LEARNING AND ATTITUDINAL EFFECTS OF A PERSONALIZED PROGRAM IN COMPUTER-ASSISTED INSTRUCTION

by

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PERSONALIZED PROGRAM IN COMPUTER-ASSISTED INSTRUCTION

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ABSTRACT

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The effects of personalized CAI on learning, seldom considered, is examined in this study. The relationship of attitudinal and personality variables on learning in personalized CAI as well as the relationship between personality and attitude toward CAI are considered. A control group worked with non-personalized CAI and an experimental group, worked with personalized CAI. Nine CAI lessons and a final criterion quiz were presented. Students who experienced personalized CAI achieved significantly higher mean scores on learning. No significant differences in attitude toward CAI were found between the two groups. Some personality characteristics, as measured by the California Psychological Inventory were significantly related to learning and to post-attitude test scores. It was concluded that personalization of CAI may seem less dehumanizing and result in more effective learning than conventional CAI.

RESUME

L'effet d'un programme l'enseignement assisté par ordinateur (CAI) personnalizé en regard de l'instruction, souvent peu considéré, est examiné dans cette étude. La relation entre les variables de la personnalité et de l'attitude en regard de l'instruction dans un programme CAI personnalisé de même que la relation entre la personnalité et l'attitude en regard du programme CAI seront considérés. Un group de contrôle a travaillé avec un programme CAI non personnalisé et un groupe expérimental a travaillé avec un programme CAI Personnalisé. Neuf leçons du programme CAI et un test de type criterium ont été presenté. Les étudiants qui ont fait l'experience d'un programme CAI personalisé ont atteint d'une manierè significative un resultat plus élevé à l'égard de l'instruction. Aucune différences significatives dans l'attitude à l'égard d'un programme CAI ont été trouver entre les deux groupes. Quelques charactéristiques de personnalité, tel que mesuré par le California Psychological Inventory, étaient en relation significatives en regard de l'instruction et de l'attitude après les résultats des tests. On a condu que la personnalisation d'un programme CAI peut sembler moins deshumanisant et résulter dans une instruction plus efficace qu'un programme CAI conventionnel.

Short Title of Thesis

PERSONALIZED COMPUTER-ASSISTED INSTRUCTION

Kolano

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CHAPTER I

THEORETICAL FRAMEWORK OF THE STUDY

Rationale of the Study

Early research on improving the learning process with computer-assisted instruction centered on the improvement of lesson material and lesson presentation. Little research was conducted on personality, attitude and social variables in relation to the learning process. Even less research was undertaken to examine the psychological implications of the resulting man-machine interaction.

The growth of CAI in the past ten years has been mainly due to its ability to individualize instruction (cf. Stolurow, 1968; Suppes, 1969; Atkinson and Wilson, 1969; Jerman, 1969). However, little positive concern has been given to the personalization of CAI. In the development of software, many educators and programmers have used student names within the presentation of CAI lessons. More often than not, the use of a student's name in a program was nothing more than "window dressing." This use of names may have been the result of speculation, hunch or intuition that it had some general effect but it was not generally known if the use of a student's first or "candy" name would

personalize the instruction or affect the learning process. There is currently little empirical evidence to support the idea that learning performance is related to the degree of personalization within a CAI lesson.

The socializing quality of the computer has been demonstrated by Hess et al. (1970). Junior high school students who were exposed to CAI demonstrated a more favorable attitude toward teachers than did those students who were not exposed to CAI. They also tended to have a more favorable image of the computer. Both groups preferred the computer to teachers, text-books or television news.

Further, Suppes and Morningstar (1968) give anecdotal evidence that students at the elementary level perceive the computer, not as a machine, but as a person and that they often direct their conversation to it. They do not, however, offer any empirical or theoretical implications to the possible effects on learning performance. For this reason it is suggested that it might be worthwhile to further investigate the effects of personalizing the CAI instructional system.

Personalization of CAI

Deviations from accepted patterns of classroom teaching, especially the notion that learning can occur in the absence of a human teacher, are disturbing to some. CAI is often attacked for its lack of motivational influence, and its failure to encourage creativity, and its absence of personal warmth. For some, the view persists that instruction

is necessarily deficient unless it fully replicates the image of a human teacher. It is possible that personalizing CAI may reduce some of these criticisms.

