

ABSTRACT

A STUDY OF COMPUTER ASSISTED INSTRUCTION
AND THE LECTURE METHOD IN THE
PRESENTATION OF COLLEGE
ECONOMICS

By

Dacia Van Antwerp

This investigation examined the relationship of internal and external conditions of learning as set forth in the theory of Biggs. It investigated the effectiveness of the external conditions of Computer Assisted Instruction (CAI) and the Lecture Method in the presentation of economics to a sample of undergraduate students. All subjects were students at Michigan State University and groups were formed on the basis of Cattell's Sixteen Personality Factor Inventory's second order factors of extraversion and neuroticism (the internal conditions of Biggs).

The major finding of this study was that under the conditions of CAI and Lecture as exemplified in this study, the personality factors of extraversion and neuroticism do not seem to interact with achievement. An additional finding of this study that subjects low in extraversion tend to achieve better overall independently of the method of treatment reinforced previous research. While no statistically

significant difference was found, this research appears to support previous studies in which subjects in the CAI treatment tend to achieve better than those in the Lecture method.

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To my loving husband,
Reginald J. McLaren, whose understanding,
patience and encouragement made the
conclusion of this study possible.

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CHAPTER I

THE PROBLEM

Introduction

A fundamental principle of Instruction Design is that the learner is the focal point of any constructed learning environment.¹ Individual differences of learners are, therefore, important. Learners' needs, backgrounds, attitudes, previous studies, and personalities are among many variables that should be considered if learning is to be most efficient.

It would seem that the better the instructional situation is tailored to the individual, the more easily he may grasp the learning. In the vast majority of cases, the more the educational environment makes sense to the individual, the more effective the learning situation becomes. If the relationship of an individual's personality can be shown to interact positively with a particular method such that he, the learner, achieves at an appropriate level, then it seems imperative that learning situations be tailored to matching learning styles.

¹Bela H. Banathy, Instructional Systems (Palo Alto, California: Fearon Publishers, 1968), 61. See also Robert F. Mager, Preparing Instructional Objectives (Palo Alto, California: Fearon Publishers, 1962), 1. See also W. James Popham and Eva L. Baker, Planning the Instructional Sequences (Englewood Cliffs, New Jersey: Prentice-Hall Inc., 1970), 1.

If the tailored learning environment provides appropriate structured input, it would seem to follow that an individual's own intrinsically motivating feedback will control and maintain learning. In other words, it would seem that the more the educational environment is similar to the individual's internal psychological factors, the better will be the learning of that individual.

One of the problems lies in the fact that not enough is known about individual learning styles. We need, therefore, to investigate the essences of different learning styles and apply the findings to the construction of different learning situations. Objective measurements of the learning behavior of many individual students must be obtained. Moreover, we need to devise more educational environments and test them against the learning behavior of those individuals whom we have assessed. The problem further requires that certain educational environments such as those found in universities be identified, duplicated and controlled. Data so obtained in an experimental situation could be replicated in other studies and the findings of such an experiment could then be applied to broader fields of education.² Such studies would help to generate solutions to the problem of matching method and learner.

²Glenn H. Bracht, "Experimental Factors Related to Aptitude-Treatment-Interactions," Review of Educational Research, XL (December, 1970), 627-645.

The present study is concerned with the learning behaviors of four personality types: Low Extroverted-High Neurotics, High Extroverted-High Neurotics, Low Extroverted-Low Neurotics, and High Extroverted-Low Neurotics. It focuses on their achievement in college economics as learned by means of Computer Assisted Instruction (henceforth in this paper to be known as CAI) as contrasted with the Lecture Method as defined in this study.³ The purpose of this study is to investigate the relationship between two instructional methods: CAI and the Lecture Method; and two learner personality characteristics: Extraversion and Neuroticism.

In a previous study by Furneaux, University students high in Neuroticism and low in Extraversion, those expected to have the highest positive intrinsic motivational potential in their scholastic setting, demonstrated such potential. It was found that they had the lowest failure rates, whereas the highest failure rates were among subjects low in Neuroticism and high in Extraversion--those persons expected to require extrinsic motivation. From Furneaux's study it can be readily seen that because of an individual's internal processing system, the same situation can be intrinsically motivating for one personality type and not for another.⁴

³Hickey believes that economics is particularly suited for computer presentation. See Albert E. Hickey (ed.), Computer-assisted Instruction: A Survey of the Literature, 3rd. ed. (Newburyport, Mass.: Extelek, October, 1968), 10.

⁴W.D. Furneaux, "The Psychologist and the University," University Quarterlies, XVII (December, 1962), 33-47.

J.B. Biggs suggest that it would be more useful if teachers screened pupils on the more basic and analytic internal process factors--Extraversion and Neuroticism--rather than on their intelligence quotient. If this were done, he predicates that a different balance of extrinsic reward systems could be used in each classroom.

If more were known about the interactive relationships of Extraversion and Neuroticism with respect to learning through Lecture or CAI and if differences were found to exist, pupils could be assigned to those learning situations in which, by personality type, they would tend to learn successfully. It is the aim of the present study to test such sets of relationships.

In order to provide the reader with a basic vocabulary, a definition of personality is necessary. Since the author is basing this study on the theory of Biggs, the definition used will be the one he employs. Although Biggs does not specifically define personality, he implies by his theory that personality may be defined as those "Traits. . . which define. . . the processes by which the individual person maintains continuing transaction with his environment. . ."⁵ Following Wundt and Cattell, Biggs identifies the two axes of personality as Extraversion and Neuroticism. These form the Complexity Program in the theory of Biggs.⁶

⁵S.B. Sells, "Personality," Encyclopedia of Educational Research, 4th ed., (ed.) by Robert L. Ebel (London: Macmillan, 1969), 935. See also J.B. Biggs, Information and Human Learning (Glenview, Ill.: Scott, Foresman and Company, 1972), 111-112.

⁶Biggs, op. cit., 49-50.

This study also follows the framework semantically set by Cattell who in studying normal persons establishes that there are two basic personality variables, Extraversion and Neuroticism, which he identifies as second order factors derived from first order traits. Hence neuroticism in this context is not to be confused with neuroticism considered as an abnormal condition.

Extraversion may be interpreted as the level of arousal. Persons high in Extraversion tend to have habitually low levels of arousal. They enjoy stimulation and work well under noisy and relatively busy conditions. Persons low in Extraversion tend to have habitually high levels of arousal. They prefer to work in quiet situations and to avoid external distractions.

Neuroticism pertains to the rate of change that occurs in an individual in response to an external stimulus pattern. This is known as the rate of arousal. Biggs used the term Neuroticism in a very loose and very stipulative sense insofar as it pertains to the relationship of emotions to the learning process. Biggs is not concerned with the psycho-pathological dimension as such but rather as a vague reactability of the normal individual to outside stimuli. Persons high in Neuroticism have a tendency to overreact to stimuli. They show signs of being tense, overanxious, and jittery, and they tend generally to overexaggerate their

response to stimuli. Persons low in Neuroticism have a tendency to remain relatively stable in their responses to stimuli.⁷

CAI has many extant definitions. The one used in this study is that CAI is the use of a computer for instruction in which there is an interaction, that is, a communication of data, between the student and the machine.⁸ The elements here are the computer, the student, the interaction between the student and the computer, and the use of the computer for instruction. It is a solitary situation in which the learner can go over and over the information presented without any external prods.

In defining the Lecture situation used in this study the focus is seen as on the teacher himself. It is through him that the quantity and quality of the students' work is determined. The Lecture situation represents a situation in which the student is one among many and need only sit and listen and at the time need not submit any evidence of comprehension.

Theory of Learning

Since the present study uses the personality types described by Biggs, it is also based on his learning theory.

⁷Biggs, op. cit., 123.

⁸Karl L. Zinn, "Glossary for Computer Uses in Education," Project CLUE, I, Appendix E (July, 1970), 3.

He believes that man as a learner is essentially an information-processing system with unique capacities and limitations which must be explicitly accounted for in the learning process. The key relationship in his theory is that between the stimulus pattern in the environment and the degree and level of arousal in the individual. In other words a particular instructional method may stimulate one individual much more than another. Consequently, if this theory can be demonstrated to exist, certain personality types should be assigned to certain defined types of instruction for optimal learning.

According to Biggs there are three stages in human learning or information processing. The first stage is that of input or perception of external stimuli. The second stage is that of thought or the processing of what is perceived. The third stage is that of performance or output. Learning is thus represented by the extent to which the output or behavior would be improved in terms of time and quality over the input.

The heart of Biggs' theory is found in Stage II (processing). There are four main components of information processing: the Immediate Memory Span; the Complexity Program; the Economy Program; and the Main Memory (See Figure 1).

The Immediate Memory Span, as he defines it, is the extent to which an individual is able to retain the input

in readiness for processing. An individual can hold seven bits of input information, plus or minus two, in this Immediate Memory Span.

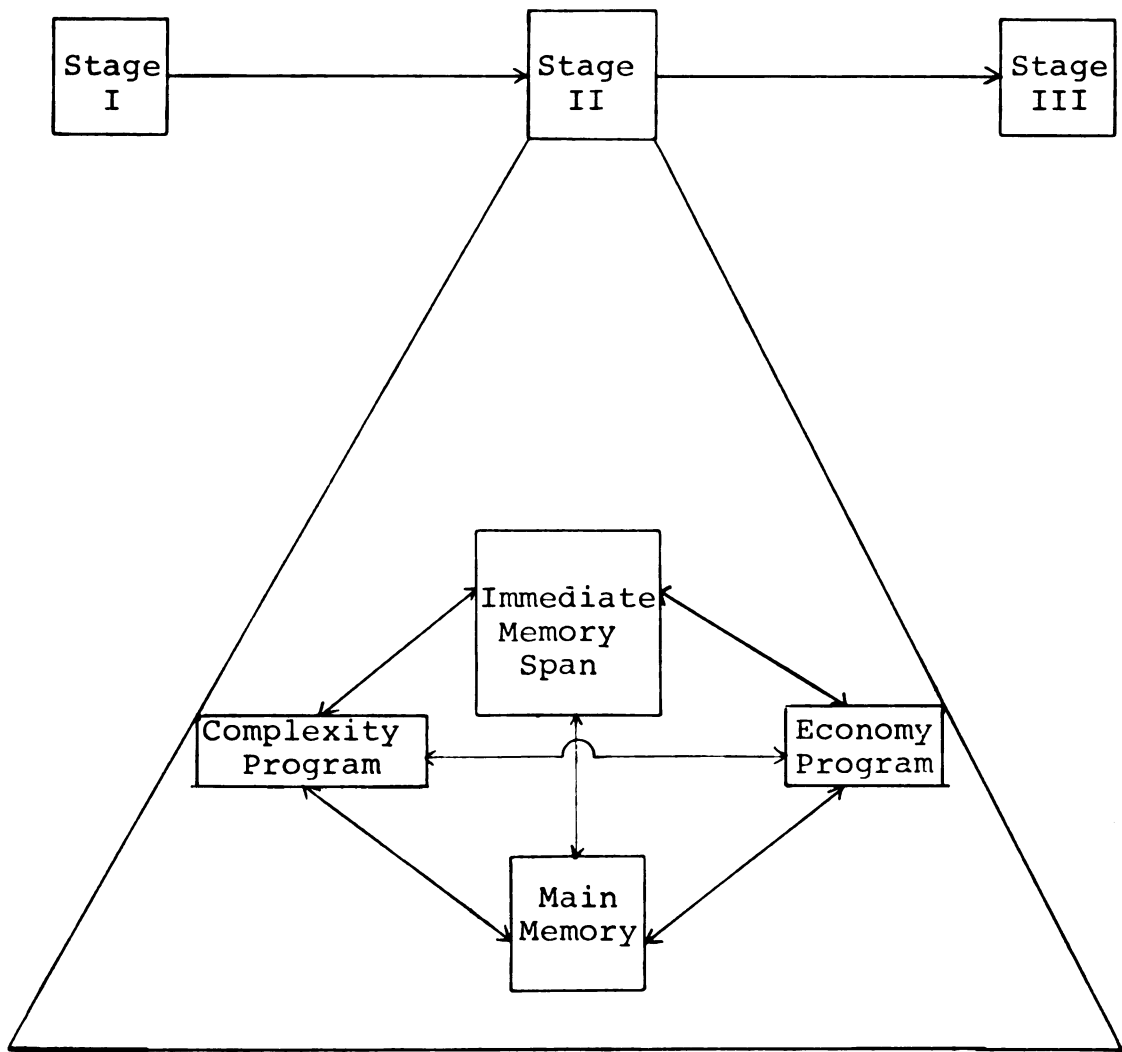


Figure 1.

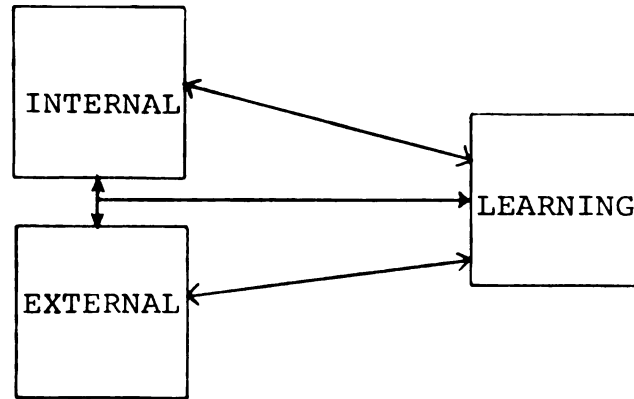
The second component is the Complexity Program. The Complexity Program has three functions: it delivers a go/no go instruction to the individual, it controls the rate of

processing, and it keeps the person supplied with input. There are three factors which comprise the Complexity program: the level of arousability or Extraversion, which is the initial or habitual level of arousal; the rate of change of arousal or Neuroticism; and the general speed at which the human processor operates affected by the interaction of Extraversion and Neuroticism.

The third component is the Economy Program which compresses information into bits which fit into the available channels of the Immediate Memory Span so that the information is sufficient to lead to problem solving. The Economy Program governs the coding process.

The last component is the Main Memory which is the storage area of information. All of these components interact one with the other.

One of the essential elements in Biggs' theory is the concept of codes and coding. This is a system of classification and the process by which this classification takes place. As Biggs believes that the general aim of education is that the individual develop the most comprehensive, most abstract and most totally integrated set of codes possible, it can be seen that for him the problem of education is the provision of conditions for the development of these codes. Learning from his viewpoint, therefore, depends on the conditions of coding. These conditions are both internal and external:



The internal conditions refer to the individual's processing system, that is, the way he structures the stimuli he receives. The most important element of this processing system is the Complexity Program or the arousability of the individual. This arousability refers to both the level of arousal--Extraversion--and the rate of change of arousal--Neuroticism. The external conditions are a function of the environment, that is, the instructional strategies.

The present study addresses itself to the highly complicated interaction between the internal psychological conditions of coding; namely, Extraversion and Neuroticism, and the external conditions of coding, namely CAI and the Lecture method. It seeks to discover what internal conditions of coding (Extraversion or Neuroticism), as determined by Cattell's Sixteen Personality Factor Inventory, interact best with two different external conditions of coding (the Lecture Method or CAI).

According to Biggs those situations which change the individual into a more complex and more efficient data-processor are those which are intrinsically motivating. Those situations which are intrinsically motivating for individuals are those in which the internal and external conditions of coding are most closely matched. Thus intrinsic motivation is the product of both the environment and the individual.

Summary

In line with Biggs's theory, building upon Furneaux's research, the purpose of this study was to conduct an experiment which attempts to investigate the degree to which a learner's capacity to absorb and digest information is affected by the personality dimensions of Extraversion and Neuroticism. In other words, the interaction of certain internal conditions of learning (Extraversion and Neuroticism) with certain external conditions of learning (CAI and the Lecture Method) will be investigated. The study is done, therefore, in the light of Biggs' concept just described and it investigates the application of Biggs' theory in CAI as contrasted with the Lecture situation.

Restrictions in time, in the availability of subjects and in finances, were the primary factors in limiting the study to testing the interaction of the personality factors of Extraversion and Neuroticism, using the Complexity Program

of Biggs, to provide the internal conditions, and two methods of treatment in a university setting (CAI and the Lecture Method), to constitute the external conditions of Biggs. Other internal and external conditions of learning should be investigated to obtain a more complete view of the relationship of internal and external conditions to one another in the learning process.

The two quite different teaching methods were chosen because it was believed that they would provide different methods of structuring the external conditions of learning. While CAI appears to be one of the most isolated methods, the Lecture Method allows for camaraderie and sociability. In a highly isolated situation which might tend to be stressful, the person high in Neuroticism would tend to overreact in CAI-to be tense, overanxious, and jumpy-and therefore probably would not perform as well as the person low in Neuroticism. According to the literature, we would predict that such a situation would tend to limit the achievement of the person high in Extraversion because of the lack of social outlet.

The Main Hypotheses of this study are:

1. High Neurotic subjects tend to achieve better in the Lecture Method and Low Neurotic subjects tend to achieve better in CAI.
2. High Extroverted subjects tend to achieve better in the Lecture Method and Low Extroverted subjects tend to achieve better in CAI.

There were two auxiliary hypotheses for those subjects in the CAI groups:

1. Low Neurotic subjects tend to have a better attitude towards CAI than High Neurotic subjects.
2. Low Extroverted subjects tend to have a better attitude towards CAI than High Extroverted subjects.

If in this small experimental situation the close interaction of the instructional environment with a person's coding system, that is, the Extraversion and Neuroticism of an individual can be seen, then it would point to the relevance of Biggs' theory to university education and to the need for more research in this area.

The importance, the relevance, and the generalizability of the problem was stated by Biggs when he said:

(there is) probably a stronger case for screening children on . . . (Neuroticism and Extraversion), . . . and using a different balance of extrinsic reward systems in each classroom, than . . . screening them on the grounds of general intellectual power.⁸

⁸Biggs, op. cit., 112.

CHAPTER II

REVIEW OF THE LITERATURE

Introduction

Cronback encouraged the observation of experimental effects for subjects of different characteristics and the conduct of investigations to find Aptitude-Treatment-Interactions.¹ The goal of such research was to find disordinal interactions between alternative instructional programs so that the optimal educational payoff is obtained when students are assigned differently to alternative programs.

