple
*C. APL
D. RPG

DIFF 55
DISC 55 _____ 17. A carefully planned Computer Assisted Instruction program should reduce the number of:

A. Teachers
*B. Failures
C. The work hours of teachers
D. B and C

DIFF 84
DISC 27 _____ 18. At this point in time, the single most expensive aspect of computer Assisted Instruction is:

A. The hardware
*B. The software
C. The maintenance of the system
D. Technical personnel

DIFF 33
DISC 46 _____ 19. Computer Assisted Instruction curriculum authors generally produce:

A. Instructional assemblers
*B. Instructional software
C. Instructional compilers
D. Instructional program controllers

Appendix C (Cont'd)

DIFF 59 _____ 20. In a drill and practice Computer Assisted
DISC 55 Instruction program, a second grade student would average using the terminal between:

A. 1 to 5 minutes
B. 1 to 10 minutes
*C. 1 to 15 minutes
D. More than 15 minutes

Appendix D

Knowledge Instrument Used in the Survey

Appendix D

Knowledge Instrument Used in the Survey

In this test select the best possible answer for each question. Place the letter of the correct answer (found under each question) in the blank to the left of the number of that question.

There is only one best answer for each question.

PLEASE ANSWER ALL OF THE QUESTIONS.

If you are in doubt as to the correct answer, put down the response that you think is best.

Appendix D (Cont'd)

_____ 1. In terms of instruction the most efficient method of storing Computer Assisted Instruction curriculum, as students interact with the computer, is by means of:

*A. Magnetic disc
B. Magnetic tape
C. Punched card
D. Punched tape

_____ 2. Computer Assisted Instruction is considered by many experts as a part of:

A. Computer Assisted Tresting
*B. Computer Managed Instruction
C. Computer Assisted Guidance
D. Computer Managed Administration

_____ 3. Most Computer Assisted Instruction systems use:

A. Student terminals real time
B. Student terminals up time
*C. Student terminals on line
D. Student terminals off line

_____ 4. Computer Assisted Instruction can be used to individualize instruction:

A. If the programs are of a branching type
B. If audio and graphic display devices are used
*C. If the curriculum writer plans for individualization
D. If there are enough terminals for each student

_____ 5. At the present time, which of the following can't a Computer Assisted Instruction system do:

A. Analyze typed responses
*B. Analyze spoken responses
C. Analyze tactile responses
D. Analyze optical responses

_____ 6. Cathode Ray Tubes are used:

A. In the operation of the Central Processing Unit
*B. For the display of information
C. In the operation of the Data Reduction Unit
D. For the storage of information

*Indicates correct response

Appendix D (Cont'd)

_____ 7. Effective Computer Assisted Instruction programs are very difficult to construct:

A. Because they are very expensive
B. Because very little is known about how students learn
*C. Because they require detailed planning by the author
D. Because of the tremendous problem of coding them into machine language

_____ 8. Which of the following is most often true of students taking lessons from a computer:

A. They feel isolated from their fellow students
*B. They get bored with poor instruction
C. It takes a long time for them to adjust to the new instructional situation
D. They have a difficult time learning to use the terminal

_____ 9. When students are working at the terminals their teacher:

A. Is usually present supervising and assisting the students with the material
B. Can be present but usually is not
C. Is present but acts only as a supervisor
*D. No generalization can be made

_____ 10. Which of the following types of Computer Assisted Instruction programs is designed to allow the learner to manipulate the machine rather than the machine manipulating the learner:

A. Dialogue
B. Tutorial
*C. Problem solving
D. Drill and practice

_____ 11. If a computer for a Computer Assisted Instruction project is said to have 35,000 positions of core storage, this would be referring to the:

A. Buffer storage unit
*B. Central processing unit
C. Data reduction unit
D. External storage unit

Appendix D (Cont'd)

_____ 12. Computer Assisted Instruction is an effective means of instruction because:

A. The student will receive immediate feedback to his response
B. A student's assignment can be predetermined by his past performance on given concepts
C. Instruction can be individualized
*D. All of the above

_____ 13. At this point in time the greatest disadvantage of the computer in terms of instruction is:

A. The computer can only communicate with the student by typed words or projected images
B. The present computers were designed for industry and not education
*C. The limited curriculum materials available for use in a Computer Assisted Instruction program
D. The absence of direct teacher observation makes it difficult to determine pupil progress

_____ 14. The largest operational Computer Assisted Instruction system can serve at the same time:

A. A maximum of 150 student terminals
B. A maximum of 100 student terminals
*C. More than 150 student terminals
D. Less than 100 student terminals

_____ 15. At this point in time, the single most common type of Computer Assisted Instruction program, in terms of numbers of students served is:

A. Problem solving
*B. Drill and Practice
C. Tutorial
D. Simulation

Appendix D (Cont'd)

_____ 16. The lack of curriculum exchange between users of Computer Assisted Instruction can be attributed for the most part to:

A. A fear of standardizing the curriculum across the country
*B. Absence of the same kind of computer and/or author language
C. The tremendous cost which prohibits such an exchange
D. A lack of communications between Computer Assisted Instruction projects

_____ 17. In a Computer Assisted Instruction project involving many students at the same time, the computer:

A. Has to be at the location of the student user
B. Can be miles away or at the location of the student user
C. Has to have time-share capabilities
*D. B and C

_____ 18. The fastest response to a student's question or answer by the computer occurs when the curriculum is stored on:

*A. Magnetic disc
B. Magnetic tape
C. Magnetic card
D. Punched card

_____ 19. Most Computer Assisted Instruction systems use a computer of the:

A. Analog type
B. Hybrid type
*C. Digital type
D. Special purpose type

_____ 20. Computer Assisted Instruction involving many students at the same time was not possible until the advent of:

*A. Time-share computers
B. The differential analysis of latency response time
C. Analog computers
D. Frequency response analysis

Appendix D (Cont'd)

_____ 21. A carefully planned Computer Assisted Instruction program should reduce the number of:

A. Teachers
*B. Failures
C. The work hours of teachers
D. B and C

_____ 22. Computer Assisted Instruction curriculum authors generally produce:

A. Instructional assemblers
*B. Instructional software
C. Instructional compilers
D. Instructional program controllers

_____ 23. In a drill and practice Computer Assisted Instruction program, a second grade student would average using the terminal between:

A. 1 to 5 minutes
B. 1 to 10 minutes
*C. 1 to 15 minutes
D. More than 15 minutes

Appendix E

Background Questionnaire

Appendix E

Background Questionnaire

Please respond to all of the following questions by either placing a check in the appropriate box, or by filling in the blank.

These boxes are for Data Processing and are NOT to be marked.

[ ] [ ] [ ]
2 3 4

1. What is the name of the School District you are employed by?

_____ [ ] 10

2. What position do you hold with your school district?

[ ] Principal

[ ] Teacher [ ] 11

3. What is your teaching or administrative level?

[ ] Elementary (K-6)

[ ] Secondary (7-12) [ ] 12

4. What is your current age?

_____ [ ] [ ]
13 14

5. If you are a secondary teacher, what subject matter area are you responsible for?

_____

6. Do you see your subject matter area as related more to science and mathematics or English and humanities?

[ ] Science and Mathematics

[ ] English and Humanities [ ] 15

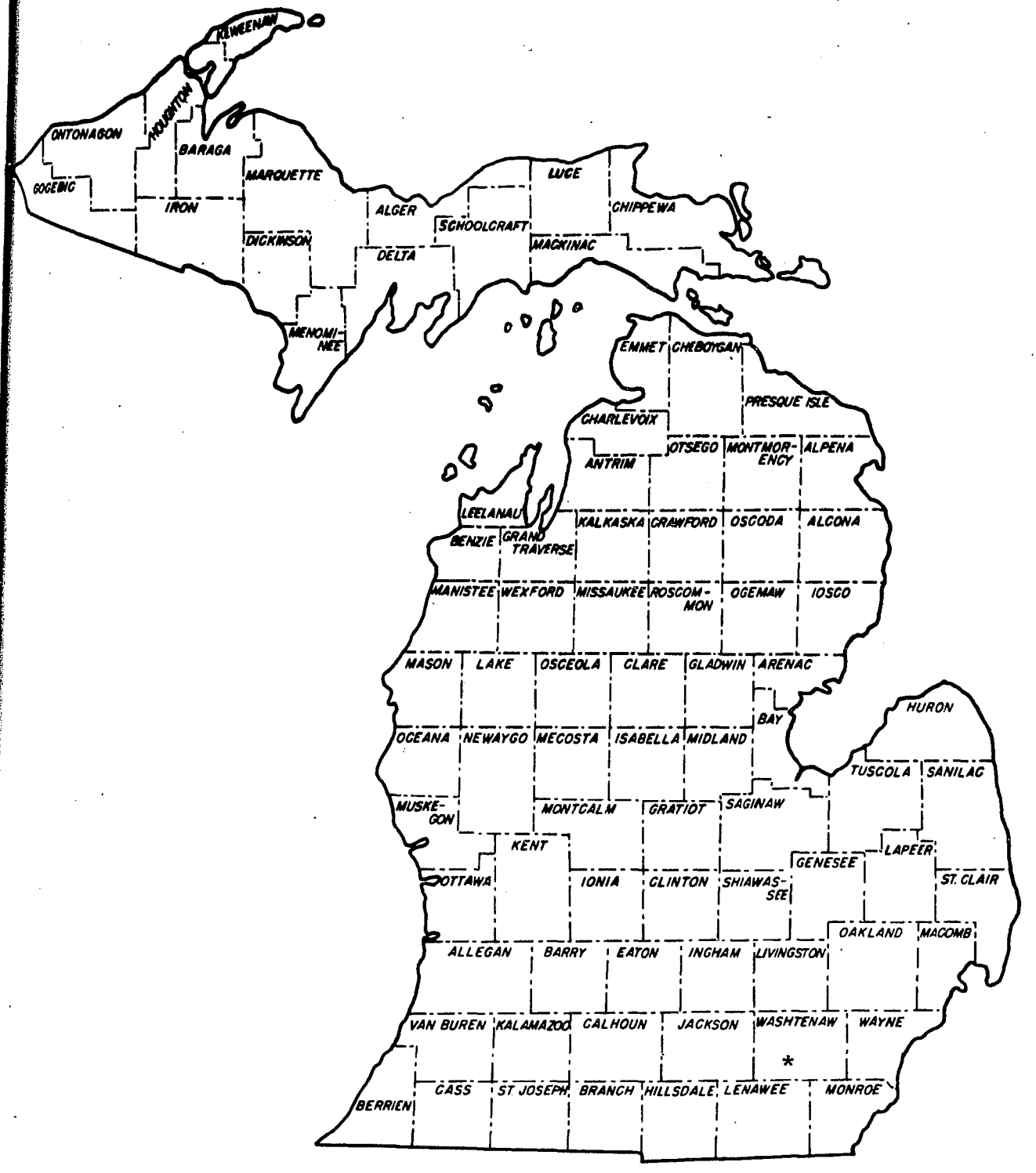
[ ] Neither

[ ] [ ]
21 22

[ ] [ ] [ ]
24 25 26

Appendix F

Map of Michigan by Counties



*Indicates geographical area of the study

Appendix G

Cover Letters and Follow-up Letter

Appendix G

Cover Letters and Follow-up Letter

TO: The Teacher

RE: C.A.I. Attitude Study

This study is for the purpose of investigating the relationship of selected variables with attitude toward Computer Assisted Instruction (CAI).