Throughout time, it appears that man has considered it to be important to use the names of others correctly. Salesmen and teachers often use names to build up rapport or confidence in an attempt to make people feel at ease, build up self-esteem, or effect a change in behaviour.

The name of a student can act as a reinforcer as it focuses the student's attention on a chosen situation. However, Oettinger (1969) does not see the use of names in CAI as a positive aspect. He writes:

> ... a fad without deeper significance than Detroit's customizing, namely taking a mass-produced object and stamping it with gold initials or heaping chrome on fins to give the illusion of individual tailoring. This is the sense in which computer programs greet you with "Good morning, _____" with the name you had to give to identify yourself to the machine in the first place. This is more genteel than "Do not fold, spindle or mutilate!" "Hey you!" or "Good to see you, 367-A-45096," but just as superficial, even when randomly selected variations heighten the effect of spontaneity.

Oettinger speaks from intuition and not research findings. It is suggested here that the personalization of CAI must include more than just the use of the student's name. The process of personalizing CAI can be achieved by having the computer call each student by name, use personal pronouns in reference to itself and the student, partake in short dia-

logues with the student, and vary the feedback to the student in the same way teachers vary reinforcement strategies.

Mesthene (1970) writes:

> ... you should not judge the value of your intentions by internal criteria only and conclude that they are good just because they work. The power of truth--of technology, science, knowledge-- is very great these days. Those who seek after it, therefore, have a duty to measure their contribution in the context of truths that often transcend... .

For this reason, it is hypothesized that CAI can be programmed to personalize instruction so as to improve learning performance. The purpose of this thesis is to test this hypothesis empirically.

General Statement of Problem

Assigning students numbers may well add to the so-called depersonalization of our modern technological society. On social insurance cards, driver's permits and credit cards, the identification of individuals by number may contribute to a sense of loss of personal identity. People may feel alienated; they may become strangers to one another.

The stress laid on names in personal development courses such as Dale Carnegie, and the constant use of names by salesmen and politicians alike, is intuitive evidence of their value in business and politics. In a similar manner they may be of value in CAI. But can the use of names in the personalization of CAI effectively improve learning? Is the

personalization of CAI of any educational value? This is the major research question of the present study. Specifically the following will be investigated:

1. the relationship between the personalization of CAI and learning performance.
2. the relationship between the personalization of CAI and the development of positive attitudes toward CAI.
3. the relationship of personality to learning with a personalized CAI mode.
4. the relationship of personality to attitudes with a personalized CAI mode.

After taking into account the mode of instruction and the attitudinal and personality characteristics of the students, the present study poses the question: "Would the personalization of CAI improve learning performance, positively affect attitude change toward CAI, benefit students with certain personality characteristics and reduce the threat of CAI being a 'dehumanizing' and 'impersonal' instructional system?"

CHAPTER II

REVIEW OF RELATED LITERATURE

Overview of the Chapter

This chapter examines the relevant literature related to learning in a personalized CAI mode. Since this area of CAI has been relatively unexplored, other related areas such as learning in CAI, student attitudes toward CAI and a review of some research on Programmed Instruction (PI) are included.

The first part of this chapter gives a brief history of CAI and reviews the implications for the educational system as a result of technological innovation and change. Based on this theoretical foundation, other findings of studies in CAI, particularly work on feedback, individualization, personality factors in learning, and student attitudes toward CAI, are reviewed.

Computer-Assisted-Instruction: A Brief History

Several uses of the computer in education have been suggested by Holtzman (1970). Business administration services include tasks such as purchasing equipment and supplies, taking inventory, calculating and distributing the payroll, and managing personnel records. Educational management services include admitting of students, the continual updating

of records, the scheduling of classes, the registering of students, as well as reporting of course grades. Computer-managed instruction (CMI) allows for the automatic management of a student's progress in an individualized program of instruction.

The concern of the present study is the direct use of the computer as a medium of instruction. Computer-assisted instruction (CAI) can be defined as the use of the computer in either providing or assisting the instructional process. In CAI, instructional materials are often stored in the computer and each student interacts directly with the material through a variety of computer-controlled media such as teletypewriters, cathode-ray tubes (CRT), and random-access slide projectors and audio units. Student responses may be used to control a learner's progress through the program and remedial aid can be administered when deemed necessary. Records of the students' performance can be kept and this may facilitate the evaluation of the instructional program itself. The student interacts with the system and receives immediate feedback to help promote effective learning.