Following his ideas, there has been increasing interest in Aptitude-Treatment-Interactions but little empirical evidence to support the concept. The results of some ninety studies in this area have been primarily descriptive, however, and of little inferential value. The question arises as to what is already known about the interaction of man's Complexity Program of the Biggs' theory: that is, the level and rate of arousability--Extraversion and Neuroticism--with the educational environment. Following are studies of authors who have been

¹Lee J. Cronbach, "The Two Disciplines of Scientific Psychology," American Psychologist, XII(November, 1957), 671-684.

concerned with Aptitude-Treatment-Interaction. First those studies dealing with Extraversion are presented, next those concerned with Neuroticism. The latter studies deal with both Programmed Instruction and CAI. These supply the most relevant research upon which the present study was based.

Basic Studies

In 1944, Thompson and Hunnicutt conducted a study of Extraversion in students and the effect of praise and blame on their scores.² They found that students low in Extraversion achieved a higher level of performance when they received praise ($p < .01$). While students high in Extraversion, achieved a higher level of performance when they received blame ($p < .05$).

The results of Thompson and Hunnicutt indicate that the educational environment has to provide external reward systems appropriate to the level of Extraversion of the individual. According to Biggs' theory, however, the other personality axis-Neuroticism-should also be considered. The present study differs from that of Thompson and Hunnicutt in that it looks at the interaction of both Extraversion and Neuroticism in two methods of treatment.

²George G. Thompson and Clarence W. Hunnicutt, "The Effect of Repeated Praise or Blame in the Work Achievement of "Introverts" and Extroverts," Journal of Educational Psychology, XXXV (May, 1944), 257-266, as cited in Bracht, op. cit., 636.

In 1956, Haight and Schmidt found that subjects who seek definite, concrete, and ordered situations are able to gain most from a teacher-centered class as compared to a group discussion.³ The authors' investigation dealt with first order traits, some of which from the second order factor of Extraversion. The aforementioned traits would belong to a person low in Extraversion. If it is true that this type of person would gain most from a teacher-centered class as contrasted with a group discussion, would he gain more from a CAI situation as compared to a teacher-centered class or Lecture Method? Seeking as he does the definite, concrete, and ordered situation, it would seem that he would gain most from CAI which allows control of the pace of learning and must be even more definite, concrete, and ordered than a Lecture situation because of the human element for which it allows, could provide. The present study hopes to follow through on this research.

Furneaux studied the interrelationship of Extraversion and Neuroticism, and the failure rate of undergraduates in a university setting.⁴ His study showed that High Extroverted-Low Neurotics in such a setting have the highest failure rate (61%). He also showed that Low Extroverted-High

³Gerard V. Haight and Warren Schmidt, "The Learning of Subject Matter in Teacher-centered and Group-centered Classes," Journal of Educational Psychology, XLVII (May, 1956), 300.

⁴Furneaux, loc. cit.

Neurotics have the lowest failure rate in such an external condition of learning (21%).

Thus Furneaux's study adds more weight to Biggs' theory. It is well known, however, that the university setting is a complex situation interwoven with all kinds of instructional situations. It would seem that Furneaux did not go far enough and that a more focused study of the interaction between Extraversion and Neuroticism in two specific instructional methods--CAI and Lecture Method--would add specificity for at least these two methods of instruction.

Studies done by Leith from 1966 to 1969 reinforced the 1956 study of Haight and Schmidt.⁵ Leith's concern was the interaction of Extraversion and learning situations. The two methods of treatment were discovery learning, in which the students were given a set of rules or principles and materials and direct instruction, consisting of clearly structured learning tasks. It was found that High Extroverts learned best with the discovery learning method while Low Extroverts learned best with direct instruction. Building on Leith's research, it would seem that Low Extroverts tend to achieve better in CAI while High Extroverts tend to achieve better in the Lecture method. The present study

⁵G.O.M. Leith, "The Acquisition of Knowledge and Mental Development of Students," British Journal of Educational Technology, I (May, 1970), 123.

will also test the interaction of Neuroticism in CAI as contrasted with the Lecture method.

Doty and Doty, in 1962, performed a study on Programmed Instruction.⁶ The results show that the greatest achievement was made by those subjects low on social needs. Their results also support the hypothesis that the effectiveness of P.I. varies as a function of personality variables.

Traweek, 1964, found that those subjects who were more test anxious, more withdrawn and less selfreliant were more successful in P.I.⁷

Brucker, in 1969, attempted to answer some basic questions regarding the interaction of P.I. and Extraversion and Neuroticism as determined by Cattell's Sixteen Personality

⁶Barbara A. Doty and Larry A. Doty, "Programmed Instructional Effectiveness in Relation to Certain Student Characteristics," Journal of Educational Psychology, LV (December, 1964), 336. Because of the close relationship between CAI and Programmed Instruction (henceforth to be known as PI for the purposes of this study), the PI research is valuable to this study. It is well therefore to define PI. According to Stolurow, PI is a form of instruction in which: the student's attention is focused on a limited amount of material at one time; a response is required to each segment of material; the student receives immediate feedback; and is self-paced.

⁷Melvin W. Traweek, "The Relationship Between Certain Personality Variables and Achievement through Programmed Instruction," California Journal of Educational Research, XV (November, 1964), 219.

Factor Inventory.⁸ He wanted to know if working in an individual learning carrel affects a person's learning achievement and/or influences a person's opinion about the method of instruction. He found that none of the subjects was measurably affected by his environment as indicated by his achievement or retention. All subjects learned quite well through the use of individualized instruction. All favored the small seminar room as contrasted with the learning carrel.

Brucker also studied the degree to which a person exhibits certain personality traits seriously hinders his learning achievement or affects his attitude toward the method of instruction. Extraversion did not seem to affect either achievement, retention, or attitude while Neuroticism did. There was no testing of interaction between the environment and personality.

Lastly, Brucker investigated whether there is a relationship between an individual's personality traits and his reaction to a learning carrel. The High Neurotics had a less favorable opinion about individualized instruction than did the Low Neurotics. Extraversion did not appreciably affect the subject's opinion.

⁸James Brucker, "The Effects of an Enclosed Individual Learning Environment Interacting with Two Personality Traits on the Achievement and Opinions of College Students Learning through the Use of Programmed Instruction," (unpublished Ph.D. dissertation, Indiana University, 1969), 52-53.

Brucker, however, neglected to take into account entering behavior. The present study hopes to compensate for this lack of giving a pretest on content in economics to be used as a covariate.

The present study will also explore the interaction of Extraversion and Neuroticism in CAI and the Lecture method. It would seem that the carrel situation would reasonably match the CAI situation as an individualized instructional method; thus it would seem that the Low Neurotics would have a better attitude towards CAI.

All these studies have contributed to our knowledge of the way the Extrovert and the Neurotic handle certain external factors of learning. None of these, however, have applied these personality variables to the area of CAI.

Both Howard and Scott (1965)⁹ and Cancro and Slotnick (1970)¹⁰ found that the man/machine interaction is a stressful situation in which man's psychological needs are involved.

A study by Sutter and Reid in 1969 looked at the interaction of two personality characteristics, sociability and submissiveness, with CAI.¹¹ They also measured test

⁹Alan Howard and Robert A. Scott, "A Proposed Framework for the Analysis of Stress in the Human Organism," Behavioral Science, X (April, 1965), 141.

¹⁰Robert Cancro and Daniel Slotnick, "Computer Graphics and Resistance to Technology," American Journal of Psychotherapy, XXIV (July 3, 1970), 465.

¹¹Emily G. Sutter and Jackson B. Reid, "Learner Variables and Interpersonal Conditions in CAI," Journal of Educational Psychology, LX (May-June, 1969), 156.

anxiety. They attempted to study, through the personality characteristics they had chosen, which of these personality types tends to achieve better in CAI. They randomly assigned their subjects to three methods of treatment: a control group and two experimental groups. One of the experimental groups took CAI alone ($N = 40$); the other experimental group took CAI with a partner ($N = 42$). They found that those subjects high in sociability and low in test anxiety achieved higher in pairs while those subjects low in sociability and high in test anxiety achieved higher alone. The interaction between anxiety and achievement was $p < 0.025$. The gains of subject interaction between sociability and achievement was found to be $p < 0.06$ for both groups. Submissive subjects gained with dominant subjects and dominant subjects working by themselves exhibited the most favorable attitude towards CAI.

Sutter and Reid's study indicates that depending on the characteristics of the learner, sociability is a factor in CAI, that High Extroverts alone in CAI would not achieve as well as Low Extroverts, and that learning may be just as efficient in a solitary CAI situation as when taken with a partner. Their research supports the interaction of the stimulus pattern of the external conditions for learning-the instructional environment with the internal conditions for learning-the personality of the individual. Such interaction is basic to the present study.

Nagel, in 1969, found an inconsistent correlation of achievement in CAI with High Extraversion. He used Extraversion as a sub-factor.¹² The present study will use an instrument that gives Extraversion greater weight as one of the axes of the personality; the other axis will be Neuroticism.

In 1970, O'Neil looked at the effect of stress on State Anxiety and on performance of CAI.¹³ Those subjects who were anxiety prone ("differential tendencies among individuals to respond with different levels of A-State in situations that are perceived as threatening") showed a greater increase in anxiety from pretask levels than did those subjects who were not anxiety prone.¹⁴ This would seem to indicate that the Low Neurotic would tend to achieve better in a CAI situation than a High Neurotic.

Many of these studies have been concerned with Neuroticism or Extraversion as operative in various types of teacher-centered classrooms. Others have been concerned

¹²Thomas Scott Nagel, "A Descriptive Study of Cognitive and Affective Variables Associated with Achievement in a Computer-Assisted Instruction Learning Situation," (unpublished Ph.D. dissertation, Michigan State University, 1969), 71.

¹³Harold F. O'Neill, Jr., State Anxiety and Performance in Computer Assisted Instruction (Washington, D.C.: Office of Naval Research, Psychological Services Division, ERIC ED 038 029, 1970), 44.

¹⁴Harold F. O'Neill, Jr., et al., "Effects of State Anxiety and Task Difficulty in Computer Assisted Learning," Journal of Educational Psychology, LX (1969), 343.

with the relationship of the same characteristics to success under the conditions of CAI. The present study has as its objectives:

- to add specificity to Biggs' theory concerning the interactions of the internal and external conditions of coding.
- to observe whether the Low or High Neurotics do better in CAI or Lecture.
- to determine whether the Low or High Extroverts do better in CAI or Lecture.
- to identify according to the level of Neuroticism and Extraversion, the person who achieves better in CAI or Lecture.
- to determine whether the High or Low Neurotic or the High or Low Extrovert has a better attitude towards CAI.

Summary

The present study has been based on Biggs' theory that the internal conditions of learning: namely, Extraversion and Neuroticism, and the external conditions of learning: namely, CAI and the Lecture method, interact to produce learning.

Furneaux has shown that in a university setting certain combinations of Extraversion and Neuroticism tend to interact with failure rates. This knowledge base needs to be extended by focusing on particular methods of instruction within the university setting. We know that subjects low in social needs, more test anxious, more withdrawn and less self-reliant achieved highest in P.I... Will this also be true in the case of subjects taking CAI?

The research investigated in this chapter tells us that the education environment should provide external reward systems appropriate to the Extraversion to the individual. The person who seeks the definite, concrete and ordered situation prefers a teacher-centered classroom to a group discussion. It would seem that he would achieve better in a CAI situation as compared to a Lecture situation.

It is known that High Neurotics have a less favorable opinion about individualized instruction in a learning carrell. Will this also be true of the CAI situtation? From Sutter and Reid there is an indication that sociability is a factor in CAI, so that Low Extroverts would probably achieve better than High Extroverts. From O'Neill it can be seen that Low Neurotics would tend to achieve better in a CAI situation than High Neurotics.

CHAPTER III

DESIGN OF THE STUDY

Introduction

After the investigation of the literature on the subject of matching learning styles with learning situations, an important problem emerged, that of matching educational environment with style of learning. This study investigated the interrelationship of two specific external conditions of learning, CAI and Lecture, with two specific internal conditions, Extraversion and Neuroticism, as defined by Biggs. The nature of the problem permits investigation of only a few of the simpler lower order interactions. The content area of economics was chosen since it was assumed to be rather unfamiliar to the subjects and at the same time amenable to CAI.

Population and Sample

The total population consisted of the undergraduate students of Michigan State University. The method of sampling used was purposive sampling as defined by McAshan.¹

¹"The purposive sample is selected by some arbitrary method because it is known to be representative of the total population". Holdreth Hoke McAshan, Elements of Educational Research (New York: McGraw-Hill, 1963), 65.

The subjects were volunteer undergraduate students of Michigan State University. Two-thirds were from suburban areas. Half of the sample indicated that their mothers were housewives. There was a mixture of ages:

17 years of age	-	1%
18 years of age	-	35%
19 years of age	-	38%
20 years of age	-	15%
over 20 years of age	-	11%

There was also a mixture of classes:

51%	were Freshmens
28%	were Sophomores
14%	were Juniors
15%	were Seniors

The sample represented thirty-two different major choices of fields and their grade point averages seemed to follow a normal curve:

5%	0.0 - 1.99
21%	2.0 - 2.49
35%	2.5 - 2.99
28%	3.0 - 3.49
10%	3.5 - 3.99

A sample size of one hundred was chosen to allow for drop-outs and nonreturns. As the data show, only seventy-two out of the one hundred originally scheduled completed the experiment. This sampling plan was consistent with the Multivariate Analysis of Covariance used in the statistical analysis. The pretest on content was used as a covariate.

Design

Following the thought of Cronbach a 2 x 2 x 2 interactive design (Figure 2) was chosen to measure the effect of the Independent Variables upon the Dependent Variable of achievement gain for all units in the study.

The subjects were measured by Cattell's Sixteen Personality Factor Inventory. Once measured on personality, the subjects were then blocked according to one of the following four levels:

High Neuroticism, High Extraversion

High Neuroticism, Low Extraversion

Low Neuroticism, High Extraversion

Low Neuroticism, Low Extraversion

Within each of these four levels the subjects were randomly assigned to the two methods of treatment: CAI and Lecture.

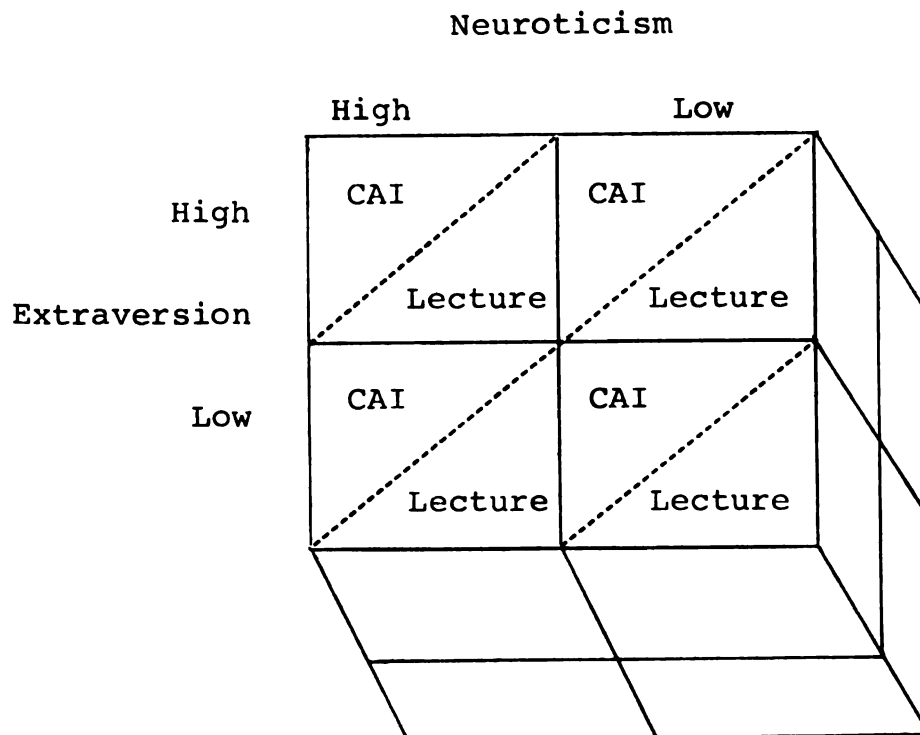


Figure 2.--Design of the Study

As can be seen in the diagram above the independent variables were (1) High Extraversion-Low Extraversion; (2) High Neuroticism-Low Neuroticism; and (3) the Method of Treatment--Lecture method and CAI, eight blocks resulted.

Figure 3 presents the distribution of subjects to the eight blocks. Within each Lecture block there were two units; within each CAI block there was a minimum of four units. Each CAI subject as well as each Lecture Group was considered as an independent unit. The degrees of freedom were sixteen and the rank of the model was eight, with $N = 25$.

		CAI	LECTURE	
HIGH NEUROTICISM	HIGH EXTRAVERSION	① ① ① ①	⑥ ⑨	EMN
	LOW EXTRAVERSION	① ① ① ①	⑧ ⑧	IMN
LOW NEUROTICISM	HIGH EXTRAVERSION	① ① ① ①	⑩ ⑥	EOP
	LOW EXTRAVERSION	① ① ① ①	⑥ ②	IOP

Figure 3.--Another View of the Design.

To investigate the effect of the independent variables upon the dependent variable, namely, attitude gain within the CAI situation, a 2 x 2 interactive sub-design was used (Figure 4). There were two independent variables, Neuroticism and Extraversion. The degrees of freedom were thirteen. The rank of the model was three and $N = 17$.

A Randomization Process was used to permit each subject on the four separate categories an equal chance for either method of Treatment, thus providing for other variables such as sex, race, intelligence quotient, grade point average, etc.

		NEUROTICISM	
		HIGH	LOW
EXTRAVERSION	HIGH		
	LOW		

Figure 4.--Design of the Attitude Study.

In the Lecture Method of Treatment the statistical unit was the Group, while in CAI each subject was considered to be the unit of measurement. The interest of the Experimenter was in the gain of the units. Since each of the

subjects felt that he was part of an experiment, each had the advantage of the Hawthorne effect.

Data and Instrumentation

The pretesting took the following pattern: (1) Cattell's Sixteen Personality Factor Inventory; (2) a pre-post test on economics; (3) a general inventory developed by the Experimenter to obtain background information (See Appendix C). on the basis of the results of the personality measures all subjects were divided according to personality category. Within each category, however, the subjects were randomly assigned to a treatment method (See Figure 3).