As you may be aware, the ESEA Title III Office of the Michigan Department of Education has a strong interest in this particular instructional strategy by virtue of project INDICOM, Waterford Township Schools, which is a Computer Assisted Instruction project funded by ESEA Title III. I will be the person responsible for conducting this study, and I have also worked extensively with the INDICOM project.

In order to achieve the objectives of the study, the following have been constructed:

Attitude Scale
Measure of Knowledge
Background Questionnaire

Your assistance in completing these questionnaires is needed at this time in order to carry out the study. Information obtained from this study could prove to be of great value to local districts in terms of implementation of Computer Assisted Instruction.

Upon completion of these instruments, they should be returned to your principal before January 19, 1971, so they can be sent to me along with any others from your school.

Please make sure that you:

(1) Have answered every question since an unanswered question will invalidate your return.
(2) Keep all of the forms together. If they become separated, it becomes impossible to analyze the data.

All responses will be kept confidential and anonymous.

Thank you for assisting in this project.

Sincerely,

Carlton P. Robardey, Intern
ESEA Title III
Michigan Department of Education

Appendix G (Cont'd)

January 6, 1970

Dear Principal:

I am asking for your assistance in the study of educator attitude toward Computer Assisted Instruction. This in-depth study will examine selected variables as they relate to attitude, and results of the study will be available to those schools involved.

Your cooperation is urgently needed at this time in order to carry out the study. I am asking that you give each teacher on the enclosed list one set of the questionnaire forms. In addition, please take one of the forms yourself and complete it. Upon completion of these questionnaires, would you please assume the responsibility for returning them in the large enclosed envelope by January 19, 1971 to:

Carlton P. Robardey, Intern
E.S.E.A. Title III
State Department of Education
P. O. Box 420
Lansing, MI 48902

Thank you for cooperating in this activity.

Sincerely,

Carlton P. Robardey, Sr.
Intern, E.S.E.A. Title III
Michigan Department of Education

CPR:bk
enclosures

Appendix G (Cont'd)

January 6, 1970

Dear Principal:

I am asking for your assistance in the study of educator attitude toward Computer Assisted Instruction. This study will examine selected variables as they relate to attitude and results of the study will be available to those schools involved.

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Carlton Robardey, Intern
E.S.E.A. Title III
State Department of Education
P. O. Box 420
Lansing, Michigan 48902

Thank you for cooperating in this activity.

Sincerely,

Carlton P. Robardey, Sr.
Intern, E.S.E.A. Title III
Michigan Department of Education

CPR:bk
enclosures

Appendix G (Cont'd)

January 19, 1971

Dear Principal:

Perhaps you have already returned the computer assisted instruction attitude study questionnaires that were recently sent to you. If so, I want to thank you. However, if you have not mailed these questionnaires as yet I am requesting your assistance in this endeavor.

A questionnaire should be completed by each teacher on the list that was enclosed with the forms. In addition, you were also to complete one of the questionnaires. Upon completion of the questionnaires, they should be returned as soon as possible to:

Carlton Robardey, Intern
E.S.E.A. Title III
Box 420
Lansing, Michigan 48902

Results of this study may contribute significantly to the implementation of computer assisted instruction at the local level. In order that these results be as representative as possible of education in the state, questionnaires should be returned from all of the schools sampled.

If for any reason it is impossible for you to return the questionnaires, I will make either telephone or personal contact with you so that as many schools as possible can be accounted for.

Thank you for your cooperation.

Sincerely,

Carlton P. Robardey, Sr.
Intern, E.S.E.A. Title III
Michigan Department of Education

Appendix H

Item Analysis of the Knowledge Instrument Used in the Survey

THE INDEX OF DIFFICULTY IS THE PERCENTAGE OF THE TOTAL GROUP MARKING A WRONG ANSWER OR OMITTING THE ITEM.

THE INDEX OF DISCRIMINATION IS THE DIFFERENCE BETWEEN THE PERCENTAGE OF THE UPPER GROUP MARKING THE RIGHT ANSWER AND THE PERCENTAGE OF THE LOWER GROUP MARKING THE RIGHT ANSWER.

THE UPPER AND LOWER GROUPS EACH CONTAIN 27% OF THE TOTAL GROUP.

PERCENTAGES MAY BE SLIGHTLY OFF, DUE TO ROUNDING.

ITEM 1 THE CORRECT OPTION IS 1.