CAI owes much to the early work on teaching machines and programmed learning of Pressey (1926), Skinner (cf. 1954, 1958), and Crowder (1962). The use of technology in education blossomed with the advent of computers for instructional use. The value of the computer can be seen in its potential to select and present instructional materials adapted to the pace, style and individual differences of each student, and to

collect and analyze data relating to the teaching and learning process (Atkinson and Wilson, 1968).

The predominant concern with both hardware and software development was demonstrated by Alpert and Bitzer (1970) when discussing the development of three instructional systems--Plato I, Plato II, and Plato III. Findings from this early implementation of computer use in education at the University of Illinois suggested that CAI maintained the interest of students of all ages, afforded a method of examining both the learning and teaching process, allowed easy modification of lesson material, and could be used in a wide variety of subject-areas to individualize instruction.

Stanford University began experimenting with CAI in 1963 and emphasized software and hardware development for use in arithmetic and reading instruction with elementary school children. Other sites of early applications of CAI are listed by Watson (1972). The University of Pittsburgh established a research and development center for experimental work in CAI in 1964. One year later Florida State University, Harvard University, and the University of Texas had implemented research programs for the express purpose of examining various aspects of CAI.

From its modest beginnings CAI has developed to include a variety of instructional strategies. The most commonly-used is known as "drill-and-practice." Here CAI is used to supplement regular classroom instruction and is designed to give students practice in developing basic skills. The computer

usually diagnoses the ability level of the student and then proceeds to give him practice exercises at the appropriate level of difficulty with the student's progress thereby being controlled by the system (Atkinson, 1968; Jerman, 1970).

The use of simulation allows the computer to replicate a real environment for the student. With this instructional strategy, a student is able to conduct an experiment in chemistry or assume control of a large corporation without leaving the confines of the CAI classroom (Muller, 1970).

Problem-solving is yet another strategy that may be used with CAI but, as Stolurow (1968) has pointed out, this often requires the student to possess a knowledge of computer languages in order to program basic information. Jerman (1969) includes "inquiry" as another application of CAI and describes this as an "information retrieval system."

In all the above strategies a high degree of student-teacher interaction is maintained. In a tutorial strategy, however, the computer can replace the teacher or instructor. In this way, an entire subject can be taught in a potentially highly individualized manner. It is this latter approach that is to be implemented in the present study.

Advantages of CAI

According to Margolin and Misch (1970) certain pressures are being placed on formal education. They have claimed that there exists a greater number of individuals to educate and that these people seem to be more varied in their abilities

and characteristics than ever before. They have also suggested that there is a greater need for specialization and adaptability with the education of "flexible" individuals who are able to cope with the changing social patterns of today's society.

Certain advantages are seen in adapting the computer for educational use. They stated that the computer possesses the ability to improve certain aspects of education including management, research and instruction. In discussing the latter, it is claimed that one of the greatest advantages of CAI is its ability to use simultaneously a variety of media to improve the learning process. Carpenter (1970) agreed with this statement and, moreover, added that the computer could automatically assess a student's performance, branching him to more appropriate material. It should be pointed out that the use of the computer does not necessarily exclude other forms of education. The computer can be used either to manage, support, or replace traditional classroom instruction (Bright, 1970).

Stolurow (1968) has noted that CAI can not only individualize both the means and ends of education, but also allows for the research of varying styles and/or methods of instruction under controlled conditions. It has been further suggested that data collected by CAI may be used to discover important aspects of the learning and teaching processes (Suppes, 1966; Alpert and Bitzer, 1970; and Carpenter, 1970).

Some of the most widely quoted advantages of CAI include its ability to provide faster and better learning,

paced progression through the subject matter, and freedom for the teacher to interact with students on a more personal level (Gerard, 1967; Margolin and Misch, 1970). Gerard (1969) has also suggested that the technical innovation of the computer in education would free the human mind to partake in more creative and imaginative work.

Disadvantages of CAI

The major obstacles to implementing CAI on a large scale according to Meierhenry (1970) include: dehumanization of the student, the invasion of his privacy, the lack of adequate terminal interfaces, the neglecting of the importance of the group process in education or any decision making, and the inability to converse directly with the computer. This latter problem of facilitating the man-machine communication is also observed by Silberman (1969). Bright (1970) and Silberman (1969) have added the problem of teacher acceptance of CAI as yet another major obstacle.