Cattell's Inventory measures sixteen primary personality traits and some secondary factors. The primary traits are:

reserved - outgoing
intelligence
affected by feelings - emotionally stable
submissive - dominant
serious - happy-go-lucky
expedient - conscientious
timid - venturesome
tough-minded - sensitive
trusting - suspicious
practical - imaginative
forthright - shrewd
self-assured - apprehensive
conservative - experimental
group-dependent - self-sufficient
relaxed - tense

Cattell claims that he has not left out any important aspect of the total personality.² The second-order factors of

²Raymond B. Cattell and Herbert W. Eber, Handbook for the Sixteen Personality Factor Questionnaire (Champaign, Ill.: Institute for Personality and Ability Testing, 1962), 21.

Extraversion and Neuroticism, upon which the hypotheses of this study are based, are simple combinations of the primary traits.³ Weighted factors of:

trusting - suspicious
self-assured - apprehensive
relaxed - tense

minus weighted factors of:

affected by feelings - emotionally stable
uncontrolled - controlled
timid - venturesome

are combined to form the score for Neuroticism. For the Extraversion score, weighted factors of:

reserved - outgoing
submissive - dominant
serious - happy-go-lucky
timid - venturesome

minus the weighted factor of:

group-dependent - self-sufficient

are combined.

The test-retest reliabilities for this instrument of Cattell's average .75, while the internal construct validities average .67. Buros considers this the best inventory measuring instrument of its kind.⁴ Some recognize it as giving the most total view of personality at the present time. It is based on thirty years of research and

³S.B. Sells, "Personality," Encyclopedia of Educational Research, 4th ed. (ed.) Robert L. Ebel (London: Macmillan, 1969), 935.

⁴Oscar Kristen Buros (ed.), Sixth Mental Measurements Yearbook (Highland Park, New Jersey: Gryphon Press, 1965), 368.

development and consequently has a solid foundation of empirical evidence for the stability and independence of its sixteen scales.

A test relative to content, designed by the Experimenter, was used to determine both entry behavior and achievement gain after Treatment (See Appendix C). The test was designed to be administered before Treatment but after the subject had spent at least fifteen minutes studying the Gross National Product Dictionary (See Appendix C) and again after Treatment to measure gain. The subjects did not know that they would have the same pre and post tests. The instrument contained twenty-four questions. Four were short essay type questions relating to articles in the New York Times, while the remainder were of the objective type: True-False and Completion.

Both the pre and post attitude tests for those subjects taking the CAI method of Treatment were based on the work of Desch and Stolurow. Thirteen statements pertaining to CAI were in the General Inventory to measure how the subjects felt about CAI before taking the Treatment (See Appendix C). In order to obtain the reactions of the CAI subjects relative to their exposure to CAI, thirteen similar statements were chosen from the Post CAI attitude instrument.

The pretesting was completed in two large group sessions for the majority of subjects and in smaller groups for the others. The personality inventories were analyzed by computer and the subjects were randomly assigned to Treatment on the basis of personality factors as planned.

The data were analyzed by means of interaction analysis. A factorial design was used so that the Investigator could observe the effect of both Neuroticism and Extraversion on the achievement of all subjects as well as on the attitude of the CAI subjects. It was also used to observe the interaction of the Independent Variables on the Dependent Variables.

After the treatment was given, the achievement of all the groups and the attitude of the CAI groups were measured and the results subjected to a multivariate Analysis of Covariance. It was thus possible to see whether different methods produced different achievement gains and whether different independent variables produced different achievement and attitude gains, as well as to observe the difference between the groups after subtracting differences due to method and personality variables. The effect on gain of both the interaction among the variables could also be observed.

Method of Treatment

The same lesson plan was provided to the lecturer and to the computer programmer (See Appendix B). Based on this plan, the lecturer, an instructor in economics, prepared his lesson and the programmer, the author, modified the program used by the University of Notre Dame and translated it from BASIC to APL.

The intent of the experiment was to provide two very different external conditions of learning. The lecture represented a clearly defined stimulus situation in which the subject would only sit and listen. It was one in which he was not required to provide evidence of comprehension, but in which he could learn from the lecturer and take notes if he so desired.⁵ The lecture was to be presented in approximately fifteen minutes in a stereotyped manner with no questions or interruptions of the presentation.

This particular lecture method consisted of first, an Instructor who gave a lecture to a group of subjects, and second, volunteers who simulated actual subjects, as the groups of subjects were considered too small for a normal lecture. So twenty persons were thus recruited to act the part of subjects. This gave the lecturer a reasonable class size and a realistic classroom setting. The subjects did not

⁵This utilization of the Lecture method of treatment followed that used by Brucker in his study, op. cit., 14.

know that the simulated subjects were not true subjects. Since each of the lecture groups was one unit for purposes of statistical analysis, eight separate lectures were given. They were conducted in an actual classroom on the campus of Michigan State University.

Upon arriving at the classroom for the lecture, the subjects were met by the lecture facilitator. She was to offer them the learning aid--the Gross National Product Dictionary--which they could take with them into the classroom if they wished. A five minute break was scheduled between the classes to give time for one group to leave and the next to enter. As they left the classroom the subjects were given the evaluative instruments to complete in another classroom (See Appendix C).

Each lecture actually lasted from seventeen to twenty minutes. Each was conducted according to plan. Given in a straightforward manner, the Instructor used the chalkboard to illustrate some of the points he was making. No questions or interruptions were permitted. Instead of ten subjects and twenty simulated subjects, the mean number of subjects in each group was closer to seven and in addition there were nineteen simulated subjects.

The difference in the time frame did not change the intent of the experiment. Moreover, the varied numbers of subjects did not influence the outcome as each lecture was considered as an independent group, as was the original intent.

The lectures took place as planned on the morning of Saturday, March 4th, 1972, while CAI took place on eight different dates over the period of April 20 to May 5, 1972 (See Appendix B).

As defined in Chapter II, CAI as referred to in this study is the use of the computer for instruction in which there is an interaction between the student and the machine. The terminal was a small keyboard model connected by telephone lines to a nearby IBM 360. There was an APL element in the keyboard as the program was written in that language (See Appendix B). The method of programming was linear. Towards the end of the lesson, the subject was able to simulate the economic environment under consideration (i.e., the change in the Gross National Product due to a change in investment demand) by entering a variable of his choice called for by the program. The student was able to use this simulation as often as he liked. The intent of the CAI method of treatment was to provide an impersonal environment in which the interaction between the subject and the machine was primary.

After arriving at the classroom in which the terminal was located, subjects received a "Hello" sheet on which the introduction to the lesson was written. It provided information that did not need to be entered on the computer. The student was provided with a dictionary of terms and could use

it if he wished to do so. When he had finished working on the computer, the subject received an evaluative instrument on the method of instruction called The Rating Report, the CAI post attitude measure to complete, and the post test on the lesson content (See Appendix C). The time the subjects spent at the terminal was measured. The mean time was seventeen minutes. Of the seventeen CAI subjects only one asked to use the simulation exercises three times. Over half asked to use the simulation twice. Seven used it once.

The CAI program was written in the tutorial mode. It allowed for simulation (See Appendix D). An analysis of covariance was run on the pre and post treatment attitudes.

Testable Hypotheses

There were two main research hypotheses to be tested.

1. High Neurotic subjects tend to achieve better in the lecture method and Low Neurotic subjects tend to achieve better in CAI.

$$H_1: p < 0.05$$

The null hypothesis here is that there is no interaction between Neuroticism and the Treatment.

$$H_0: p < 0.05$$

2. High Extraverted subjects tend to achieve better in the lecture method and Low Extraverted subjects tend to achieve better in CAI.

$$H_2: p < 0.05$$

In this case the null hypotheses is that there is no interaction between Extraversion and the method of Treatment.

$$H_0: p < 0.05$$

There were also two auxiliary hypotheses which were to be tested.

1. Low Neurotic subjects tend to have a better attitude toward CAI than High Neurotic subjects.

$$H_3: p < 0.05$$

The null hypothesis here is that there is no interaction between Neuroticism and the method of Treatment.

$$H_0: p < 0.05$$

2. Low Extraverted subjects tend to have a better attitude toward CAI than High Extraverted subjects.

$$H_4: p < 0.05$$

The null hypothesis here is that there is no interaction between Extraversion and the method of Treatment.

$$H_0: p < 0.05$$

Model

The model used to test the main hypotheses was the three-way analysis of covariance. The independent variables were: (1) Extraversion; (2) Neuroticism; and (3) the method of Treatment. The dependent variable was achievement gain. The pretest on content was used as a covariate.

The data to be analyzed had to be looked at for interactions. This is one reason why the three-way analysis of covariance (ANOVA) was used.

To observe the attitude of the CAI subjects a two-way analysis of variance was used. This provided a way to measure the interaction of personality and attitude. The independent variables were: (1) Extraversion and (2) Neuroticism. The dependent variable was the attitude gain. The two dimensions of this model were Extraversion and Neuroticism.

Summary

It was decided that the most feasible study was a small scale preliminary investigation into the problem of the interaction of personality and two learning situations. Hopefully, empirical evidence would be forthcoming relative to these interactions.

The sample consisted of seventy-two volunteer subjects divided into twenty-five independent groupings. These subjects were all undergraduates at Michigan State University. It would seem that the difference in numbers of subjects and in the dates of the treatment did not interfere with the experiment. Although eighty subjects would have been ideal, the intent of the experiment was nevertheless carried out. The addition of the CAI attitude measure meant that a broader look could be taken at the individuals who took this method of treatment.

CHAPTER IV

ANALYSIS OF RESULTS

Introduction

The design of this study enables the data to be analyzed in a particular manner. Once gathered, the data present certain trends to be discerned. The findings of such a small study cannot produce undebatable conclusions; rather they present possibilities and directions for replication in future studies.

Results were arrived at through the analyses of the data by means of interaction analyses. A factorial design was used so that the investigator could observe the effect of both Neuroticism and Extraversion on the achievement of the subjects. It was also used so that he could observe the interaction of the independent variables on the dependent variable. After the Treatment was given, the achievement of the groups was tested and the results subjected to a multivariate analysis of covariance. It was thus possible to see whether the main effects of this study produced different degrees of achievement. The design of this study was a $2 \times 2 \times 2$ model.

Findings

The null hypothesis, that there is no interaction between Neuroticism and the method of Treatment, could not be rejected ($p < 0.2433$).

The research Hypothesis that subjects high in Neuroticism tend to achieve better in the Lecture Method and subjects low in Neuroticism tend to achieve better in CAI failed to be accepted.

$$\text{Computed } F_{(N-1df)} = 1.4680$$

$$\text{Needed } F_{(N-1df).05} = 4.26$$

The null hypothesis, that there is no interaction between Extraversion and the method of Treatment could not be rejected ($p < 0.1709$).

The second Hypotheses that subjects high in Extraversion tend to achieve better in the Lecture method and subjects low in Extraversion tend to achieve better in CAI failed to be accepted.

$$\text{Computed } F_{(N-1df)} = 2.0566$$

$$\text{Needed } F_{(N-1df).05} = 4.26$$

In the ANCOVA table for achievement (Table 1), the statistics are listed for the Main Effects and the observed interactions. Of the three main effects, Treatment, Neuroticism and Extraversion, the null hypothesis failed to be rejected for the Treatment ($p < 0.0575$) and Neuroticism ($p < 0.3817$). There seems to be an interaction, however, between

Extraversion and the achievement of the subjects ($p < 0.0110$). In general the subject low in Extraversion seems to achieve higher. The null hypotheses in the second order interactions failed to be rejected at the p point of .05, thus indicating that there would not seem to be interactions among them.

TABLE 1.--ANCOVA table for achievement study.

	MS	F	P
Treatment	155.2731	4.1885	0.0575
Neuroticism	30.0002	0.8693	0.3817
Extraversion	307.1318	8.2849	0.0110
Treatment x Neuroticism	54.4214	1.4680	0.2433
Neuroticism x Extraversion	7.7644	0.2094	0.6534
Treatment x Extraversion	76.2398	2.0566	0.1709
Treatment x Neuroticism x Extraversion	20.6718	0.5576	0.4661

Listed in Table 2 are the findings from the ANOVA test for attitudes. It would seem that, statistically speaking, nothing has been learned since the null hypotheses for the two Main Effects, Neuroticism and Extraversion, failed to be rejected. For Neuroticism this was at a p point of 0.0883 and for Extraversion at 0.9401. It would seem that the degree to what a person is neurotic or extraverted does not relate with his attitude towards CAI.

The null hypothesis that there is no interaction between Neuroticism and the subject's attitude towards CAI could not be rejected ($p < 0.0883$).

The auxiliary hypothesis that CAI subjects low in Neuroticism tend to have a better attitude towards CAI than subjects high in Neuroticism failed to be accepted.

$$\text{Computed } F_{(N-1df)} = 3.3962$$

$$\text{Needed } F_{(N-1df).05} = 4.49$$

The other auxiliary hypothesis that CAI subjects low in Extraversion tend to have a better attitude towards CAI than subjects high in Extraversion failed to be accepted.

$$\text{Computed } F_{(N-1df)} = 0.0059$$

$$\text{Needed } F_{(N-1df).05} = 4.49$$

The null hypothesis that there is no interaction between Extraversion and the subject's attitude toward CAI could not be rejected ($p < 0.9401$).

TABLE 2.--ANCOVA table for attitude study.

	MS	F	P
Neuroticism	1573.1645	3.3962	0.0883
Extraversion	2.7200	0.0050	0.9401
Neuroticism x Extraversion	7.9605	0.0172	0.8978

Because of the interactive nature of the investigation, other possible hypotheses emerged during the course of the study. The hypotheses and the results follow.

The null hypothesis that the test is content was not a reliable predictor, was rejected ($p < 0.0372$). Therefore the effect was found for the alternate hypothesis that the test in content was a reliable predictor.

$$\text{Computed } F_{(N-1df)} = 5.1686$$

$$\text{Needed } F_{(N-1df).05} = 4.26$$

The null hypothesis that the method of treatment had no interaction with the achievement of the subjects, could not be rejected ($p < 0.0575$).

The hypothesis that those subjects taking the CAI treatment achieve better than those subjects in Lecture Method was not accepted.

$$\text{Computed } F_{(N-1df)} = 4.1885$$

$$\text{Needed } F_{(N-1df).05} = 4.26$$

TABLE 3.--Regression analysis.

Variable	Square M.R.	M.R.	F	P
Post Content Score	0.2442	0.4941	5.1686	0.0372
Step Down F				P
5.1686				0.0372

In Table 3, the Regression Analysis of the content score, the statistics listed indicate that the Test in Content was a reliable predictor. As the pretest in Content was used as covariate it was considered necessary to analyze it to observe whether or not this was statistically true. It proved to be statistically significant at the p point of 0.0372.

The null hypothesis that Neuroticism does not interact with achievement could not be rejected ($p < 0.3817$). The hypothesis that those subjects high in Neuroticism tend to achieve better than those subjects low in Neuroticism was not accepted.

$$\text{Computed } F_{(N-1df)} = 0.8693$$

$$\text{Needed } F_{(N-1df).05} = 4.26$$

The null hypothesis that Extraversion does not interact with achievement was rejected ($p < 0.0110$). The hypothesis that those subjects low in Extraversion tend to achieve higher than those subjects high in Extraversion was accepted.

$$\text{Computed } F_{(N-1df)} = 8.2849$$

$$\text{Needed } F_{(N-1df).05} = 4.26$$

The null hypothesis, that there was no interaction between the aptitude variables and the Treatment could not be rejected ($p < 0.4661$).

The hypothesis that Extraversion and Neuroticism interacted with the Treatment was not accepted.

$$\text{Computed } F_{(N-1df)} = 0.5576$$

$$\text{Needed } F_{(N-1df).05} = 4.26$$

The null hypothesis that there is no interaction between the aptitude variables and the CAI subject's attitude towards CAI could not be rejected ($p < 0.8978$), (See Table 2).

The hypothesis that Extraversion and Neuroticism interact with the subjects' attitude towards CAI was not accepted.

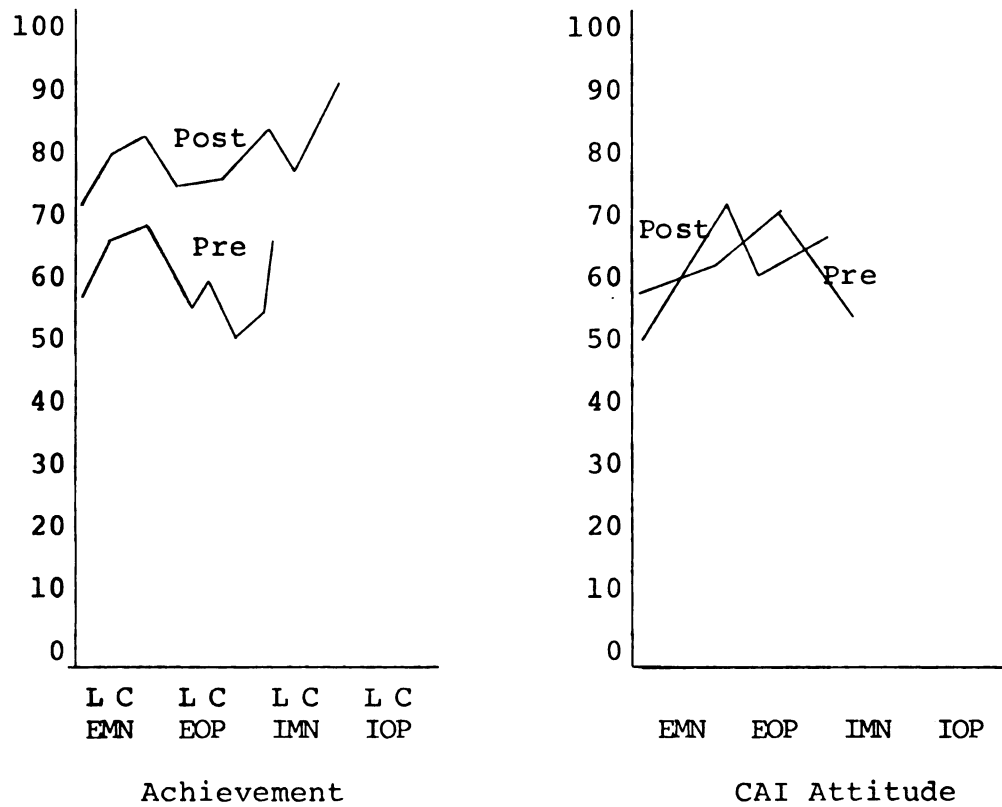
$$\text{Computed } F_{(N-1df)} = 0.0172$$

$$\text{Needed } F_{(N-1df).05} = 4.49$$

Figure 5 presents the pre and post scores of the groups. The scores are graphed according to personality variables within the Method of Treatment. The gain in achievement from pre and post tests by all groups as well as the higher achievement of those subjects low in extraversion ($p < 0.0110$) may be visualized.