	ITEM RESPONSE PATTERN					ITEM STATISTICS	
	1	2	3	4	5	INDEX OF DIFFICULTY	71
						INDEX OF DISCRIMINATION	41
UPPER 27%	36	27	4	1	0	MAXIMUM DISCRIMINATION	65
	53%	40%	6%	1%	0%	DISCRIMINATING EFFICIENCY	63
MIDDLE 46%	29	60	17	10	0	BISERIAL CORRELATION	.4279
	25%	52%	15%	9%	0%	POINT BISERIAL CORRELATION	.3185
LOWER 27%	8	44	12	4	0	STUDENTS T FOR TEST OF POINT	
	12%	65%	18%	6%	0%	BISERIAL CORRELATION	5.312
TOTAL	73	131	33	15	0	MEAN SCORE - RIGHTS	11.31
	29%	52%	13%	6%	0%	MEAN SCORE - WRONGS	9.18

Appendix H (Cont'd)

ITEM 2 THE CORRECT OPTION IS 2.

	ITEM RESPONSE PATTERN					ITEM STATISTICS	
	1	2	3	4	5		
UPPER 27%	8	41	17	2	0	INDEX OF DIFFICULTY	56
	12%	60%	25%	3%	0%	INDEX OF DISCRIMINATION	31
MIDDLE 46%	22	51	38	5	0	MAXIMUM DISCRIMINATION	89
	19%	44%	33%	4%	0%	DISCRIMINATING EFFICIENCY	34
LOWER 27%	23	20	21	4	0	BISERIAL CORRELATION	.3221
	34%	29%	31%	6%	0%	POINT BISERIAL CORRELATION	.2559
TOTAL	53	112	76	11	0	STUDENTS T FOR TEST OF POINT BISERIAL CORRELATION	4.185
	21%	44%	30%	4%	0%	MEAN SCORE - RIGHTS	10.66
						MEAN SCORE - WRONGS	9.10

ITEM 3 THE CORRECT OPTION IS 3.

	ITEM RESPONSE PATTERN					ITEM STATISTICS	
	1	2	3	4	5		
UPPER 27%	17	9	37	5	0	INDEX OF DIFFICULTY	65
	25%	13%	54%	7%	0%	INDEX OF DISCRIMINATION	36
MIDDLE 46%	60	9	39	8	0	MAXIMUM DISCRIMINATION	72
	52%	8%	34%	7%	0%	DISCRIMINATING EFFICIENCY	50
LOWER 27%	46	8	12	2	0	BISERIAL CORRELATION	.3832
	68%	12%	18%	3%	0%	POINT BISERIAL CORRELATION	.2948
TOTAL	123	26	88	15	0	STUDENTS T FOR TEST OF POINT BISERIAL CORRELATION	4.877
	49%	10%	35%	6%	0%	MEAN SCORE - RIGHTS	11.02
						MEAN SCORE - WRONGS	9.14

Appendix H (Cont'd)

ITEM 4 THE CORRECT OPTION IS 3.

	ITEM RESPONSE PATTERN					ITEM STATISTICS	
	1	2	3	4	5		
UPPER 27%	10	3	44	11	0	INDEX OF DIFFICULTY	41
	15%	4%	65%	16%	0%	INDEX OF DISCRIMINATION	18
MIDDLE 46%	12	14	72	18	0	MAXIMUM DISCRIMINATION	88
	10%	12%	62%	16%	0%	DISCRIMINATING EFFICIENCY	20
LOWER 27%	15	9	32	12	0	BISERIAL CORRELATION	.2148
	22%	13%	47%	18%	0%	POINT BISERIAL CORRELATION	.1709
TOTAL	37	26	148	41	0	STUDENTS T FOR TEST OF POINT BISERIAL CORRELATION	2.742
	15%	10%	59%	16%	0%	MEAN SCORE - RIGHTS	10.23
						MEAN SCORE - WRONGS	9.18

ITEM 5 THE CORRECT OPTION IS 2.

	ITEM RESPONSE PATTERN					ITEM STATISTICS	
	1	2	3	4	5		
UPPER 27%	0	28	9	31	0	INDEX OF DIFFICULTY	67
	0%	41%	13%	46%	0%	INDEX OF DISCRIMINATION	22
MIDDLE 46%	0	41	14	60	1	MAXIMUM DISCRIMINATION	60
	0%	35%	12%	52%	1%	DISCRIMINATING EFFICIENCY	36
LOWER 27%	4	13	17	34	0	BISERIAL CORRELATION	.2671
	6%	19%	25%	50%	0%	POINT BISERIAL CORRELATION	.2045
TOTAL	4	82	40	125	1	STUDENTS T FOR TEST OF POINT BISERIAL CORRELATION	3.303
	2%	33%	16%	50%	0%	MEAN SCORE- RIGHTS	10.69
						MEAN SCORE- WRONGS	9.37

Appendix H (Cont'd)

ITEM 6 THE CORRECT OPTION IS 2.

	ITEM RESPONSE PATTERN					ITEM STATISTICS	
	1	2	3	4	5		
UPPER 27%	16	33	10	9	0	INDEX OF DIFFICULTY	69
	24%	49%	15%	13%	0%	INDEX OF DISCRIMINATION	37
MIDDLE 46%	30	36	25	25	0	MAXIMUM DISCRIMINATION	61
	26%	31%	22%	22%	0%	DISCRIMINATING EFFICIENCY	60
LOWER 27%	29	8	15	16	0	BISERIAL CORRELATION	.4623
	43%	12%	22%	24%	0%	POINT BISERIAL CORRELATION	.3500
TOTAL	75	77	50	50	0	STUDENTS T FOR TEST OF POINT BISERIAL CORRELATION	5.907
	30%	31%	20%	20%	0%	MEAN SCORE - RIGHTS	11.40
						MEAN SCORE - WRONGS	9.09

ITEM 7 THE CORRECT OPTION IS 3.