Other major difficulties in the implementation of CAI are problems with the proper development of hardware (Stolurow, 1968), especially in the realm of video and audio output components (Atkinson and Wilson, 1969). The prohibitive cost factor (Atkinson and Wilson, 1969; Silberman, 1969) and the design of curriculum material contingent on the present understanding of the learning process (Atkinson and Wilson, 1969; Stolurow, 1969; Suppes, 1969) are perhaps the greatest obstacles to the full-scale implementation of CAI.

Another possible problem confronting CAI is the fear of excessive standardization of instruction. Stansfield (1968) has expressed the belief that CAI is too inflexible, leaving little room for creativity, but has stated that possibilities for the future do exist, due mainly to the computer's potential to individualize instruction. Suppes (1969) has agreed with this formulation assuming that with individualization, intellectual variance will increase rather than decrease.

Although the above mentioned observations are valid, answers to some of these criticisms can be offered. Jerman (1969) has described a CAI drill-and-practice program in mathematics used at Stanford University which appeared to be highly flexible in meeting the needs of the students involved by individually tailoring each lesson. The drills are continually updated by the computer so that the practice exercises presented are at the appropriate level of difficulty. It seems to be a simple matter for students to be challenged as they proceed through each unit at their own pace.

Both Bright (1970) and Meierhenry (1970) have criticized teacher training institutions for not preparing teachers to accept their changing role in a technologically advancing system of education. It seems obvious that this is the area wherein teacher acceptance of CAI may be fostered.

The problem of group processes in CAI has been examined by Cartwright (1973). He divided 300 students into a control group which consisted of subjects who worked individually, and three experimental groups consisting of two, three,

or four subjects working together through the CAI material. He found no differences in learning performance among the four groups suggesting that students using CAI learned equally in groups or individually. Learning with the group process however, appears to be less dehumanizing. An added benefit of group CAI was the reduction of instructional costs by 75%.

It is foreseeable that most of the present shortcomings, including the development of adequate hardware and software, can be overcome. However the solution of the two major problems: man-machine communication and prohibitive cost factors, although probable, does not appear possible in the immediate future. Suppes (1969) has suggested that data is available for a serious attempt to be made at resolving the third major problem, the understanding of the learning process. The fourth major problem, the dehumanization of the student, is explored in the present study.

Humanization and Technology

Indications of an impending, and perhaps, even existing, impersonal world due to technological innovation are given by Martin (1971). He has voiced concern that the

> ... use of devices to usurp the human guidance of learning will impair or destroy those attributes of human behaviour which are derivated from human instruction.

But he has also admitted that in education, technology can effect

> ... a shift from efforts to motivate learning based upon peer and sibling rivalry and social competition exploited by the school to learning energized by self-growth and self-enhancement by individualizing education.

Stating that technology is merely a tool in the instructional process, Martin (1971) warns that to be totally effective and not dehumanizing, the educational system must be in the control of the learner and must be multi-sensory in dimension. He states that is imperative that

> ... the learner dominate the act of learning, where he measures his performance, where he modifies his acts as the result of his evaluation of the consequences, where he manipulates the materials of learning, and where he engages all his senses in his own style...

in order to ensure truly human growth. However, it should be pointed out that if growth is to occur, then the psychological implications of the man-machine interaction cannot be ignored.

The idea that technology itself is neither humanizing or dehumanizing is put forth by Goshen (1971). According to him, it is people's use of technological devices that give rise to the problem. Any situation which enhances human relationships is humanizing and conversely, any situation which has the effect of making people remote from each other is dehumanizing. The most dehumanizing environment is seen as one which fosters indifference and human detachment, whereas a humanizing environment is one in which human relationships develop and prosper. It is suggested here that the personal-

ization of CAI may aid in the development of a humanized environment by adding a "human-like" element to an area which is often seen as cold, impersonal, and dehumanizing.