The higher achievement of the CAI groups is more difficult to discern ($p < 0.0575$). In the graph of the attitude scores of the CAI subjects, one point in particular may be noted: the drop in attitude of those subjects high in neuroticism ($p < 0.0883$).

Pre and Post Scores



L = Lecture

C = CAI

EMN = High Neuroticism - High Extraversion

EOP = Low Neuroticism - High Extraversion

IMN = High Neuroticism - Low Extraversion

IOP = Low Neuroticism - Low Extraversion

Figure 5

To analyze four aspects of the two different Methods of Treatments, a Rating Report was administered to all of the subjects after the Treatment (see Appendix). This Rating Report was a list of statements with which each subject was asked to indicate either his agreement or disagreement. Four areas of the Method of Treatment were investigated by this Rating Report:

1. The entry-level of the subjects
2. The communication of the particular Method of Treatment
3. The atmosphere of the learning situation
4. The learning of the students

TABLE 4.--Summary of Rating Report Results.

Area	CAI	Lecture
Entry Level	72%	79.5%
Communication	78.25%	61.75%
Instructional Atmosphere	81%	27.66%
Learning	47.75%	34.75%

The subjects overwhelmingly felt that they needed the material, but considered themselves inadequately prepared for the lesson. The great majority of subjects felt both that instructional situations communicated but a larger percentage of CAI subjects responded positively.

Learning was pleasant for the great majority of the CAI subjects but not for the Lecture subjects. Although a larger percentage of CAI subjects than Lecture subjects felt that they had learned, this percentage was not high. (See Appendix C).

In order to measure also the post attitude of the CAI subjects another instrument was used. (See Chapter III). The post attitude of those subjects in the Lecture Method was not measured as such. Related to the hypotheses concerning the attitude of the CAI subjects are the following additional comments written by the CAI subjects on the Post CAI Attitude Questionnaire.

Additional Reasons they liked working with the computer:

It was fun.
It's the first time I ever used one and it was interesting.
It was a new experience.

Additional Reasons they did not like working with the computer:

The machine could not give an explanation in detail.
I like having a human professor.
It did not explain in depth.
I couldn't ask questions. (twice)
I didn't understand what it was talking about.

"Please add anything else which you feel would provide information to people working with computer classes."

There should be an explanation as to the Math in the examples, not just showing answers. I had trouble figuring where and how the computer came

up with the results. If it had shown what operations were being performed and explained them, it would have been easier to learn.

I think there should be a teacher working along with the computer. I wasn't able to grasp the concepts. If a teacher were there I could ask about the parts of the question I did not understand.

I think when one first works with a computer the material should be pretty easy to grasp so the student can get used to the machine, later when he is comfortable introduce new and more difficult material.

If the experiment was designed only to test the teaching advantages of computer vs. lecture by a professor, I'd have to say I think it could have been done more effectively. Perhaps this is a biased opinion because I detest economics, but I do think computers are good "teachers" and I enjoy using them. Basically, I feel this test was no fair indication of my ability to learn or the relative worth of a computer as a method of teaching. I would be willing to do further experiments if economics was not involved.

The computer is a good idea but in conjunction with a professor it would be more profitable because unless you are able to ask questions of the computer--sometimes confusion results. It is an interesting way of learning--starting from scratch rather than in the middle of material might prove better . . . I don't think I had beginning background in economics--that is enough for this.

The computer was fun to work with and very interesting, but you cannot ask it about questions or concepts that you do not understand which is why I think I would prefer a teacher either alone or along with the computer.

Once one becomes familiar with the terms (computer terms) I imagine they would find it less confusing. But that hindered many of my responses.

This was a good experience except for two reasons. It was hard to look back at previous information which it is easy to do in a book and secondly I couldn't ask questions to explain difficult points or elaborate on interesting points.

I think working on the computer is much more interesting because one generally needs to think a little more than in a (classroom) or test situation. It is much more rewarding knowing you have learned something on your own.

The CAI Facilitator reported that all of the CAI subjects asked for the computer print out of their interaction. The very fact that the request was made by each subject is of interest. Two of the subjects were reported to be "terribly excited" about the medium.

Conclusions

As can be seen in the ANCOVA Table for Achievement (Table 1), Neuroticism and Extraversion do not appear material to the subject's achievement. Little interaction was seen between the personality variables of Extraversion and Neuroticism with the Method of Treatment, as related to the achievement of the subjects ($p < 0.4661$).

The interaction between Neuroticism with the Method of Treatment could be found twenty-four percent of the time ($p < 0.2433$); the interaction between Extraversion with the Method of Treatment could be found seventeen percent of the time ($p < 0.1709$).

As examination of the ANOVA Table for Attitude reveals that Neuroticism on the one hand and Extraversion on the other are immaterial to the attitude of the CAI subjects towards CAI. It can be concluded from the data that neither Neuroticism nor Extraversion interacted collectively with the CAI subjects' attitude toward CAI. Those subjects low in Neuroticism had a better attitude ($p < 0.0883$) toward CAI than those subjects high in Neuroticism by almost one standard deviation. Those same subjects had a better attitude towards CAI than those subjects high in Neuroticism. On the scale of Extroversion there does not seem to be any difference between one's place on the continuum of Extraversion and one's attitude towards CAI.

The test to justify the inclusion of the pretest in the analysis was statistically significant at the p point of .0372. It can thus be concluded that the instrument was definitely a good predictor. (See Table 3).

It appears from the data that whether subjects are low or high on the scale of Neuroticism no difference occurs in their achievement. In terms of the Extraversion scale, however, it also appears that those subjects low in Extraversion achieve significantly higher than those subjects high in Extraversion. From this particular study it can be concluded that those subjects low in Extraversion achieve higher than those high in Extraversion.

As the significance level for the study was at .05, the finding that the achievement gain of the CAI subjects was at .0575 cannot be considered statistically significant. At the same time the fact that the CAI subjects' overall achievement was greater than that of the Lecture subjects should not fail to be noted; it was almost one standard deviation higher than that of the Lecture subjects.

Comparing the feedback from the Rating Report with the subjects' comments about the external conditions of learning, it can be concluded that the CAI situation was rated higher in all four areas investigated. CAI was rated much higher, however, in Communication and the pleasantness of the learning environment. The comments of the CAI students speak for themselves. The absence of a human teacher was definitely felt by the subjects. The fact that it was felt to be fun and interesting, however, did show positive attitude towards CAI.

Figure 6 presents both the pre and post achievement scores of all eight groups. In this way the gain can be seen.

Summary

Neither Neuroticism nor Extraversion appear to interact with CAI or the Lecture Method. Moreover, there was found to be no significant difference between the level of Neuroticism and achievement. Between the achievement of

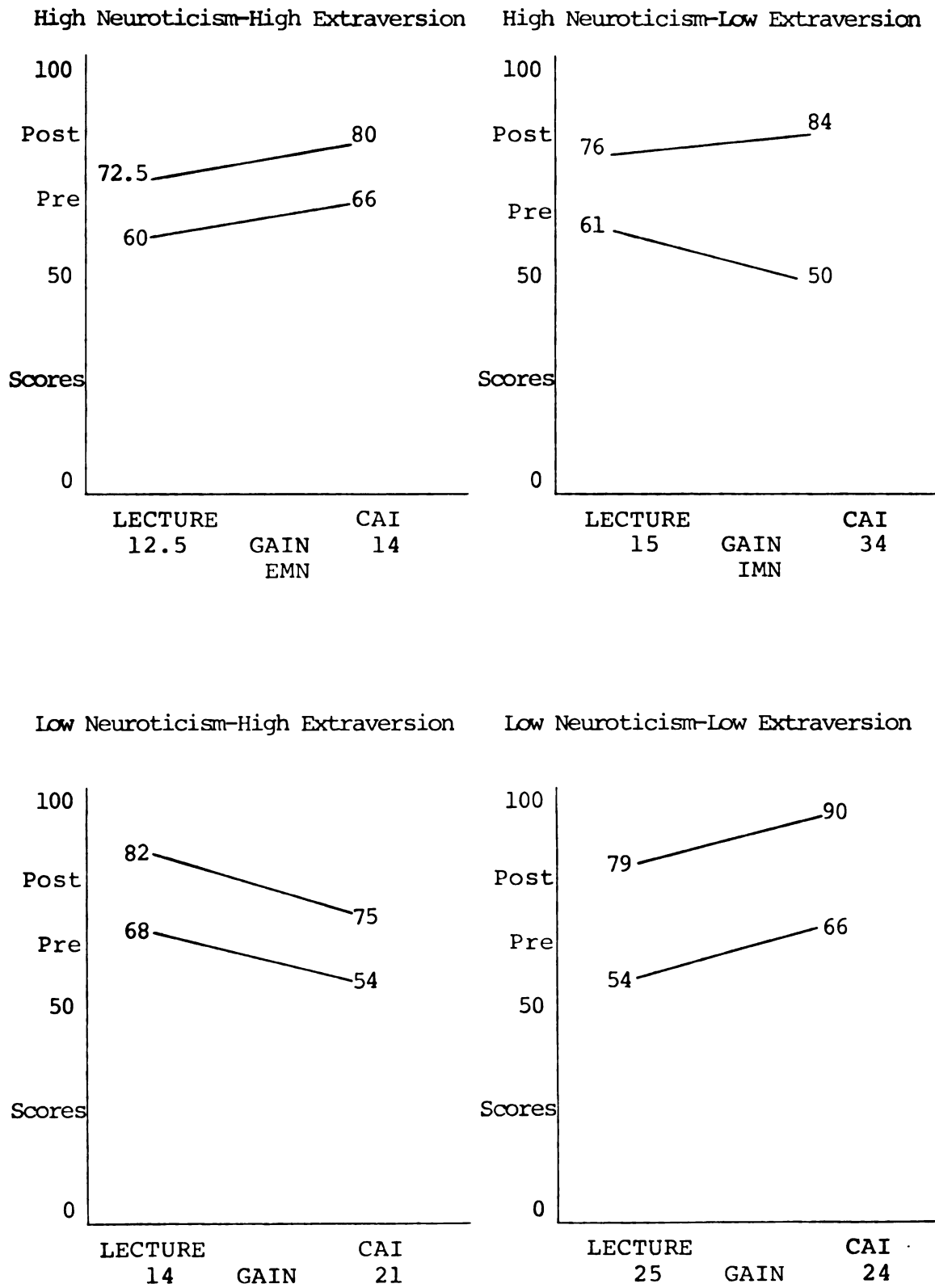


Figure 6

those subjects high in Extraversion and those low in Extraversion there was found to be a significant difference, with those subjects low in Extraversion achieving more than one standard deviation higher than those subjects high in Extraversion. The CAI subjects achieved almost one standard deviation higher than the Lecture subjects.

With regard to attitude only the CAI subjects were measured. The level of Extraversion was found to be ($p < 0.9401$); the level of Neuroticism was found to be ($p < 0.0883$).

CHAPTER V

SUMMARY AND CONCLUSIONS

Introduction

The major contribution of this study appears to be that achievement does not seem to improve as a result of the use of either of the two methods of Treatment; CAI or Lecture, as opposed to the other, considering the personality traits of Extraversion and Neuroticism. This investigation would seem to show that under the external conditions of learning as used in this study it makes no difference whether the individual's internal conditions of coding, specifically the Complexity Program of Biggs, are matched with the external conditions.

Another contribution of this study is the reenforcement of the finding that subjects low in Extraversion tend to achieve better overall, independently of the method of treatment.

Another contribution is the finding, although not statistically significant, that those subjects in the CAI Treatment tend to achieve better than those subjects in the Lecture Treatment, a finding similar to those of previous research.

Having these contributions in mind it is necessary to look at the implications of this study, to do some speculating and finally to suggest other possible approaches.

Implications

Since the present study did not show statistical significance in the interactions of the Complexity Program, i.e., Extraversion and Neuroticism with the two Methods of Treatment, it would seem that the interaction of the internal and external factors of learning is not as essential to learning as Biggs' theory indicates.

Since those subjects low in Extraversion seem to achieve higher in both methods of treatment, it would seem that they would tend to achieve higher under other methods of treatment.

Since the CAI subjects achieved at the $p < 0.0575$ level, even though this level is not statistically significant in this study, it would seem to follow that, irrespective of the internal conditions of coding, the external condition of CAI seems to stimulate and motivate individuals. One would normally expect that at $p < 0.0575$ the lines of interaction might be close, but, as can be seen in the following graph, this is not the case. The difference in achievement is greater for the CAI subjects, but not statistically significant. From this investigation it would therefore appear that CAI tends to facilitate learning.

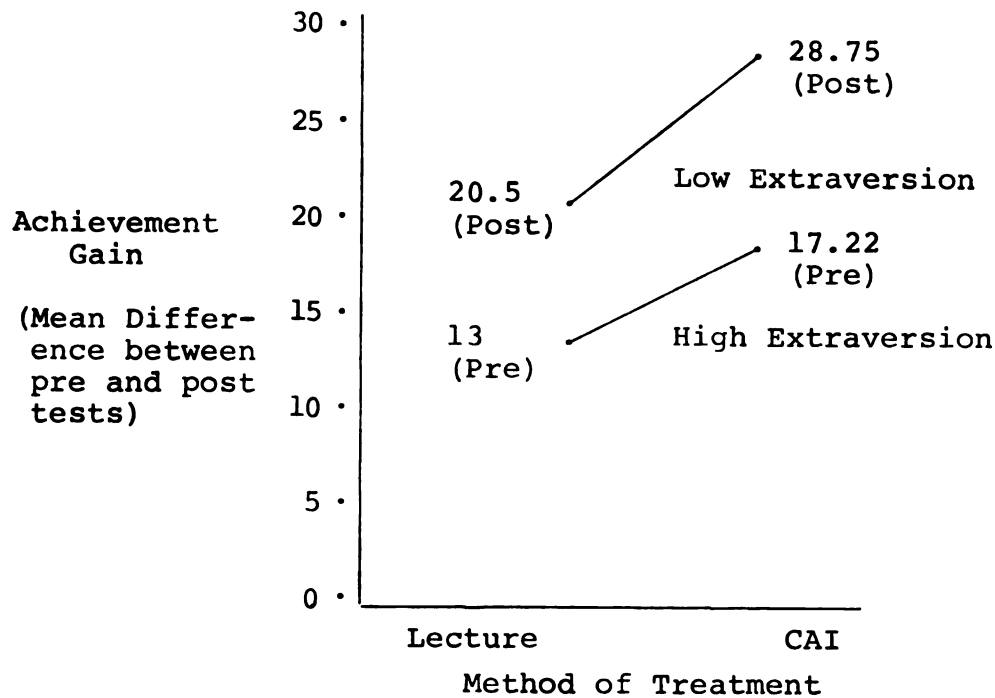


Figure 7.--Three-way Interaction: Extraversion-Achievement Gain-Method of Treatment

This present study might appear to contradict findings of Thomas Nagel. Nagel found small positive correlations between High Extraversion and achievement in CAI and small negative correlations between Neuroticism and achievement in CAI. In the present study those subjects low in Extraversion generally achieved higher and neither Extraversion nor Neuroticism as such seemed to interact with the method of Treatment and achievement, those subjects low in Neuroticism having a better attitude towards CAI.

The present study reenforces the findings of Sutter and Reid in that the lack of interpersonal contact in the CAI situation does not hamper learning.

Bucker's study, like Nagel's, shows small positive correlations of achievement with subjects high in Extraversion as contrasted with subjects low in Extraversion. In contrast, the present study seems to show that subjects low in Extraversion were doing better than those subjects high in Extraversion. The finding in the present study that CAI subjects low in Neuroticism have a better attitude towards the learning environment would seem to support a similar finding of Brucker's study on Programmed Instruction.

Suggestions for Further Research

It might prove more fruitful if further research on Biggs' theory were conducted in a natural situation rather than in a contrived situation, and over a long period of time. Such a rearrangement would provide a more realistic setting for investigating the interaction of the external conditions of coding and the internal conditions of the subjects and the achievement and attitude of such subjects.

More research is needed to discover whether the personality of the student, as defined in this study, needs to be considered in a man/machine situation such as CAI. It might be well to concentrate only on CAI subjects and within that group to provide for varied conditions of external coding conditions in a CAI environment.

Moreover, as was suggested above, an experiment such as the present one needs to be replicated over a longer time frame. The present study is just a beginning. It would also be prudent to measure a larger sample than was measured. Trends based on a single study are not readily interpretable. Further more, using the same hypotheses and Methods of Treatment, the achievement as well as the attitude of subjects might be investigated using content areas other than economics.

A study of those subjects high in Neuroticism within the framework of CAI would add to the knowledge base and might clear up an apparent contradiction in the findings of this present study: namely, that while those subjects low in Neuroticism had a better attitude, those subjects high in Neuroticism achieved higher. Perhaps by means of such a study an attempt might be made to make CAI more appealing to those subjects high in Neuroticism.

Since there is an interaction between Extraversion and achievement, a more detailed investigation might provide more knowledge.

A study using the same hypotheses but two other different methods of treatment might also yield new knowledge. Interesting results could perhaps be found in the interaction of internal and external conditions of coding, that is, from a study in which CAI was taken with a human manager with a study in which CAI was taken without a human manager.