	ITEM RESPONSE PATTERN					ITEM STATISTICS	
	1	2	3	4	5		
UPPER 27%	6	12	39	11	0	INDEX OF DIFFICULTY	59
	9%	18%	57%	16%	0%	INDEX OF DISCRIMINATION	44
MIDDLE 46%	18	17	56	25	0	MAXIMUM DISCRIMINATION	70
	16%	15%	48%	22%	0%	DISCRIMINATING EFFICIENCY	62
LOWER 27%	26	18	9	15	0	BISERIAL CORRELATION	.4215
	38%	26%	13%	22%	0%	POINT BISERIAL CORRELATION	.3337
TOTAL	50	47	104	51	0	STUDENTS T FOR TEST OF POINT BISERIAL CORRELATION	5.597
	20%	19%	41%	20%	0%	MEAN SCORE - RIGHTS	11.00
						MEAN SCORE - WRONGS	8.95

Appendix H (Cont'd)

ITEM 8 THE CORRECT OPTION IS 2.

	ITEM RESPONSE PATTERN					ITEM STATISTICS	
	1	2	3	4	5		
UPPER 27%	31	13	19	5	0	INDEX OF DIFFICULTY	88
	46%	19%	28%	7%	0%	INDEX OF DISCRIMINATION	7
MIDDLE 46%	49	10	42	15	0	MAXIMUM DISCRIMINATION	31
	42%	9%	36%	13%	0%	DISCRIMINATING EFFICIENCY	22
LOWER 27%	25	8	25	10	0	BISERIAL CORRELATION	.1641
	37%	12%	37%	15%	0%	POINT BISERIAL CORRELATION	.1001
TOTAL	105	31	86	30	0	STUDENTS T FOR TEST OF POINT BISERIAL CORRELATION	1.590
	42%	12%	34%	12%	0%	MEAN SCORE - RIGHTS	10.61
						MEAN SCORE - WRONGS	9.68

ITEM 9 THE CORRECT OPTION IS 4.

	ITEM RESPONSE PATTERN					ITEM STATISTICS	
	1	2	3	4	0		
UPPER 27%	18	6	15	29	0	INDEX OF DIFFICULTY	65
	26%	9%	22%	43%	0%	INDEX OF DISCRIMINATION	19
MIDDLE 46%	44	8	20	44	0	MAXIMUM DISCRIMINATION	67
	38%	7%	17%	38%	0%	DISCRIMINATING EFFICIENCY	28
LOWER 27%	29	9	14	16	0	BISERIAL CORRELATION	.2598
	43%	13%	21%	24%	0%	POINT BISERIAL CORRELATION	.2015
TOTAL	91	23	49	89	0	STUDENTS T FOR TEST OF POINT BISERIAL CORRELATION	3.252
	36%	9%	19%	35%	0%	MEAN SCORE - RIGHTS	10.62
						MEAN SCORE - WRONGS	9.34

Appendix H (Cont'd)

ITEM 10 THE CORRECT OPTION IS 3.

	ITEM RESPONSE PATTERN					ITEM STATISTICS	
	1	2	3	4	5	INDEX OF DIFFICULTY	52
						INDEX OF DISCRIMINATION	16
UPPER 27%	17	5	38	8	0	MAXIMUM DISCRIMINATION	96
	25%	7%	56%	12%	0%	DISCRIMINATING EFFICIENCY	16
MIDDLE 46%	28	4	57	27	0	BISERIAL CORRELATION	.1810
	24%	3%	49%	23%	0%	POINT BISERIAL CORRELATION	.1444
LOWER 27%	14	6	27	21	0	STUDENTS T FOR TEST OF POINT	
	21%	9%	40%	31%	0%	BISERIAL CORRELATION	2.307
TOTAL	59	15	122	56	0	MEAN SCORE - RIGHTS	10.25
	23%	6%	48%	22%	0%	MEAN SCORE - WRONGS	9.37

ITEM 11 THE CORRECT OPTION IS 2.

	ITEM RESPONSE PATTERN					ITEM STATISTICS	
	1	2	3	4	5	INDEX OF DIFFICULTY	59
						INDEX OF DISCRIMINATION	22
UPPER 27%	8	38	12	10	0	MAXIMUM DISCRIMINATION	90
	12%	56%	18%	15%	0%	DISCRIMINATING EFFICIENCY	24
MIDDLE 46%	17	42	30	27	0	BISERIAL CORRELATION	.3159
	15%	36%	26%	23%	0%	POINT BISERIAL CORRELATION	.2485
LOWER 27%	15	23	16	14	0	STUDENTS T FOR TEST OF POINT	
	22%	34%	24%	21%	0%	BISERIAL CORRELATION	4.056
TOTAL	40	103	58	51	0	MEAN SCORE - RIGHTS	10.70
	16%	41%	23%	20%	0%	MEAN SCORE - WRONGS	9.17

Appendix H (Cont'd)

ITEM 12 THE CORRECT OPTION IS 4.