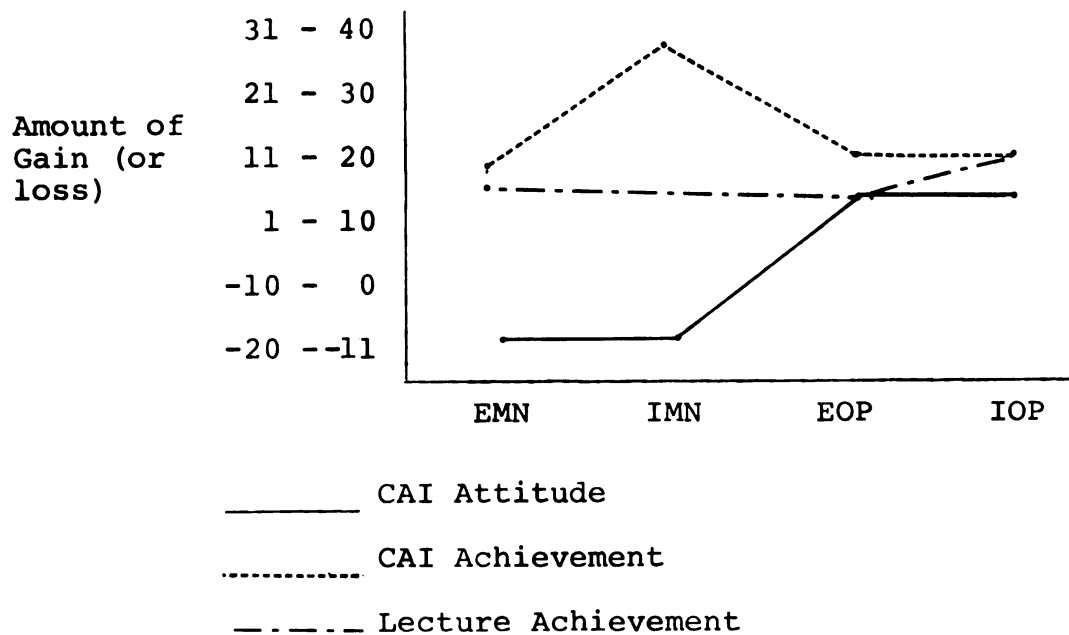
Finally, a study correlating attitude towards method of teaching with achievement under the method of question would expand the knowledge base. Such a study might also help to explain why in the present investigation subjects low in Neuroticism had a more favorable attitude towards CAI while those subjects high in Neuroticism achieved higher. (See Figure 8).

Speculation

The No Significant Difference in the finding that neither Neuroticism nor Extraversion seems to interact with achievement in these particular methods of treatment leads one to hypothesize about the reasons for this finding:

1. The Measure of Aptitudes is not good. This could not have been true as the Sixteen Personality Factor Inventory of Cattell is considered by Buros as being the best measuring instrument of its kind. It has proven reliability and validity for measuring the particular variables that the Investigator wanted to measure. It was administered in strict accord with the procedural regulations and to insure its objectivity and reliability it was computer scored.

2. The Variables do not seem to make any difference. This would mean that the similarity of the individual's internal psychological factors to his



EMN = High Extraversion - High Neuroticism

IMN = Low Extraversion - High Neuroticism

EOP = High Extraversion - Low Neuroticism

IOP = Low Extraversion - Low Neuroticism

Figure 8.--Distribution of Gain

educational environment does not necessarily assure that his intrinsically motivating internal feedback will control and maintain learning in such a situation as the present study investigated. Perhaps the key relationship in Biggs' theory, i.e., that between the stimulus pattern in the environment and the degree and level of arousal in the individual, is not as essential as Biggs believes.

Collectively the variables did not interact with the Treatment. Those subjects low in Extraversion, however, generally achieved higher than those high in Extraversion; therefore those subjects low in Extraversion are generally better students. Since this has been indicated by previous research, there is no need to discuss the question.

That there is no significant differences in achievement between those subjects high in Neuroticism and those low in Neuroticism is an interesting point for discussion. What this fact seems to indicate is that the learning environment, as established in this study, is indifferent to those subjects grouped according to the variable. This is most interesting with reference to the CAI Treatment since the man/machine interaction has been considered by some authors to be a stressful situation. If such had been true in this study, those subjects grouped low in Neuroticism should have achieved higher. The stress which leads persons high in Neuroticism to overreact, however, is perhaps that stress which exists between persons and not that caused by a machine environment.

3. The difficulty may stem from another source. Even though statistical techniques were carefully employed, the length of the experiment might not have been sufficient to discriminate and the size of the sample might not have been large enough. Bias may possibly have resulted from

several factors. The study was conducted under experimental conditions outside of regular classes. The size of the Lecture groups in the level of subjects low in both Neuroticism and Extraversion was small in comparison to the other three levels. Some lectures were early in the day and some later. Moreover, four of the CAI subjects had machine difficulties. In one instance the paper ran out in the middle of the lesson; in another the computer "went down": in another the subject was "dropped off" twice. Such occurrences did not contribute to a positive attitude towards CAI, and therefore CAI had to be conducted over a period of time instead of in one day as had been originally scheduled. In short, although as many good experimental measures as possible were built into the study, some of the less favorable factors mentioned may have contributed to the results of this study.

Since Grade Point Averages were not taken into account in the distribution of the sample, perhaps those subjects low in Extraversion, considered separately, or those assigned to CAI, considered separately, had high Grade Point Averages. Looking at the four levels it can be seen that the Grade Point Average are not very different:

	Lecture	CAI
High Neuroticism - High Extraversion	2.84	3.24
High Neuroticism - Low Extraversion	2.85	3.03
Low Neuroticism - High Extraversion	2.91	2.59
Low Neuroticism - Low Extraversion	2.98	3.20

Another variable not taken into account in the distribution of the sample to Method of Treatment was that of being an eldest child. As research has shown that eldest children tend to be high achievers, the sample might have been biased in this respect. But, as the table below shows, the eldest children were fairly evenly distributed across the sample groupings.

	Lecture	CAI
High Neuroticism - High Extraversion	3	0
High Neuroticism - Low Extraversion	6	0
Low Neuroticism - High Extraversion	7	2
Low Neuroticism - Low Extraversion	4	1

Since only three of the CAI subjects were eldest children, this occurrence would have had no effect whatever on the higher achievement of the CAI subjects. Moreover, the higher achievement of the subjects low in Extraversion could not be affected by this variable since only eleven of the subjects were in the grouping low in Extraversion and twelve subjects were grouped high in Extraversion.

Some of the subjects did not value the content area in itself and so the method of teaching takes on more importance. The fact that learning via CAI was felt to be much more pleasant than in the Lecture Method means more since the score of the material covered was the same.

The Rating Report indicates that many of the subjects did not feel that they had learned. The fact that there was a

great variance on the pretest on content (227.058) and not much on the posttest (46.161) shows that learning did take place. This is also seen in the gain in achievement, which was more unified after the Treatment. The standard deviation on the pretest was 15,0685 while on the posttest it was 6.7942. Achievement was also higher in all groups.

Since 65% of the sample were female and 35% male, the variable in question might have tended to create some bias. This possibility invites investigation by means of further studies. Of the seventeen CAI subjects eleven are female, and of the sixteen CAI subjects low in Extraversion nine are female. Although the difference in mix here is not great, it should be investigated further. Below is a table showing the distribution of the subjects according to sex:

	Lecture		CAI	
	M	F	M	F
High Neuroticism - High Extraversion	4	11	2	3
High Neuroticism - Low Extraversion	7	9	3	1
Low Neuroticism - High Extraversion	7	9	0	4
Low Neuroticism - Low Extraversion	1	7	1	3

A sample, randomly assigned according to personality, might not have had appropriate levels of high and low Extraversion and Neuroticism. But, as the table below shows, this does not appear to be the case:

2 x 2 x 2	Treatment	$\bar{x}_N$ Neuroticism	$\bar{x}_E$ Extraversion
High Neuroticism- High Extraversion	Lecture 1	6.91	6.95
	Lecture 2	7.67	5.94
	CAI	7.24	6.78
High Neuroticism- Low Extraversion	Lecture 1	7.63	3.58
	Lecture 2	6.9	2.98
	CAI	7.97	3.7
Low Neuroticism- High Extraversion	Lecture 1	4.04	6.59
	Lecture 2	4.0	7.43
	CAI	3.97	6.1
Low Neuroticism- Low Extraversion	Lecture 1	4.05	4.03
	Lecture 2	5.5	4.15
	CAI	4.5	4.17

Summary

As stated in Chapter II, the objectives of the present study were:

1. To add specificity to Biggs' theory concerning the interactions of the internal and external conditions of learning.

From the results of this study it would seem that under the conditions of CAI and Lecture as exemplified in this study, the external conditions of Learning, Extraversion and Neuroticism the internal conditions of learning do not interact ($p < 0.4661$).

2. To observe whether the level of Neuroticism in CAI or Lecture of an individual affects his level of achievement.

The findings of this study would seem to indicate that Neuroticism does not interact with Method of Treatment ($p < 0.2433$).

3. To observe whether the level of Extraversion of an individual affects his level of achievement.

The present study would seem to indicate that Extraversion does not interact with the Method of Treatment ($p < 0.1709$).

4. To identify along the continuum of Neuroticism or Extraversion, the person who may achieve higher in CAI or Lecture.

Given the p point of 0.0110, it would appear that those subjects low in Extraversion achieve higher regardless of the Method of Treatment.

5. To observe whether a better attitude towards CAI is any way dependent upon an individual's level of Neuroticism or Extraversion.

The results of this study would seem to indicate that Extraversion did not interact with the attitude of the subjects toward CAI ($p < 0.9401$). The same was true of Neuroticism and its interaction with the subjects' attitude toward CAI, but with a considerable difference ($p < 0.0883$).

Because the sample was drawn by purposive sampling from the undergraduate population of Michigan State University and because the characteristics of the sample seem to relate to those of the population, it can be assumed that the results can be generalized to such a population (Appendix A).

Whereas this study investigated a small group in a small time frame, the experiment was thought to be valuable as an initial effort in investigation of the theory of Biggs relating the internal and external conditions of learning. It was at first thought that smallness of members would make the study less valuable, but the fineness of statistical measures compensated.

In conclusion, it may be stated that the major contribution of this study is that under the conditions of CAI and the Lecture Method the personality factors of

Extraversion and Neuroticism do not seem to interact with achievement. The theory of Biggs that the internal conditions of coding as exemplified by the Complexity Programs, i.e., Extraversion and Neuroticism, need to be matched with certain external conditions of coding does not seem to be the case, at least within the parameters of this study.

APPENDICES

APPENDIX A

CHARACTERISTICS OF SAMPLE

APPENDIX A

CHARACTERISTICS OF SAMPLE

Family Background

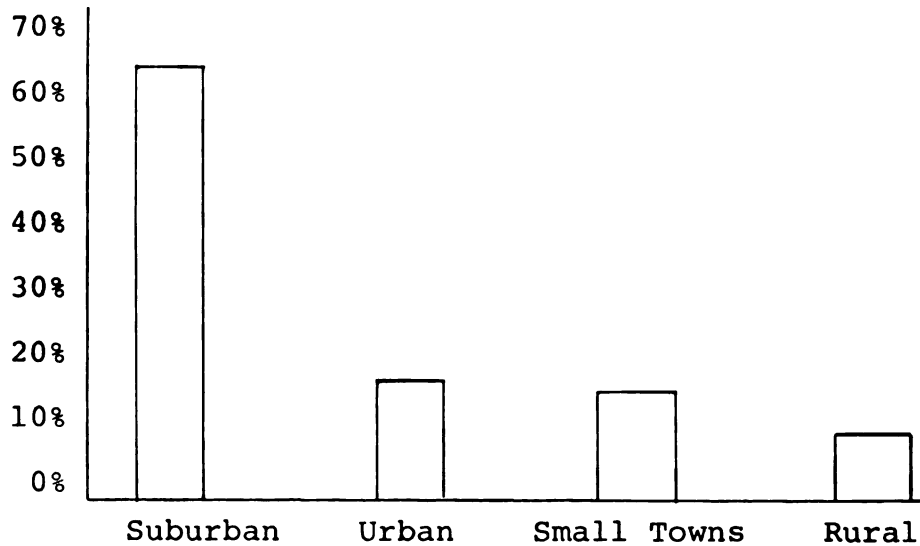
Major Characteristics

Over two-thirds (64%) of the sample were raised in predominantly suburban areas. Almost half (43%) of the mothers of the subjects are housewives. Thirty-eight percent of their fathers and 31% of their mothers are white collar workers. Almost 80% of their fathers had college experience, 18% of them graduating, and 23% taking post-graduate courses, while a little over half of the mothers (53%) had had some college experience with 15% graduating and 9% having some post-graduate courses.

Almost a third of the sample (32%) are eldest children, another third (35%) have brothers or sisters who are college graduates and 30% have siblings who have some college.

Minor Points

- 27% of their fathers are professionals
- 24% of their mothers are professionals
- 14% of their fathers are self-employed
- 1% of their fathers own farms
- 1% of their mothers are self-employed



Areas from which the Sample Came

- 8% of their fathers are skilled workers
- 1% of their mothers are skilled workers
- 10% of their fathers are industrial workers.
- 4% of their fathers had a grammar school education
- 3% of their fathers started but did not complete High School
- 7% of their mothers started but did not complete High School

Personal Characteristics

- Sex: 35% of the sample are male; 65% are female
- Age:
 - 1% - 17 years of age
 - 35% - 18 years of age
 - 38% - 19 years of age
 - 15% - 20 years of age
 - 11% - Over 20 years of age

- Class Standing: 51% Freshmen
 28% Sophomores
 14% Juniors
 7% Seniors

Major Choice of Field

21 No Preference

4 Medical Technology
 4 Social Science

3 Political Science
 3 Psychology

2 Audiology and Speech	2 Pre-Med
2 Criminal Justice	2 Parks and Recreation
2 Elementary Education	2 Retail Clothing and Textiles
2 Nursing	2 Sociology and Special Education
2 Management	

1 Anthropology	1 Mathematics Education
1 Art	1 Music Therapy
1 Biology	1 Pre-Law
1 Chemistry	1 Public Relations
1 Computer Science	1 Social Economics
1 Conservation	1 Social Work
1 Crop Science	1 Spanish
1 Educational Communications	1 TV and Radio
1 Electrical Engineering	1 Veterinary Medicine
1 Geography	

Grade Point Average

The mean grade point average was 2.89. They seemed to follow a normal curve.

4%	0.0 - 1.99
21%	2.0 - 2.49
35%	2.5 - 2.99
28%	3.0 - 3.49
10%	3.5 - 3.99

Background and Attitude Towards
Economics

The general inventory also included a series of items which were constructed to ascertain the level of interest of the subjects in the content area of economics. The subjects were asked to respond either positively (yes) or negatively (no) to a series of statements.

Four items relative to their appreciation of the components of the economic system were included. The first statement, "I hate money," was answered negatively by the majority (93%). To the statement, "Wall Street performs a very useful function," almost four-fifths (79%) agreed, 3% did not answer. Seventy-eight percent responded negatively to the statement, "I read the business section of the paper." But half (57%) answered yes to the statement, "The balance between labor, capital and taxes interests me."

The question of whether the respondents appreciated economics as a subject in school was raised in three statements. To the first, "I think economics is interesting," 62% answered yes. Not quite four-fifths (79%) answered yes to the statement, "I am interested in knowing what is behind money." Only 1% of the sample answered affirmatively to the statement, "I plan to major in economics."

Their appreciation of capitalism was judged by their responses to two statements: to the first statement, "Everyone should own stock," 84% said no, 1% was undecided and 15% said yes. The other statement, "I have invested at one time or another," was answered affirmatively by over two-thirds (68%).

The last area relative to economics was related to their academic background. Half had had no high school courses in economics and 86% had had none in college.

APPENDIX B

OPERATIONAL MEASURES

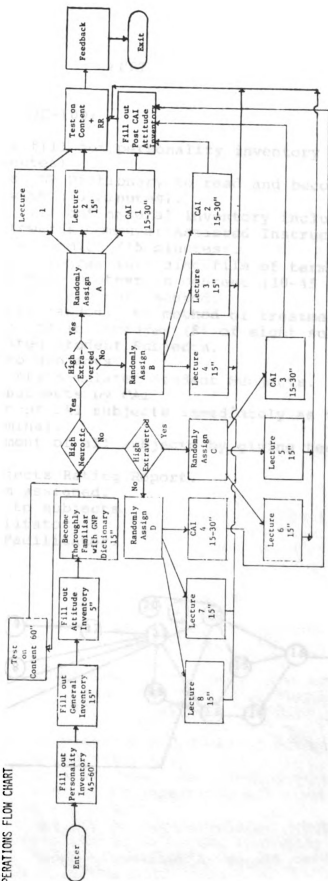
SYSTEMS FLOW CHART

A



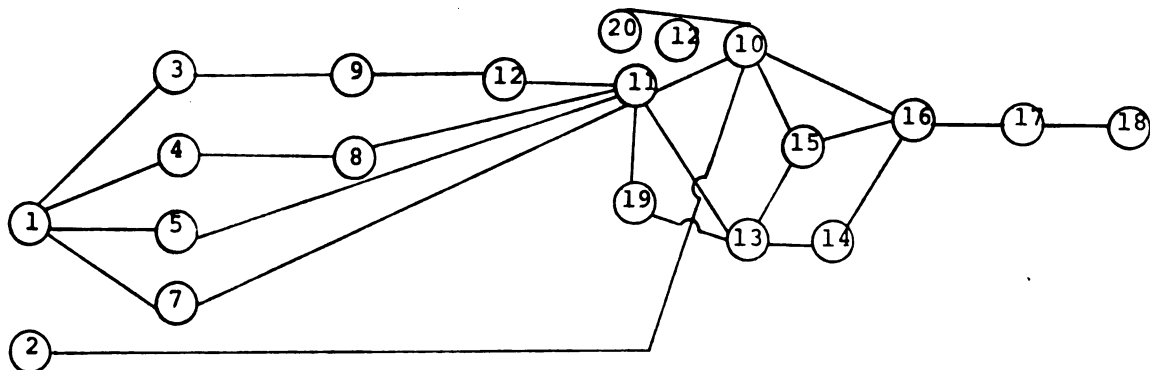
B

OPERATIONS FLOW CHART



PERT

1. Get Subjects (90-100)
2. Get Lecturer
3. Have subjects fill out personality inventory (45-60 minutes).
4. Give subjects GNP Dictionary to read and become familiar with (15 minutes).
5. Have subjects fill out general inventory including attitude towards Computer Assisted Instruction (CAI) and economics (15 minutes).
6. Enter computer program into disc file of terminal.
7. Have subjects take pretest on content (30-45 minutes).
8. Have personality inventory scored.
9. Assign subjects randomly to method of treatment.
10. Instruct subjects in lectures (8) of eight subjects and Simulated Student Subjects.
11. Assign time to subjects.
12. Get about twenty Simulated Student Subjects.
13. Instruct 20 subjects by CAI
14. Test attitude of CAI subjects immediately as they leave terminal.
15. Test achievement of all subjects by giving test on content.
16. Give all subjects Rating Report.
17. Get classroom assigned.
18. Get feedback to subjects
19. Get CAI Facilitator.
20. Get Lecture Facilitator.



DESIGN OF ECONOMICS LESSON PLAN

The Effect of Time and Initial Shift in Investment Demand and the Economy.

GOAL: The subject will be able to understand the impact of a shift in investment on the Gross National Product, i.e., that:

- the greater the shift, the greater the impact.
- this impact occurs over time, i.e., it is not instantaneous.
- the size of the Gross National Product changes as a result of the shift decreases as equilibrium is approached, given a positive shift.

REFERENT SITUATION: In reading newspaper articles relating to a shift in investment and its effect on the Gross National Product, the subject will be able to relate what he reads to the real world.

REFERENT SITUATION TEST: Given an article relating to a shift in investment and the Gross National Product the subject would be able to decide whether to invest, not invest or withdraw his investments so that his original capital does not lose its current worth.

INSTRUCTIONAL OBJECTIVE: Given two excerpts from the August 16, 1971 New York Times, the subject will answer some questions relative to the result of the actions outlined in the articles, relative to:

- time
- a shift in investment
- and purpose,

and some other questions relative to pertinent information covered in the lesson.

There will be a one hour time limit. The lower limit of acceptable performance will be a percentage of sixty.

ENTRY BEHAVIOR:

1. No previous knowledge of economics will be required.
2. An assessment will be made of both content knowledge and attitude towards the computer.
3. Ability to participate as needed in all aspects of the study including familiarizing oneself with the GNP Dictionary.

DIRECTIONS TO LECTURE FACILITATOR

1. Tell the subjects that we'll let them know their gain between the pre and post tests.
2. Be in Room 100 Berkey from 9-12:30, Saturday, March 4th, 1972.
3. Check the real subjects in and have someone call them if they are not present five minutes before the time. See the Simulated Student Subjects directions for those who will play this role. You will have a list of the real students. There will be 64; 8 in each lecture for a total of 8 lectures.
4. Have the GNP Dictionary ready and passed.
5. At the end of each lecture get the real subjects and have them.
 - a. Fill out the Rating Report (not more than five minutes approximate time).
 - b. Take the test on the content (not more than 30 minutes approximate time).

Do NOT let them leave without checking these two instruments to make sure they have completed them. If they do not know the answers, have them make an educated guess.

6. Pass out formula to those who ask.

DIRECTIONS TO CAI FACILITATOR

1. Tell the subjects that we'll let them know their gain between the pre and post tests.
2. Make sure each subject is present at least five minutes before his appointed time.
 - a. Check him off on your list. Telephone him if he is not there.
 - b. Give him "Hello!" sheet.
3.
 - a. Help the subject get started and then withdraw. The interaction between the subject and the machine in an impersonal environment is part of the study.
 - b. He may use the GNP Dictionary.
4. After fifteen minutes or so--whenever the subject is finished, give him:
 - a. The Rating Report to fill out.
 - b. The CAI Post Attitude Measure to complete.
 - c. The Test on the Content. If they do not know the answers, have them make an educated guess.

Do not let him leave without obtaining these instruments.
5. Give the formula to any subject who asks.
6. Please notice that there is no "turn-around" time because of the expense involved.

EXPERIMENTER'S DIRECTIONS TO SSS

1. Pretend you are real students, i.e., try to look the part. This is a simulation.
2. Leave the Room after each lecture but if offered RR or Test, just tell my helper that you are a SSS*. You should take a GNP Dictionary and use it if you wish.
3. Reenter the Room almost immediately so that the next lecture may begin on schedule. Play this by ear--it may not be necessary or even possible to leave and reenter.
4. Even though you may not understand what the lecturer is saying, please do not ask any questions. For purposes of the experiment the Lecturer has been told to try to deliver a "pure" lecture with no interruptions. After the last lecture and when all of the subjects (the real ones) have left you can ask him.

Class Times: 9:30-9:45; 9:50-10:05; 10:10-10:25;
10:30-10:45; 10:50-11:05; 11:10-11:25;
11:30-11:45; 11:50-12:05.

Place: 100 Berkey, MSU, East Lansing.

Time: 9 a.m., March 4, a Saturday

SSS* = Simulated Student Subjects

DATES COMPUTER USED

Following is a breakdown of the dates the computer was used and the number of subjects using it that date:

<u>Date</u>	<u>Number of SS</u>
4/20	3
4/21	1
4/22	2
4/29	4*
5/1	3*
5/2	1**
5/3	2
5/5	3**

*One of these subjects failed to complete the evaluative instruments.

**One of these subjects had to return a second time because of machine difficulty.

APL KEYBOARD FOR 2741 TERMINAL

APPENDIX C

INSTRUMENTS

So You're Thinking of Volunteering? . . .

Requirements

Pre-Treatment

- | | |
|--|--|
| 1. Fill out a personality inventory on your attitudes and interests. | 187 questions
(10 pages)
<u>30-45 min.</u> |
| 2. Fill out a general inventory, autobiographical: your sex, age, <u>etc.</u> , computer background | 42 questions
<u>10 min.</u> |
| 3. Familiarize yourself with the GNP Dictionary and then immediately | 1 page
<u>10 min.</u> |
| 4. Take a test on the subject to be taught to determine entry behavior. You may use the Dictionary if you need to. | |

Treatment

Probably a Saturday or an evening. You will be notified when and where to come for your part in the experiment. Please come 5 to 10 minutes early.

- | | |
|----------------------------------|----------|
| 1. Lecture | 15 mins. |
| OR | |
| 2. Computer Assisted Instruction | 15 mins. |

Post-Treatment

- | | |
|--|-------------|
| 1. Immediate test on content | 15-30 mins. |
| 2. Rating Report, so we will know where we went wrong. | 5 mins. |

IF you are in the CAI group:

- | | |
|-----------------|----------|
| 3. Post measure | 10 mins. |
|-----------------|----------|

Rewards

The Experimenter's gratitude. Experience in a study. Feedback on the experiment.

ANSWER SHEET: THE 16 PF, FORM (A or B) DATE _____

IDENTIFICATION: PRINT YOUR NAME IN THE BOXES PROVIDED THEN PLACKEN THE LETTER BOX BELOW WHICH MATCHES EACH LETTER OF YOUR NAME.

YOUR LAST NAME YOUR FIRST NAME YOUR MIDDLE NAME YOUR NAME

• Use pencil only. • Fill in each number in black and fills the entire space. • Erase completely any answer you wish to change. •

AGE (Nearest Year)	SEX	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
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General Inventory

Time Began _____ Name _____
Student No. _____
Time Ended _____ Date _____

Please circle the appropriate response.

1. I was raised in a predominately: a. Urban area
b. Suburban area
c. Small town
d. Rural area
2. My father's occupation is (was): a. Professional
(doctor, lawyer, etc.); b. Self-employed businessman;
c. Farm owner; d. Skilled tradesman (e.g., carpenter);
e. White collar (clerical, sales, etc.); f. Industrial
worker; g. Other _____
3. My mother's occupation is (was): a. Professional;
b. Self-employed businesswoman; c. Farm owner;
d. Skilled tradeswoman (sewer); e. White collar
(clerical, secretary, etc.); f. Industrial worker;
g. Other _____
4. The number of years of schooling my father had was:
a. 1-8; b. 9-11; c. High School graduate;
d. Some college or trade school; e. College graduate;
f. Post-graduate or professional training.
5. The number of years of schooling my mother had was:
a. 1-8; b. 9-11; c. High School graduate;
d. Some College or trade school; e. College graduate;
f. Post-graduate or professional training.
6. The highest educational level attained by elder brothers
or sisters was: a. I have no older brothers or
sisters; b. 1-8; c. 9-11; d. High School graduate;
e. Some college; f. College graduate.
7. I am a: a. Male; b. Female
8. I am: a. 17; b. 18; c. 19; d. 20; e. over 20 years old.
9. My class standing is: a. Freshman; b. Sophomore;
b. Junior; d. Senior.

10. My major is _____.
11. My cumulative grade point average is _____.
12. My formal education relative to computers consists of:
 - a. a course in high school (e.g., FORTRAN programming)
 - b. a course in college
 - c. plans to take at least one course in the future
 - d. no courses or plans for them.
13. Computers are interesting to me. YES NO
14. When the topic is about computers, I feel inadequate YES NO
15. I am indifferent toward computers YES NO
16. I feel threatened by computer science. YES NO
17. I am curious about how computers work. YES NO
18. I would learn more quickly by using the computer. YES NO
19. I could work at my own speed on the computer. YES NO
20. It would be interesting to work by computer. YES NO
21. I would like sitting and working alone. YES NO
22. I think students might learn better by computer than with an Instructor YES NO
23. It would be easier to learn by computer than with films and slides. YES NO
24. I think students learn better by computer than with a book. YES NO
25. I have used a typewriter. YES NO
26. I'm afraid I could not learn how to use a computer very well. YES NO
27. I would need a Teacher as I work on the computer. YES NO
28. I would like to use a computer. YES NO

29.	Using a computer would be like having a friendly Instructor.	YES	NO
30.	Learning by computer would go too fast.	YES	NO
31.	I would not mind if I missed a question while working on a computer since no one would be watching me.	YES	NO
32.	I hate money.	YES	NO
33.	I think economics is interesting.	YES	NO
34.	Wall Street performs a very useful function.	YES	NO
35.	Everyone should own stock.	YES	NO
36.	I am interested in knowing what is behind money.	YES	NO
37.	I read the business section of the paper.	YES	NO
38.	I have invested at one time or another.	YES	NO
39.	The balance between labor, capital and taxes interests me.	YES	NO
40.	I took economics in High School.	YES	NO
41.	I have taken courses in economics in College.	YES	NO
42.	I plan to major in economics.	YES	NO

GNP DICTIONARY

Time Began _____ Name _____

Time Ended _____ Student No. _____

Autonomous Consumption: (A)

Consumption irrespective of the GNP, i.e., that consumption if the GNP was zero.

Consumption: (C)

the using of goods and services.

Consumption Function:

a model used to explain Consumption: $C + A$ (MPC) (Y)

Equilibrium Condition:

the economist's ideal state which is never reached. It is when all the components of the economy are in balance and no further changes would be made under existing conditions.

Gross National Product: (GNP)

the sum of goods and services produced, or the sum of wages, rents, interest payments and profits.

Investment Demand:

Investment goods purchased.

Macro Economics:

the study of economic aggregates, the study of the economy as a whole or its basic subdivisions.

Marginal:

the last incremented unit of quantity under consideration.

Marginal Propensity to Consume: (MPC)

that proportion of additional income which would be consumed. It is a description of consumer behavior.

Model:

a simplified representation, frequently mathematical, of reality. Here the model is $Y = C + CI + G$.

Period:

a time interval.

Propensity:

a natural inclination

Saving:

GNP less Consumption and less Taxes. Saving is what is left over after Consumption and Taxes.

Simulation:

An operating model of a physical or social or as in this case, economic situation.

Theory:

General or abstract principles of a body of fact.

COMPUTER TERMS**Program:**

the set of instructions that tells the computer what to do.

Input:

the information that is put into the computer.

Activate the computer:

to start the computer.

TEST

Here is an excerpt from the New York Times of Monday,
August 16, 1971

Page 1 Highlights of Nixon Plan
Washington, Aug. 15

TAXES The President asked Congress . . . to
establish an investment tax credit of 10
percent for one year to be followed by a
permanent 5 percent credit on investments
in new American-made machinery and equipment.
He pledged to ask Congress next year for
further initiatives.

Here is another.

Page 15 Transcript of a statement broadcast
New Economic Policy

The time has come for a new economic policy
for the United States. Its targets are
unemployment, inflation and international
speculation, and this is how we are going
to attack those targets:

First, on the subject of jobs...we have an
unemployment problem...

The time has come for American industry,...
to embark on a bold program of new invest-
ment production for peace.... Job Develop-
ment Act of 1971.

I will propose to provide the strongest
short-term incentive in our history to
invest in new machinery and equipment that
will create new jobs for Americans: a 10
percent job development credit for one year
effective as of today with a 5 percent
credit after Aug. 15, 1972.

This tax credit for investment in new equip-
ment will not only generate new jobs. It
will raise productivity; it will make our
goods more competitive in the years ahead.

Time Began _____ Date _____ Name _____
Time Ended _____ Student No. _____

Please write less than 25 words on the first three questions below. Question 4 may have less than 50 words. Use the next sheet to write your answer, if there is not enough room on this sheet.

1. What was the purpose of giving a tax credit as outlined in the enclosed article.
2. Assuming an initial shift in investment demand of \$1,000, with the GNP at \$1,020,000,000,000, what is the GNP at Period 0?
3. Why was Mr. Nixon anxious to have this shift in Investment Demand at this time (late August, 1971) rather than at Election time (November, 1972)?
4. Suppose a \$10,000,000 shift to reach an expected Equilibrium level of \$1,150,000,000,000 by November, 1972 was first decided upon and then it was decided to obtain the same Equilibrium level by May, 1972.
 - a. What do you recommend? Be as explicit as possible.
 - b. In what way will your recommendation and its final impact effect the economy?

5. _____ economics deals with the economy as a whole and its component parts.
6. A theory attempts to describe principles which run through and account for a set of _____.
7. A representation of reality in a simpler and more workable form is called a _____.
8. GNP is short for _____.
9. Two components of the economic system are autonomous consumption and investment demand T F
10. An increase in Investment Demand means that the GNP Consumption and Savings will go up. T F
11. Purchases of goods and services by a buyer may also be called expenditures of that buyer. T F
12. Autonomous Consumption, Unemployment and the Budget are factors in the equation which determines GNP, as we studied it. T F
13. A model takes all pertinent facts into account. T F
14. Economic Equilibrium refers to the balance in the economy between full and part-time employment. T F
15. When Investment Demand is _____, GNP, Consumption and Savings go up.
16. Macro economics deals with the economy as a whole. T F
17. The change in the GNP as a result of Equilibrium change is upwards or downwards depending on whether the Shift in Investment Demand is positive or negative, all other things being fixed. T F
18. Investors should be encouraged to invest during a time of unemployment. T F
19. Consumption and Savings are influenced by an Initial Shift in Investment Demand. T F
20. The amount of equilibrium change relates to the time period as well as the Initial Shift in Investment Demand. T F

HELLO!

Welcome to Computer Assisted Instruction (CAI). Please read the paragraph below and then go over to the computer terminal and sit down. The CAI Facilitator will show you how to begin when you tell him (or her) that you're ready.

As you are probably new to economics, we are going to use a very simple model to try to teach you a very simple lesson. In matters pertaining to the economy always remember that many, many variables affect it. We shall be looking at a tiny segment.

This program uses a simple macro simulation model to study the effect of an initial shift in investment demand on the economy, specifically on the following components: Gross National Product (GNP), Consumption (CON) and Saving (SAV) in relation to the time process. In this model, the time process will be identified as unspecified periods of time, relating to fiscal years in reality. In this program the following values have been assigned to the following variables.

The Marginal Propensity to Consume of the
GNP is .75.

Autonomous Consumption is 100.

Government Purchases of Goods and Services are 200.

Taxes are fixed at 200.

The Investment Demand is 150.

As the economy, even in a simplified model, is an ongoing process, if one wants to affect it, one has to enter the system somewhere. For our purposes we have chosen the initial shift in investment demand as the point of entry. Changing this will allow us to see changes to the GNP, CON and SAV.

Ready? Tell the Facilitator.

CAI POST MEASURE

Time Began _____ Date _____ Name _____

Time Ended _____ Student No. _____

1. I needed to spend more time on the machine to learn the material. SA A D SD
2. I feel I learned the material. SA A D SD
3. The machine was easy to use. SA A D SD

4. Students give many reasons for liking to work with the computer, from those listed below select the one that applies most to you.

I liked to work with the computer because:

- a. I could go at my own speed.
- b. The machine never got tired of answering.
- c. The machine gave the material in small parts I could digest.
- d. I liked the presentation.
- e. Other, please list.

5. Sometimes students do not like working with the computer. If you did not, was it for any reasons given below? Select the one that applies most to you, if you answer this question.

I did not like working with the computer because:

- a. The machine was too slow.
- b. The machine gave too little information at a time.
- c. It was boring.
- d. I don't like working alone.
- e. Other, please list.

6. I learned more quickly on the computer than I feel I would have in a lecture situation. SA A D SD
7. I worked at my own speed on the computer SA A D SD
8. It was interesting to work by computer. SA A D SD

- | | | | | | |
|-----|--|----|---|---|----|
| 9. | I feel it was easier to learn by computer than if I had had a Professor. | SA | A | D | SD |
| 10. | I liked sitting and working alone. | SA | A | D | SD |
| 11. | I think students learn better by computer than with a teacher. | SA | A | D | SD |
| 12. | I feel it was easier to learn by computer than if I had had a film/slide presentation | SA | A | D | SD |
| 13. | I feel students would learn better by computer than if they studied from the book. | SA | A | D | SD |
| 14. | I have used a typewriter. | SA | A | D | SD |
| 15. | I'm afraid I did not learn how to use a computer very well. | SA | A | D | SD |
| 16. | I need a Teacher as I work on the computer. | SA | A | D | SD |
| 17. | I liked using a computer. | SA | A | D | SD |
| 18. | Using a computer is like having a friendly Professor. | SA | A | D | SD |
| 19. | Learning by computer went too fast. | SA | A | D | SD |
| 20. | I did not care if I missed a question while working by computer since no one was watching me. | SA | A | D | SD |
| 21. | Please add anything else which you feel would provide information to people working with computer classes. | | | | |

ATTITUDE MEASURES

Both the pre and post attitude tests were based on the work of Desch and Stolurow (Desch, S. H., and L. M. Stolurow, Project TAPS, Harvard University, Cambridge, Mass., DHEW, Washington, July, 1969, pp. 7 and 8 of the appendix). From the General Inventory thirteen statements pertaining to CAI were chosen to measure the attitude of the subjects toward CAI. Thirteen statements were also chosen from the Post CAI attitude measure. Ten of the thirteen had a one-to-one correspondence, the post measures being merely the past tense of the pre statements. Following are the statements, when used and the reasons for their choice.