	ITEM RESPONSE PATTERN					ITEM STATISTICS	
	1	2	3	4	5		
						INDEX OF DIFFICULTY	29
						INDEX OF DISCRIMINATION	43
UPPER 27%	5	3	1	59	0	MAXIMUM DISCRIMINATION	69
	7%	4%	1%	87%	0%	DISCRIMINATING EFFICIENCY	62
MIDDLE 46%	15	5	6	90	0	BISERIAL CORRELATION	.4714
	13%	4%	5%	78%	0%	POINT BISERIAL CORRELATION	.3561
LOWER 27%	20	5	13	30	0	STUDENTS T FOR TEST OF POINT	
	27%	7%	19%	44%	0%	BISERIAL CORRELATION	6.025
TOTAL	40	13	20	179	0	MEAN SCORE - RIGHTS	10.49
	16%	5%	8%	71%	0%	MEAN SCORE - WRONGS	8.10

ITEM 13 THE CORRECT OPTION IS 3.

	ITEM RESPONSE PATTERN					ITEM STATISTICS	
	1	2	3	4	5		
						INDEX OF DIFFICULTY	43
						INDEX OF DISCRIMINATION	45
UPPER 27%	11	3	52	2	0	MAXIMUM DISCRIMINATION	93
	16%	4%	76%	3%	0%	DISCRIMINATING EFFICIENCY	48
MIDDLE 46%	31	7	71	7	0	BISERIAL CORRELATION	.5034
	27%	6%	61%	6%	0%	POINT BISERIAL CORRELATION	.4006
LOWER 27%	24	15	21	8	0	STUDENTS T FOR TEST OF POINT	
	35%	22%	31%	12%	0%	BISERIAL CORRELATION	6.912
TOTAL	66	25	144	17	0	MEAN SCORE - RIGHTS	10.85
	26%	10%	57%	7%	0%	MEAN SCORE - WRONGS	8.39

Appendix H (Cont'd)

ITEM 14 THE CORRECT OPTION IS 3.

	ITEM RESPONSE PATTERN					ITEM STATISTICS	
	1	2	3	4	5		
UPPER 27%	7	7	37	17	0	INDEX OF DIFFICULTY	58
	10%	10%	54%	25%	0%	INDEX OF DISCRIMINATION	26
MIDDLE 46%	12	18	51	35	0	MAXIMUM DISCRIMINATION	82
	10%	16%	44%	30%	0%	DISCRIMINATING EFFICIENCY	31
LOWER 27%	27	3	19	19	0	BISERIAL CORRELATION	.2578
	40%	4%	28%	28%	0%	POINT BISERIAL CORRELATION	.2043
TOTAL	46	28	107	71	0	STUDENTS T FOR TEST OF POINT BISERIAL CORRELATION	3.299
	18%	11%	42%	28%	0%	MEAN SCORE - RIGHTS	10.52
						MEAN SCORE - WRONGS	9.26

ITEM 15 THE CORRECT OPTION IS 2.

	ITEM RESPONSE PATTERN					ITEM STATISTICS	
	1	2	3	4	5		
UPPER 27%	10	57	2	2	0	INDEX OF DIFFICULTY	42
	15%	79%	3%	3%	0%	INDEX OF DISCRIMINATION	44
MIDDLE 46%	33	68	11	4	0	MAXIMUM DISCRIMINATION	86
	28%	59%	9%	3%	0%	DISCRIMINATING EFFICIENCY	51
LOWER 27%	22	24	15	7	0	BISERIAL CORRELATION	.4449
	32%	35%	22%	10%	0%	POINT BISERIAL CORRELATION	.3549
TOTAL	65	146	28	13	0	STUDENTS T FOR TEST OF POINT BISERIAL CORRELATION	6.002
	26%	58%	11%	5%	0%	MEAN SCORE - RIGHTS	10.71
						MEAN SCORE - WRONGS	8.53

Appendix H (Cont'd)

ITEM 16 THE CORRECT OPTION IS 2.

	ITEM RESPONSE PATTERN					ITEM STATISTICS	
	1	2	3	4	5	INDEX OF DIFFICULTY	78
						INDEX OF DISCRIMINATION	22
UPPER 27%	3	23	12	30	0	MAXIMUM DISCRIMINATION	46
	4%	34%	18%	44%	0%	DISCRIMINATING EFFICIENCY	47
MIDDLE 46%	11	24	21	60	0	BISERIAL CORRELATION	.2624
	9%	21%	18%	52%	0%	POINT BISERIAL CORRELATION	.1833
LOWER 27%	14	8	22	24	0	STUDENTS T FOR TEST OF POINT	
	@L%	12%	32%	35%	0%	BISERIAL CORRELATION	2.948
TOTAL	28	55	55	114	0	MEAN SCORE - RIGHTS	10.85
	11%	22%	22%	45%	0%	MEAN SCORE- WRONGS	9.50

ITEM 17 THE CORRECT OPTION IS 4.

	ITEM RESPONSE PATTERN					ITEM STATISTICS	
	1	2	3	4	5	INDEX OF DIFFICULTY	34
						INDEX OF DISCRIMINATION	40
UPPER 27%	3	4	2	59	0	MAXIMUM DISCRIMINATION	66
	4%	6%	3%	87%	0%	DISCRIMINATING EFFICIENCY	60
MIDDLE 46%	18	16	6	76	0	BISERIAL CORRELATION	.4569
	16%	14%	5%	66%	0%	POINT BISERIAL CORRELATION	.3544
LOWER 27%	11	14	11	32	0	STUDENTS T FOR TEST OF POINT	
	16%	21%	16%	47%	0%	BISERIAL CORRELATION	5.922
TOTAL	32	34	19	167	0	MEAN SCORE - RIGHTS	10.56
	13%	13%	8%	66%	0%	MEAN SCORE - WRONGS	8.29

Appendix H (Cont'd)

ITEM 18 THE CORRECT OPTION IS 1.