<u>Statement</u>	<u>Questions in Which Used</u>	<u>Reasons for Choice</u>
Computers are interesting to me. Response: Yes.	Gen. Inv. 13	The positive response to this statement indicates a positive attitude towards computers and lack of intimidation by machines. This interest shows an openness as well as a positive view.
I am indifferent toward computers. Response: No.	Gen. Inv. 15	If one is indifferent towards something, one is closed. A negative response indicates potential for a positive view.
I am curious about how computers work. Response: Yes	Gen. Inv. 17	A positive answer to this statement indicates interest. Inquisitiveness and intellectual curiosity are also shown.
I feel I learned the material. Response: Agree, Strongly Agree	Post CAI Att. 2	There is a strong indication that learning has taken place.
The machine was easy to use. Response: Agree, Strongly Agree	Post CAI Att. 3	The machine did not get in the way. It was not a hindrance, but rather facilitated learning.
I feel it was easier to learn by computer.	Post CAI Att. 9	The learner was not hampered by the idiosyncracies of a teacher.
I would learn more quickly by using the computer. Response: Yes	Gen. Inv. 18	Positive responses to these statements obviously reflect a positive attitude toward CAI. It implies a certain hope and trust of this method of instruction.
I learned more quickly on the computer than I feel I would have in a lecture situation. Response: Agree, Strongly Agree	Post CAI Att. 6	

<u>Statement</u>	<u>Questions in Which Used</u>	<u>Reasons for Choice</u>
I could work at my own speed on the computer. Response: Yes	Gen. Inv. 19	CAI makes individual learning possible by letting the student work at his own speed. This permits self pacing as opposed to unhealthy competition.
I worked at my own speed on the computer. Response: Agree, Strongly Agree	Post CAI Att. 7	
It would be interesting to work by computer. Response: Yes	Gen. Inv. 20	Where there is interest there is intellectual curiosity, concern, an outward movement towards the environment. This stimulates creativity and fosters freedom and self-awareness.
I was interested to work by computer. Response: Agree, Strongly Agree	Post CAI Att. 8	
I would like sitting and working alone. Response: Yes	Gen. Inv. 21	The computer allows them to work alone, which they prefer.
I liked sitting and working alone. Response: Agree, Strongly Agree	Post CAI Att. 10	
I think students might learn better by computer than with an instructor. Response: Yes	Gen. Inv. 22	This shows an awareness of human fallibility. The respondent is more trusting towards a machine as it is more reliable.
I think students learn better by computer than with a teacher. Response: Agree, Strongly Agree.	Post CAI Att. 11	
I think students learn better by computer than with a book. Response: Yes	Gen. Inv. 24	There is recognition of the fact that every author may err while the computer program may be easily adjusted to correct itself, the book usually cannot be. Also the "now" experience of having the information printed out as one sits at the terminal, is appealing to the learner.
I feel students would learn better by computer than if they studied from a book. Response: Agree, Strongly Agree	Post CAI Att. 13	

<u>Statement</u>	<u>Questions in Which Used</u>	<u>Reasons for Choice</u>
I'm afraid I could not learn how to use a computer very well. Response: No I'm afraid I did not learn how to use a computer very well. Response: Disagree, Strongly Disagree.	Gen. Inv. 26 Post CAI Att. 15	The lack of the ability to meet new situations in the use of CAI would portend an appreciation of their usefulness.
I would like to use a computer. Response: Yes I liked using a computer. Response: Agree, Strongly Agree.	Gen. Inv. 28 Post CAI Att. 17	The fact that the subject likes a situation signifies a positive attitude and a sense of adventure.
Learning by computer would go too fast. Response: No Learning by computer went too fast. Response: Disagree, Strongly Disagree.	Gen. Inv. 30 Post CAI Att. 19	The subject believes that his learning would be relative to his rate of learning.
I would not mind if I missed a question while working on a computer since no one would be watching me. Response: Yes I did not care if I missed a question while working by computer since no one was watching me. Response: Agree, Strongly Agree	Gen. Inv. 31 Post CAI Att. 20	This shows the desire for freedom to be what one is and not make excuses.

RATING REPORT

Time Began _____ Date _____ Name _____

Time Ended _____ Student No. _____

- | | | |
|---|-----|----|
| 1. Words and concepts were used in the lesson that I had never seen or heard previously | YES | NO |
| 2. The use of examples helped to get points across. | YES | NO |
| 3. Learning today was a pleasant experience. | YES | NO |
| 4. At the end of today's lesson I knew the material covered. | YES | NO |
| 5. It was assumed that I knew the material which I did not. | YES | NO |
| 6. The material was covered too rapidly. | YES | NO |
| 7. I enjoyed this lesson. | YES | NO |
| 8. I understood the principle covered. | YES | NO |
| 9. I knew all the material covered in the lesson before it took place. | YES | NO |
| 10. Time went slowly during the lesson. | YES | NO |
| 11. I enjoyed learning about the economy. | YES | NO |
| 12. The material was well organized. | YES | NO |
| 13. My overall knowledge of economics has increased. | YES | NO |
| 14. I was adequately prepared for the material covered in this lesson. | YES | NO |
| 15. I have become more competent in economics due to this lesson. | YES | NO |
| 16. It was pleasant to learn about the economy. | YES | NO |

The group to which I was assigned was _____

RESULTS OF RATING REPORT

<u>Area</u>	<u>Statement</u>		<u>CAI</u>	<u>Lecture</u>
<u>Entry Level</u>	I knew all of the material covered by the lesson before it took place.	NO	100%	96.5%
	Words and concepts were used in the lesson that I had never seen or heard previously	YES	61%	68%
<u>CAI</u> 72.0%	It was assumed that I knew material which I did not.	YES	61%	66%
<u>Lecture</u> 79.5%	I was adequately prepared for the material covered in this lesson	NO	66.3%	87.5%
<u>Communi- cation</u>	The use of examples helped to get points across.	YES	77%	70%
	The material was covered too rapidly.	YES	55%	77%
<u>CAI</u> 78.25%	Time went slowly during the lesson.	NO	100%	43%
<u>Lecture</u> 61.75%	The material was well organized.	YES	81%	57%
<u>Instruc- tional</u>	Learning today was a pleasant experience.	YES	95%	27%
<u>Atmo- sphere</u>	I enjoyed this lesson.	YES	89%	20%
<u>CAI-81.0%</u> <u>Lecture</u> 27.66%	It was pleasant to learn about the economy.	YES	59%	36%
<u>Learn- ing</u>	At the end of today's lesson I knew the material covered.	YES	28%	15%
	I understood the principles covered.	YES	45%	40%
<u>CAI</u> 47.75%	My overall knowledge of economics has increased.	YES	66%	52%
<u>Lecture</u> 34.75%	I have become more competent in economics due to this lesson.	YES	52%	32%

APPENDIX D

COMPUTER PROGRAMS

COMPUTER PROGRAMS

▼ GNP1[0]▼

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[1]  ▼ GNP
[2]  'PLEASE TYPE YOUR FIRST NAME.'
[3]  N=3
[4]  'OK, 'N;' LET'S SEE WHAT WE CAN LEARN.'
[5]  'FIRST, WELCOME, MY NAME IS HAL, I'M SURE WE'LL GET ALONG.'
[6]  M=0.75
[7]  A=100
[8]  G=200
[9]  I=200
[10] T=150
[11] I←0
[12] Y←(A+I+G)+(1-M)
[13] C←A+M*Y
[14] S←Y-C
[15] Q←0
[16] P←100*(Q+Y)
[17] 'HAVE YOU READ THE SHEET OF PAPER THAT YOU RECEIVED? IT'S ABOUT THE'
[18] 'SIMULATION WE'RE GOING TO USE. IF YES, TYPE GNOP, IF NOT TYPE GNP1.'
[19] 'WE'RE GOING TO SEE WHAT AN INITIAL SHIFT IN INVESTMENT DEMAND DOES'
[20] 'TO THE GNP, CON, AND SAV, OVER TIME. NOW IT'S YOUR TURN TO TYPE.'

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▼ GNP1[0]▼

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[1]  ▼ GNP1
[2]  'THIS SIMPLE MACRO SIMULATION MODEL IS USED TO STUDY THE EFFECT'
[3]  'OF AN INITIAL SHIFT IN INVESTMENT DEMAND ON THE ECONOMY.'
[4]  'SPECIFICALLY ON THE FOLLOWING COMPONENTS: GROSS NATIONAL'
[5]  'PRODUCT (GNP), CONSUMPTION (CON) AND SAVINGS (SAV) IN RELATION'
[6]  'TO THE TIME PROCESS. IN THIS MODEL THE TIME PROCESS WILL BE'
[7]  'IDENTIFIED AS UNSPECIFIED PERIODS OF TIME, RELATING TO FISCAL'
[8]  'YEARS IN REALITY.'
[9]  'THE FOLLOWING VARIABLES FOR THE PURPOSE OF THIS LESSON WILL BE:'
[10] 'MARGINAL PROPENSITY TO CONSUME OF THE GNP .75'
[11] 'AUTONOMOUS CONSUMPTION 100'
[12] 'GOVERNMENT PURCHASES OF GOODS AND SERVICES 200'
[13] 'TAXES ARE FIXED AT 200'
[14] 'INVESTMENT DEMAND 150.'
[15]  GNOP

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▼ GNOP[0]▼

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[1]  ▼ GNOP
[2]  'FIRST EXAMPLE'
[3]  'THE VALUE FOR THE INITIAL SHIFT IN INVESTMENT DEMAND IS 15.'
[4]  'THE TIME PERIODS TO BE PRINTED ARE 4.'
[5]  'BASED ON THE ABOVE VALUES THE INITIAL EQUILIBRIUM VALUES ARE:'
[6]  'GNP=1800 CON=1450 SAV=350 TAXES=200'
[7]  'PERIOD GNP CON SAV TAXES'
[8]  '0 1815.000 1461.250 353.750 200.000'
[9]  '1 1826.250 1469.688 356.563 200.000'
[10] '2 1834.688 1476.016 358.672 200.000'
[11] '3 1841.016 1480.762 360.254 200.000'
[12] '4 1845.762 1484.321 361.440 200.000'
[13] 'NOTICE THAT A SHIFT IN INVESTMENT DEMAND HAS PRODUCED A CHANGE IN'
[14] 'THE GNP (AND THEREFORE ALSO IN CONSUMPTION AND SAVINGS). LIKE ALL'
[15] 'CHANGING THINGS, THE ECONOMY TENDS TO SEEK ITS OWN BALANCE OR'
[16] 'EQUILIBRIUM.'
[17]  GNOP1

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      VGNOP1[ ]V
      V GNOP1
[1] 'GUESS WHAT THE NEW EQUILIBRIUM LEVEL OF THE GNP WILL BE.'
[2] 'PLEASE USE ONLY FOUR DIGITS.'
[3] ANS2+
[4] 'NICE TRY. AS THE SHIFT WAS POSITIVE, THE NEW EQUILIBRIUM WOULD HAVE TO'
[5] 'BE GREATER THAN THE ORIGINAL EQUILIBRIUM. USING SOME MATH WE DON'T'
[6] 'WANT TO GO INTO NOW, THE ACTUAL ANSWER TURNS OUT TO BE 1860.'
[7] 'TO SUMMARIZE IN TABULAR FORM:'
[8] 'PERIOD CHANGE IN GNP:'
[9] '0 TO 1 11,250'
[10] '1 TO 2 8,438'
[11] '2 TO 3 7,328'
[12] '3 TO 4 4,746'
[13] GNOP2
[14] +0
[15] +0
[16] +0
[17] +0
[18] +0
[19] +0
[20] +0

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      VGNOP2[ ]V
      V GNOP2
[1] 'ANOTHER EXAMPLE FOR 'N
[2] 'I'M GLAD YOU'RE DOING SO WELL.'
[3] 'ALL FACTORS ARE THE SAME IN THIS EXAMPLE EXCEPT FOR AN INITIAL SHIFT'
[4] 'IN INVESTMENT DEMAND ON THE ECONOMY. THE INITIAL EQUILIBRIUM VALUES'
[5] 'THEREFORE ARE THE SAME AS BEFORE.'
[6] 'GNP=1800 CON=1450 SAV=350 TAXES=200'
[7] 'SHIFTING THE INVESTMENT DEMAND UPWARDS BY 35, HERE IS WHAT HAPPENS.'
[8] 'PERIOD GNP CON SAV TAXES'
[9] '0 1835.000 1476.250 358.750 200.000'
[10] '1 1861.250 1495.938 365.312 200.000'
[11] '2 1880.938 1510.703 370.235 200.000'
[12] '3 1895.703 1521.778 373.926 200.000'
[13] '4 1906.778 1521.778 373.926 200.000'
[14] 'WHAT IS THE CHANGE IN GNP FROM PERIOD 0 TO PERIOD 1?'
[15] '(OMIT ALL NUMERALS TO THE RIGHT OF THE DECIMAL POINT. DO NOT ENTER'
[16] 'THE DECIMAL POINT.)'
[17] ANS2+
[18] 'PRETTY GOOD, IT IS 26. NOW FOR THE NEXT.'
[19] 'FROM PERIOD 1 TO PERIOD 2, IT IS?'
[20] ANS3+
[21] 'GOOD IT IS 19. FROM 2 TO 3 IT IS 15, AND FROM 3 TO 4 IT IS 11.'
[22] 'GUESS WHAT THE NEW EQUILIBRIUM LEVEL OF THE GNP WILL BE.'
[23] 'KEEP IN MIND WHAT YOU HAVE LEARNED FROM THE PREVIOUS EXAMPLE.'
[24] 'PLEASE USE FOUR DIGITS ONLY.'
[25] ANS4+
[26] 'GOOD TRY. THE CORRECT ANSWER IS 1940. IF YOU WOULD LIKE THE FORMULA'
[27] 'ASK WHEN LEAVING THE ROOM. THE NEW EQUILIBRIUM LEVEL OF GNP MUST BE'
[28] 'GREATER THAN 1860 BECAUSE THE SHIFT IN INVESTMENT DEMAND IS GREATER'
[29] 'THIS TIME.'
[30] GNOP3

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VGNCPP3[ ]V
V GNOP3
[1] 'TO GIVE YOU SOME IDEA OF HOW 1940 WAS REACHED, HERE IS A TABULAR'
[2] 'PRESENTATION OF WHAT HAPPENS TO THE GNP OVER 10 TIME PERIODS.'
[3] 'PERIOD GNP CHANGE';[ ]+''
[4] '0 1835.000';[ ]+''
[5] '26.250'
[6] '1 1861.250'
[7] '19.688'
[8] '2 1880.938'
[9] '14.765'
[10] '3 1895.703'
[11] '11.075'
[12] '4 1906.778'
[13] '8.306'
[14] '5 1915.084'
[15] '6.229'
[16] '6 1921.313'
[17] '4.672'
[18] '7 1925.985'
[19] '3.504'
[20] '8 1929.489'
[21] '2.628'
[22] '9 1932.117'
[23] '1.971'
[24] '10 1934.088'
[25] GNPXM
V

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VGNPXM[ ]V
V GNPXM
[1] M1+1
[2] GNPX1
V

```

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VGNPX1[ ]V
V GNPX1
[1] L←M1+L
[2] M1←0
[3] 'PRACTICE EXAMPLE';[ ]+''
[4] 'USING THE SAME INITIAL EQUILIBRIUM VALUES, ENTER A VALUE FOR AN'
[5] 'INITIAL SHIFT IN INVESTMENT DEMAND. IT MUST BE A TWO DIGIT NUMBER.'
[6] S1←[ ]
[7] L←L+1
[8] Y1←1800
[9] C1←1450
[10] S2←350
[11] X1←200
[12] Y3←Y1
[13] C3←C1
[14] S3←S2
[15] J←0
[16] 'PERIOD GNP CON SAV TAXES';[ ]+''
[17] L1:Y0←Y1
[18] CO←C1
[19] SO←S2
[20] Y1←Y0+S1+N+J
[21] C1←A+N+Y1
[22] S2←Y1-C1
[23] ' 'J; ' 'Y1; ' 'C1; ' 'S2; ' '200.000';[ ]+''
[24] JO←J
[25] J←JO+1
[26] +(J≤5)/L1
[27] 'PERIOD 0 IS THE PERIOD IN WHICH THE INITIAL SHIFT IN INVESTMENT DEMAND'
[28] 'OCCURRED.'
[29] Y0←(A+I+G)+(1-N)
[30] CO←A+N+Y0
[31] SO←Y0-CO
[32] Q←Y-Y0
[33] GNPX2
[34] →0
[35] →0
V

```



```

-----
      VGNPX2[0]V
      V GNPX2
-----
[1] B=S1+(1-M)
[2] D=M*B
[3] F=B-D
[4] 'CHANGE TO NEW EQUILIBRIUM, GNP';B;' CON ';D;' SAV ';F
[5] 'THE NEW EQUILIBRIUM VALUES ARE:'
[6] 'NEW GNP ';(Y3+B);' CON ';(C3+D);' SAV ';(S3+P)
[7] 'IF YOU WANT MORE PRACTICE, TYPE GNPXM, IF NOT TYPE GNOP4.'
-----
      V

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-----
      VGNOP4[0]V
      V GNOP4
-----
[1] 'THANKS FOR BEING SUUCH A GOOD SPORT. ';H;' BYE.'
[2] 'YOU PRACTICED ';L;' TIMES.'
[3] L=0
[4] 'THANKS AGAIN. HOPE TO SEE YOU AGAIN.'
[5] 'THIS IS THE END.'
-----
      V

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SAMPLE OF WORKED PROGRAM

GNP

PLEASE TYPE YOUR FIRST NAME.

DAVID

OK, DAVID LET'S SEE WHAT WE CAN LEARN.

FIRST, WELCOME, MY NAME IS HAL. I'M SURE WE'LL GET ALONG.

HAVE YOU READ THE SHEET OF PAPER THAT YOU RECEIVED? IT'S ABOUT THE

SIMULATION WE'RE GOING TO USE. IF YES, TYPE GNOP, IF NOT TYPE GNP1.

WE'RE GOING TO SEE WHAT AN INITIAL SHIFT IN INVESTMENT DEMAND DOES

TO THE GNP, CON, AND SAV, OVER TIME. NOW IT'S YOUR TURN TO TYPE.

GNOP

FIRST EXAMPLE

THE VALUE FOR THE INITIAL SHIFT IN INVESTMENT DEMAND IS 15.

THE TIME PERIODS TO BE PRINTED ARE 4.

BASED ON THE ABOVE VALUES THE INITIAL EQUILIBRIUM VALUES ARE:

GNP=1800 CON=1450 SAV=350 TAXES=200

PERIOD	GNP	CON	SAV	TAXES
0	1815.000	1461.250	353.750	200.000
1	1826.250	1469.688	356.563	200.000
2	1834.688	1476.016	358.672	200.000
3	1841.016	1480.762	360.254	200.000
4	1845.762	1484.321	361.440	200.000

NOTICE THAT A SHIFT IN INVESTMENT DEMAND HAS PRODUCED A CHANGE IN THE GNP (AND THEREFORE ALSO IN CONSUMPTION AND SAVINGS). LIKE ALL CHANGING THINGS, THE ECONOMY TENDS TO SEEK ITS OWN BALANCE OR EQUILIBRIUM.

GUESS WHAT THE NEW EQUILIBRIUM LEVEL OF THE GNP WILL BE.

PLEASE USE ONLY FOUR DIGITS.

□:

1860

NICE TRY. AS THE SHIFT WAS POSITIVE, THE NEW EQUILIBRIUM WOULD HAVE TO BE GREATER THAN THE ORIGINAL EQUILIBRIUM. USING SOME MATH WE DON'T WANT TO GO INTO NOW, THE ACTUAL ANSWER TURNS OUT TO BE 1860.

TO SUMMARIZE IN TABULAR FORM:

PERIOD	CHANGE IN GNP
0 TO 1	11.250
1 TO 2	8.438
2 TO 3	7.328
3 TO 4	4.746

ANOTHER EXAMPLE FOR DAVID

I'M GLAD YOU'RE DOING SO WELL.

ALL FACTORS ARE THE SAME IN THIS EXAMPLE EXCEPT FOR AN INITIAL SHIFT IN INVESTMENT DEMAND ON THE ECONOMY. THE INITIAL EQUILIBRIUM VALUES THEREFORE ARE THE SAME AS BEFORE:

GNP=1800 CON=1450 SAV=350 TAXES=200

SHIFTING THE INVESTMENT DEMAND UPWARDS BY 35, HERE IS WHAT HAPPENS.

PERIOD	GNP	CON	SAV	TAXES
0	1835.000	1476.250	358.750	200.000
1	1861.250	1495.938	365.312	200.000
2	1880.938	1510.703	370.235	200.000

3 1895.703 1521.778 373.926 200.000
 4 1906.778 1521.778 373.926 200.000

WHAT IS THE CHANGE IN GNP FROM PERIOD 0 TO PERIOD 1?

(OMIT ALL NUMERALS TO THE RIGHT OF THE DECIMAL POINT. DO NOT ENTER THE DECIMAL POINT.)

Q:

26

PRETTY GOOD. IT IS 26. NOW FOR THE NEXT, FROM PERIOD 1 TO PERIOD 2, IT IS?

Q:

19

GOOD IT IS 19. FROM 2 TO 3 IT IS 15, AND FROM 3 TO 4 IT IS 11. GUESS WHAT THE NEW EQUILIBRIUM LEVEL OF THE GNP WILL BE. KEEP IN MIND WHAT YOU HAVE LEARNED FROM THE PREVIOUS EXAMPLE. PLEASE USE FOUR DIGITS ONLY.

Q:

1940

GOOD TRY. THE CORRECT ANSWER IS 1940. IF YOU WOULD LIKE THE FORMULA ASK WHEN LEAVING THE ROOM. THE NEW EQUILIBRIUM LEVEL OF GNP MUST BE GREATER THAN 1860 BECAUSE THE SHIFT IN INVESTMENT DEMAND IS GREATER THIS TIME.

TO GIVE YOU SOME IDEA OF HOW 1940 WAS REACHED, HERE IS A TABULAR PRESENTATION OF WHAT HAPPENS TO THE GNP OVER 10 TIME PERIODS.

PERIOD	GNP	CHANGE
0	1835.000	
1	1861.250	26.250
2	1880.938	19.688
3	1895.703	14.765
4	1906.778	11.075
5	1915.084	8.306
6	1921.313	6.229
7	1925.985	4.672
8	1929.489	3.504
9	1932.117	2.628
10	1934.088	1.971

PRACTICE EXAMPLE

USING THE SAME INITIAL EQUILIBRIUM VALUES, ENTER A VALUE FOR AN INITIAL SHIFT IN INVESTMENT DEMAND. IT MUST BE A TWO DIGIT NUMBER.

Q:

35

PERIOD	GNP	CON	SAV	TAXES
0	1835	1476.25	358.75	'200.000
1	1861.25	1495.9375	365.3125	'200.000
2	1880.9375	1510.703125	370.234375	'200.000
3	1895.703125	1521.777344	373.9257813	'200.000
4	1906.777344	1530.083008	376.6943359	'200.000
5	1915.083008	1536.312256	378.770752	'200.000

PERIOD 0 IS THE PERIOD IN WHICH THE INITIAL SHIFT IN INVESTMENT DEMAND OCCURRED.

CHANGE TO NEW EQUILIBRIUM, GNP140 CON 105 SAV 35

THE NEW EQUILIBRIUM VALUES ARE:

NEW GNP 1940 CON 1555 SAV 385

IF YOU WANT MORE PRACTICE, TYPE GNPXM, IF NOT TYPE GNOP4.

GNOP4

THANKS FOR BEING SUCH A GOOD SPORT. DAVID BYE.

YOU PRACTICED 1 TIMES.

THANKS AGAIN. HOPE TO SEE YOU AGAIN.

THIS IS THE END.

APPENDIX E
1973 POST SURVEY

20128 Lichfield
Detroit, MI 48221
May 25, 1973

Dear Participant,

A couple of years ago now, you took part in an experiment I conducted at MSU. When you volunteered I said that I would let you know how you did. Comparing your post-test with your pre-test you (gained) (lost) (stayed the same) (didn't finish) _____ points.

Just out of interest, could you fill in the answers to the questions below? Just circle below and tear at the dotted line and mail to me at the above address.

Thanks again for your help.

Sincerely,

Dacia Van Antwerp

-
1. Since participating in your experiment I took a course in Economics. YES NO
 2. Since participating in your experiment I took a course in computer science or a computer related field. YES NO

RESULTS OF 1973 POST STUDY

QUESTIONNAIRE

Overall

Questionnaires were sent to all 72 subjects who took part in the experiment two years after the experiment had taken place. This was done to let them know their gain and to obtain data as to whether they had taken courses either in Economics or a computer related field after the experiment. Their answers would tend to show whether they had been motivated by the study to take courses in either field.

Of the total sent 48% did not respond. Of this 48%, 26% were returned to the sender marked "Addressee Unknown" and 22% were apparently received and not answered.

Of the 37 answers received, 11 persons or 30% of those responding had taken at least one course in one of the two areas. Three of these subjects had taken a course in both areas. One subject had taken five courses in Economics. Eight Lecture subjects had taken at least one course in Economics. No CAI subjects had done so. Five lecture subjects and one CAI subject had taken a course in a computer related area while one CAI subject stated that he would have done so if his schedule had permitted.

If those questionnaires that were returned to the sender are omitted from the total it leaves a net total of

53 questionnaires which were apparently received by the subjects. The 37 returned by the subjects to the experimenter equals 70% of this total. Thirty percent of the 53 did not respond.

High Extraversion - High Neuroticism

Thirty-three percent of these subjects who took the lecture as a method of treatment returned the questionnaires sent. Eight percent of these subjects who took CAI retained their questionnaires. Two subjects had taken a course in Economics and one a course in a computer science area. All of these subjects were in the lecture method of treatment. Overall 33% of those who returned the questionnaire had taken a course in either Economics or a Computer Science related field after the study.

Of the net sent 45% of the lecture subjects returned their questionnaire and 100% of the CAI subjects.

Low Extraversion - High Neuroticism

Fifty-six percent of those who took the lecture method of treatment returned their questionnaire while 50% of those who took CAI did so. Of those who returned their questionnaire 55% had taken a course in either Economics or a computer science related course. Two of these subjects had taken a course in both subject areas and one subject had taken five courses in Economics. Only one of the

the subjects who had taken CAI had taken a course and this was in a computer science related field.

Of the net sent 90% of the Lecture subjects and 66% of the CAI subjects returned their questionnaire.

High Extraversion - Low Neuroticism

Fifty percent of those subjects who took the lecture method of treatment returned their questionnaire and 50% of those who were in CAI. Only one subject had taken a course in either area. This subject had been in the Lecture method of treatment yet had taken both an Economics course and a computer sciences related course.

Of the net sent 66% of the lecture subjects returned their questionnaire and 100% of the CAI subjects.

Low Extraversion - Low Neuroticism

Fifty percent of those subjects who had taken the lecture method of treatment returned their questionnaire while 75% of the CAI subjects did so. Only one subject, from the lecture method of treatment, had taken a course in a computer science related area. One CAI subject commented that he would have taken a computer science related course if his schedule would have permitted. Although this is the only subject to have stated this, it might have been true in other cases.

Of the net sent 57% of the lecture subjects and 75% of the CAI subjects returned their questionnaires.

Summary

From the above it can be seen that interest in the content area was greater after the experiment resulting in 22% of the 37 who responded having taken an economics course after the experiment. In the area of computers, 16% of the 37 went on to take a course in a computer related field while none had done so before the experiment. As only one of these had been a CAI subject it indicates that the attitude towards computers was perhaps more positive among the Lecture subjects even before and during the experiment. However, since a larger majority of the CAI subjects (85%) returned their questionnaires, it would seem to indicate a more positive attitude towards the experiment by the CAI subjects. The Lecture subjects who responded were 65%.

The low extraverted-high neurotic subjects took the most number of courses--eleven. This group also had the highest number of individuals who took courses--seven. In other words 63% of all those who took further courses were in this group. The one CAI subject who took a course in a computer related field was also in this group.

BIBLIOGRAPHY

BIBLIOGRAPHY

- Atkinson, Richard C. "Computerized Instruction and the Learning Process." American Psychologist, XXIII (April, 1968), 225-239.
- Biggs, J. B. Information and Human Learning. Glenview, Ill.: Scott, Foresman, 1971.
- Briggs, Leslie J. "Learner Variables and Educational Media." Review of Educational Research, XXXVIII (April, 1968), 160-172.
- Bracht, Glenn H. "Experimental Factors Related to Aptitude-Treatment Interactions." Review of Educational Research, XL (December, 1970), 627-645.
- Brucker, James. "The Effects of an Enclosed Individual Learning Environment Interacting with Two Personality Traits on the Achievement and Opinion of College Students Learning through the Use of Programmed Instruction." Unpublished Ph.D. Dissertation, Indiana University, 1969.
- Bunderson, C. Victor. "The Computer as a Means Toward Controversial Educational Ends." Proceedings of the Second Annual Conference on Computers in the Undergraduate Curricula. Hanover, N.H.: Dartmouth College and the National Science Foundation, 1971.
- Buros, Oscar Krisen, ed. Sixth Mental Measurements Yearbook. Highland Park, N.J.: Gryphon Press, 1965.
- Cattell, Raymond B. and Herbert W. Eber. Handbook for the Sixteen Personality Factor Questionnaire. Champaign, Ill.: Institute for Personality and Ability Testing, 1962.
- Cancro, Robert and Robert A. Scott. "A Proposed Framework for the Analysis of Stress in the Human Organism." Behavioral Science, X (April, 1965), 461-469.
- Commission on Instructional Technology. To Improve Learning. Washington, D.C.: United States Printing Office, 1970.

- Campeau, Peggie L. "Test Anxiety and Feedback in Programmed Instruction." Journal of Educational Psychology, LIX (March, 1968), 159-163.
- Corliss, William R. Computers. Washington, D.C.: United States Atomic Energy Commission, Division of Technical Information, 1967.
- Cronbach, Lee J. "The Two Disciplines of Scientific Psychology." American Psychologist, XII (November, 1957), 671-684.
- Davis, Keith and James H. Banning. The Role of Personality and Attitude Variables in Programmed Instruction. Washington, D.C.: University of Colorado at Boulder, April, 1968, ERIC, ED 022 364.
- Diamond, James J. A Report on Project GROW: Philadelphia's Experimental Program in Computer Assisted Instruction. Philadelphia: Philadelphia School District, Office of Research and Evaluation, August, 1969.
- Doty, Barbara A. and Larry A. Doty. "Programmed Instructional Effectiveness in Relation to Certain Student Characteristics." Journal of Educational Psychology, LV (December, 1964), 334-338.
- Eysenck, H. J. Theoretical and Methodologies Issues. London: Staples' Press, 1970.
- Ford, John D. and Dewey A. Slough. "Development and Evaluation of CAI for Navy Electronics Training: I. Alternating Current Fundamentals." San Diego, Calif.: Naval Personnel and Training Research Laboratory, May, 1970.
- Furneaux, W. D. "The Psychologist and the University." Universities Quarterly, XVII (December, 1962), 33-47.
- Glasser, Robert. "Psychological Questions in the Development of CAI." Paper given at the University of Texas, October 21, 22, 1968. Newburyport, Mass., Entelek, Computer Assisted Instruction, Computer Managed Instruction, Programmed Instruction Information Exchange, No. 37, 38 (1971), 70-1057/37J.
- Grimes, Jesse W. and Wesley Allinsmith. "Compulsivity, Anxiety and School Achievement." Merrill-Palmer Quarterly, VII (1962), 247-269.

- Hansen, Duncan N. "Current Issues in CAI." Computer Assisted Instruction, Computer Managed Instruction, Programmed Instruction, Information Exchange No. 37, 38 (1971), 7--1060/37 Newburyport: Euletek, 1971.
- Haight, G. V. and W. Schmidt. "The Learning of Subject Matter in Teacher-Centered and Group-Centered Classes." Journal of Educational Psychology, XLVII (1956), 295-301.
- Hess, Robert D., et al. The Computer as a Socializing Agent: Some Socioaffective Outcomes of CAI. Stanford, Calif: Stanford Center for Research and Development in Teaching, School of Education, 1970.
- Hickey, Albert E., ed. Computer-assisted Instruction: A Survey of the Literature. 3rd ed. Newburyport Mass.: Eatelek, October, 1968, Technical Report No. 8, Office of Naval Research, Contract No. N00014-68-C-0236.
- Kight, Howard R. and Julius H. Sassenrath. "Relation of Achievement Motivation and Test Anxiety to Performance in Programmed Instruction." Journal of Educational Psychology, LVII (February, 1966), 14-17.
- Leith, G. O. M. "The Acquisition of Knowledge and Mental Development of Students." Journal of Educational Technology, I, (May, 1970), 116-128.
- Lumsden, Keith, ed. New Developments in Teaching Economics. Englewood Cliffs, N.J.: Prentice-Hall, 1967.
- Linvill, William K. "Technology and the Needs of Man." Stanford Today. Leland Stanford Junior University, 332 Euclid Hall, Stanford Series II, 4, Summer, 1970.
- Lopez, Guillaemo. "CAI: A New Dimension to the Teaching-Learning Act." Journal of Educational Data Processing, VI (Winter, 1968-69), 40-52.
- Lublin, Shirley Curran. "Reinforcement Schedules, Scholastic Aptitudes, Autonomy Need, and Achievement in a Programmed Course." Journal of Educational Psychology, XVI (December, 1965), 295-302.
- Ludvigh, Elek John III. "Extraversion and Preferred Level of Sensory Stimulation." Unpublished Ph.D. Dissertation, Michigan State University, 1971.

- Lynn, R. and I. E. Gordon. "The Relation of Neuroticism and Extraversion to Intelligence and Educational Attainment." British Journal of Educational Psychology, XXXI (1961).
- McClary, W. P. "The Spectrum of Computing." Educational Technology, XI (December, 1971), 28-31.
- Meadow, Charles T. Man-machine Communication. New York: John Wiley and Sons, 1970.
- Miller, Elwood E. "Instructional Systems Development." Unpublished Ph.D. Dissertation, Michigan State University, 1963.
- Nagel, Thomas Scott. "A Descriptive Study of Cognitive and Affective Variables Associated with Achievement in a Computer-Assisted Instruction Learning Situation." Unpublished Ph.D. Dissertation, Michigan State University, 1969.
- O'Neil, Harold F. Jr. State Anxiety and Performance in Computer Assisted Instruction. Washington, D.C.: Office of Naval Research Psychological Services Division, Florida State University, Computer Assisted Instruction Center, ERIC ED 038 029, 1970.
- Osipow, Samuel H. Theories of Career Development. New York: Appleton-Century-Crofts, 1968.
- Quick, Thomas J. "The Student in Project PLAN: A Functionary Program of Individualized Education." Elementary School Journal (October, 1970), 42-54.
- Sells, S. B. "Personality." Encyclopedia of Educational Research. Edited by Robert L. Ebel. 4th ed., Laudon, Macmillan, 1969, p. 935.
- Sharac, Jo-Anne and Darlene Russ. "Evaluation of Student Learning and Information Utilization in a Computer-simulated Economic Model." Proceedings of the Second Annual Conference on Computers in the Undergraduate Curricula. Hanover, N.H.: Dartmouth College and the National Science Foundation, 1971, pp. 94-98.
- Stolurow, Lawrence M. "Computer-Assisted Instruction." The Schools and the Challenge of Innovation. New York: Committee for Economic Development, 1969, Supplementary Paper No. 28.

- Sutter, Emily G. and Jackson B. Reid. "Learner Variables and Interpersonal Conditions in CAI." Journal of Educational Psychology, XL (May-June, 1969), 153-157.
- Tallmadge, G. K. and J. W. Shearer. "Relationships Among Learning Styles, Instructional Methods and the Nature of Learning Experiences." Journal of Educational Psychology, LX (1969), 222-230.
- Thompson, George G. and Clarence W. Hunnicutt. "The Effect of Repeated Praise or Blame in the Work Achievement of 'Introverts' and 'Extroverts.'" Journal of Educational Psychology, XXXV (May, 1944), 257-266.
- Traweck, Melvin W. "The Relationship between Certain Personality Variables and Achievement through Programmed Instruction." California Journal of Educational Research, XV (1965), 215-220.
- Trent, James W. "Dispositional Differences between Technical and Liberal Arts Majors." Berkeley: University of California Center for the Study of Higher Education, March 12, 1965.
- Walthew, John Kendall. "The Relationship between Success in Learning from Programmed Material and Selected Personality Characteristics of Eighth and Ninth Grade Students from Classes of Average and Above Average Verbal Scholastic Aptitude." Unpublished Ph.D. Dissertation, Cornell University, 1964.
- Woodruff, Arnold B., Charles Falt and Diane Wagner. "Effects of Learner Characteristics on Programmed Learning Performance." Psychology in the Schools, III (January, 1966).
- Zinn, Karl L. "Glossary for Computer Uses in Education." Vol. I, Appendix E, Ann Arbor, MI., University of Michigan, Project CLUE, July, 1970.

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