	ITEM RESPONSE PATTERN				
	1	2	3	4	5
UPPER 27%	42	22	1	3	0
	62%	32%	1%	4%	0%
MIDDLE 46%	42	55	8	11	0
	36%	47%	7%	9%	0%
LOWER 27%	9	39	8	12	0
	13%	57%	12%	18%	0%
TOTAL	93	116	17	26	0
	37%	46%	7%	10%	0%

ITEM STATISTICS	
INDEX OF DIFFICULTY	63
INDEX OF DISCRIMINATION	49
MAXIMUM DISCRIMINATION	75
DISCRIMINATING EFFICIENCY	65
BISERIAL CORRELATION	.5320
POINT BISERIAL CORRELATION	.4132
STUDENTS T FOR TEST OF POINT BISERIAL CORRELATION	7.174
MEAN SCORE - RIGHTS	11.44
MEAN SCORE - WRONGS	8.84

ITEM 19 THE CORRECT OPTION IS 3.

	ITEM RESPONSE PATTERN				
	1	2	3	4	5
UPPER 27%	9	6	50	3	0
	13%	9%	74%	4%	0%
MIDDLE 46%	26	19	53	18	0
	22%	16%	46%	16%	0%
LOWER 27%	15	7	32	14	0
	22%	10%	47%	21%	0%
TOTAL	50	32	135	35	0
	20%	13%	54%	14%	0%

ITEM STATISTICS	
INDEX OF DIFFICULTY	46
INDEX OF DISCRIMINATION	27
MAXIMUM DISCRIMINATION	79
DISCRIMINATING EFFICIENCY	34
BISERIAL CORRELATION	.3206
POINT BISERIAL CORRELATION	.2564
STUDENTS T FOR TEST OF POINT BISERIAL CORRELATION	4.194
MEAN SCORE - RIGHTS	10.52
MEAN SCORE - WRONGS	8.96

Appendix H (Cont'd)

ITEM 20 THE CORRECT OPTION IS 1.

	ITEM RESPONSE PATTERN					ITEM STATISTICS	
	1	2	3	4	5	INDEX OF DIFFICULTY	44
						INDEX OF DISCRIMINATION	43
UPPER 27%	51	7	2	8	0	MAXIMUM DISCRIMINATION	93
	75%	10%	3%	12%	0%	DISCRIMINATING EFFICIENCY	46
MIDDLE 46%	67	13	14	22	0	BISERIAL CORRELATION	.4112
	58%	11%	12%	19%	0%	POINT BISERIAL CORRELATION	.3284
LOWER 27%	22	12	16	18	0	STUDENTS T FOR TEST OF POINT	
	32%	18%	24%	26%	0%	BISERIAL CORRELATION	5.497
TOTAL	140	32	32	48	0	MEAN SCORE - RIGHTS	10.69
	56%	13%	13%	19%	0%	MEAN SCORE - WRONGS	8.68

ITEM 21 THE CORRECT OPTION IS 2.

	ITEM RESPONSE PATTERN					ITEM STATISTICS	
	1	2	3	4	5	INDEX OF DIFFICULTY	68
						INDEX OF DISCRIMINATION	18
UPPER 27%	0	30	4	34	0	MAXIMUM DISCRIMINATION	70
	0%	44%	6%	50%	0%	DISCRIMINATING EFFICIENCY	25
MIDDLE 46%	5	33	7	71	0	BISERIAL CORRELATIONZ	.1898
	4%	28%	6%	61%	0%	POINT BISERIAL CORRELATION	.1458
LOWER 27%	7	18	10	33	0	STUDENTS T FOR TEST OF POINT	
	10%	26%	15%	49%	0%	BISERIAL CORRELATION	2.330
TOTAL	12	81	21	138	0	MEAN SCORE - RIGHTS	10.44
	5%	32%	8%	55%	0%	MEAN SCORE - WRONGS	9.49

Appendix H (Con'td)

ITEM 22 THE CORRECT OPTION IS 2.

	ITEM RESPONSE PATTERN					ITEM STATISTICS	
	1	2	3	4	5		
UPPER 27%	5	43	2	18	0	INDEX OF DIFFICULTY	64
	7%	63%	3%	26%	0%	INDEX OF DISCRIMINATION	54
MIDDLE 46%	14	41	20	41	0	MAXIMUM DISCRIMINATION	72
	12%	35%	17%	35%	0%	DISCRIMINATING EFFICIENCY	75
LOWER 27%	12	6	15	35	0	BISERIAL CORRELATION	.6027
	18%	9%	22%	51%	0%	POINT BISERIAL CORRELATION	.4663
TOTAL	31	90	37	94	0	STUDENTS T FOR TEST OF POINT BISERIAL CORRELATION	8.334
	12%	36%	15%	37%	0%	MEAN SCORE - RIGHTS	11.69
						MEAN SCORE - WRONGS	8.74

ITEM 23 THE CORRECT OPTION IS 3.

	ITEM RESPONSE PATTERN					ITEM STATISTICS	
	1	2	3	4	5		
UPPER 27%	3	20	40	5	0	INDEX OF DIFFICULTY	59
	4%	29%	59%	7%	0%	INDEX OF DISCRIMINATION	33
MIDDLE 46%	17	35	46	18	0	MAXIMUM DISCRIMINATION	85
	15%	30%	40%	16%	0%	DISCRIMINATING EFFICIENCY	38
LOWER 27%	18	19	18	13	0	BISERIAL CORRELATION	.3511
	26%	28%	26%	19%	0%	POINT BISERIAL CORRELATION	.2799
TOTAL	38	74	104	36	0	STUDENTS T FOR TEST OF POINT BISERIAL CORRELATION	4.574
	15%	29%	41%	14%	0%	MEAN SCORE - RIGHTS	10.80
						MEAN SCORE - WRONGS	9.09

Appendix H (Cont'd)

SUMMARY DATA

DISTRIBUTION OF ITEM DIFFICULTY INDICES

	NUMBER OF ITEMS	PERCENTAGE
91-100		0
81-90	1	4
71-80	2	9
61-70	7	30
51-60	6	26
41-50	5	22
31-40	1	4
21-30	1	4
11-20		0
00-10		0

DISTRIBUTION OF DISCRIMINATION INDICES

	NUMBER OF ITEMS	PERCENTAGE
91-100		0
81-90		0
71-80		0
61-70		0
51-60	1	4
41-50	7	30
31-40	5	22
21-30	5	22
11-20	4	17
00-10	1	4
LESS THAN 00		0

MEAN ITEM DIFFICULTY	57
MEAN ITEM DISCRIMINATION	32
KUDER RICHARDSON RELIABILITY #20	.4605
STANDARD ERROR OF MEASUREMENT	2.2328

Appendix I

Derived Weights for Attitude Scale Items

Appendix I

Derived Weights for Attitude Scale Items

ITEM		WEIGHTS SA	A	N	D	SD
1. I am very interested in learning about computer assisted instruction.	1.	1	1	2	3	4
2. Teaching machines can individualize instruction more effectively than other methods.	2.	1	2	3	4	5
3. Computer assisted instruction is an impersonal teaching approach.	3.	2	3	3	4	5
4. Computer assisted instruction will improve instructional programs.	4.	1	1	3	4	5
5. Computer assisted instruction challenges the student to do his best.	5.	1	2	3	4	5
6. I would prefer to take a course by computer rather than by conventional instruction.	6.	2	3	4	5	5
7. Use of teaching machines causes students to feel isolated.	7.	2	2	3	4	5
8. Use of the computer for data processing activities is more important than use of the computer for instruction.	8.	1	2	3	4	5
9. Computer assisted instruction is based on the same principles as good classroom teaching.	9.	1	2	3	4	5
10. I am uneasy about the use of computers for teaching youth.	10.	1	2	3	4	5
11. Computer assisted instruction can develop problem solving techniques.	11.	1	1	2	4	5
12. Teaching machines are inflexibile mediums.	12.	1	2	3	4	5
13. Most elementary students would be adversely affected by computerized instruction.	13.	1	1	3	4	5

Appendix I (Cont'd)

		WEIGHTS				
		SA	A	N	D	SD
14. I would prefer to take a course by conventional instruction rather than by computer assisted instruction.	14.	2	3	3	4	5
15. Teaching by machine will tend to dehumanize the curriculum.	15.	1	2	3	4	5
16. The advocates for computer assisted instruction should press harder for its adoption.	16.	1	2	3	4	5
17. By using computer assisted instruction, a teacher will probably become a better teacher.	17.	1	2	3	4	5
18. Computer assisted instruction threatens the teacher's role.	18.	2	2	2	4	5
19. Educators will find computer assisted instruction techniques successful.	19.	1	1	3	4	5
20. Computer assisted instruction hinders the social development of the student.	20.	1	2	3	4	5

Appendix J

Item Response Pattern for the Attitude Scale

Appendix J

Item Response Pattern for the Attitude Scale

ITEM	SA	A	N	D	SD*
1. I am very interested in learning about computer assisted instruction.	1	10	30	134	77
2. Teaching machines can individualize instruction more effectively than other methods.	7	65	64	94	22
3. Computer assisted instruction is an impersonal teaching approach.	37	104	47	61	3
4. Computer assisted instruction will improve instructional programs.	2	19	87	118	26
5. Computer assisted instruction challenges the student to do his best.	3	47	109	83	10
6. I would prefer to take a course by computer rather than by conventional instruction.	43	96	83	22	8
7. Use of teaching machines causes students to feel isolated.	7	72	103	66	4
8. Use of the computer for data processing activities is more important than use of the computer for instruction.	23	81	77	65	6
9. Computer assisted instruction is based on the same principles as good classroom teaching.	13	53	66	105	15
10. I am uneasy about the use of computers for teaching youth.	13	75	42	109	13
11. Computer assisted instruction can develop problem solving techniques.	3	22	79	128	20
12. Teaching machines are inflexible mediums.	6	62	70	104	10

*Responses from 252 teachers and principals.

Appendix J (cont'd)

ITEM	SA	A	N	D	SD
13. Most elementary students would be adversely affected by computerized instruction.	7	49	74	107	15
14. I would prefer to take a course by conventional instruction rather than by computer assisted instruction.	32	95	84	34	7
15. Teaching by machine will tend to dehumanize the curriculum.	6	97	59	83	7
16. The advocates for computer assisted instruction should press harder for its adoption.	7	44	123	68	10
17. By using computer assisted instruction, a teacher will probably become a better teacher.	9	60	84	88	11
18. Computer assisted instruction threatens the teacher's role.	3	45	35	143	26
19. Educators will find computer assisted instruction techniques successful.	3	18	110	110	11
20. Computer assisted instruction hinders the social development of the student.	13	51	81	97	10