Landers (1971) also makes reference to humanizing education through technology. He foresees both positive and negative attributes to this possibility. He describes "soft humanizing" as a positive force whereby technology can facilitate "person-to-person" communication and in the realm of education facilitate the "person-to-learning material" communication. Here the capacity for independent inquiry can be increased by freeing the student from the limitations of time and space. "Hard humanizing" is described as a negative force beginning with a potentially unfavorable situation which reduces creativity and overpowers the student with overly rigid control. Even though Landers (1971) has stated that technology can be a humanizing factor in education, no research findings are offered to support the claim nor does he describe the possible humanizing process apart from claiming that the effects and hazards of the new technological system should be identified, analyzed, and controlled or eliminated. It is possible that one hazard of technological innovation generally, and CAI specifically, is the probability of treating students as individual objects rather than persons. Students usually have little to say concerning their education but the attitude they hold toward a method of instruction may affect their performance. Most proponents of CAI and other educational designers are well aware of this. When designing instructional

units for CAI, it is argued that the material should be personalized in order to facilitate learning by creating a human-like environment.

Vague reservations have been expressed by Williamson (1971) concerning the onslaught of technology in education and whether or not technology should humanize education. Persselin (1971) has chided the engineers of technological innovation as being more concerned with the product rather than the process. He claimed that as a result both teachers and students feel that education is impersonal and dehumanizing.

Similarly, problems in today's educational institutions have been noted by Canfield (1971). He described these as alienation, hostility and violence resulting from the school's inability to deal with basic student concerns of identity, interrelationships, and personal power. He claimed that these problems can be lessened by providing individualized instruction which might reduce the often-experienced sense of failure. Moreover, he has stated that both people and machines might better accomplish this end if it can communicate some aspects of a human-like quality to the student.

Gerard (1967) and Suppes (1970) agree that the computer or other technological devices need not be dehumanizing. They have pointed out that the book did not dehumanize nor did dehumanization occur through the re-creation of traditional stage drama on film or television. Bright (1970) too, has indicated that the question of CAI being impersonal is an

inaccurate one. According to him, the real question is whether or not the computer is less dehumanizing than the regular classroom. He has suggested that only the top and bottom five percent of the students in a normal classroom receive any special, personal contact from the teacher. In CAI, each student can have a sense of individual attention and personal success. Moreover, if present cost problems are solved, the computer may also free the teacher to have an inter-personal relationship with more than just ten percent of the class.

It would seem difficult to argue that technology has not had a humanizing effect since it potentially gave man an opportunity to invest his time and energy to the fulfillment of life and society. Ideally, the use of technology in education should have a similar effect as it may free the teacher to interact with students on a more personal level. But people still fear the impersonal machine. The present study investigates the possibility of minimizing the fear, alienation, and negative attitude associated with CAI by personalizing the CAI programs, thereby adding a "human-like" dimension to this instructional system. It is herein suggested that the humanization of CAI can be facilitated by introducing personalization to a basically impersonal technological device.

Reinforcement and Feedback

Skinner (1968) writes:

> ... it is not the reinforcers which count, so much as their relation to behavior. In teaching it is less important to find new reinforcers than to design better contingencies using those already available.

Personalization of CAI can be a reinforcing agent and belongs to the category that is referred to in the latter part of Skinner's statement. An unsystematic contingency setting can negatively affect learning performance. Even in current applications of CAI, contingencies could be much improved. If personalization is to be used as a reinforcing agent with CAI, it must be better managed and must certainly go beyond the notion of simply using a student's first name throughout the program. The teacher is a reinforcing agent in the classroom (Geis and Chapman, 1971), and if removed, ought to be replaced by an instructional system that can interact with the student in a neo-human manner.

Geis and Chapman (1971) have reviewed a number of possible reinforcers. They include in their list the usual familiar extrinsic reinforcers such as M & M candies, points, tokens, and toys. They stated that progress itself, aversing stimulation, finding shortcuts to lesson one's work load and reducing tension were also possible reinforcers. In this comprehensive review of reinforcers in self-instructional systems the personalization of CAI as a reinforcing agent is not mentioned. They did, however, describe social reinforcers wherein two people working on a single Programmed Instruction unit give each other reinforcement in the interaction that occurs during learning. Cartwright (1973) made a similar

claim regarding CAI. It is possible that a mechanical machine and a human learner may constitute a pseudo "social interaction" in CAI. If this is true, and if this interaction is of itself reinforcing, the process may be enhanced if an element of personalization could be implemented.

Geis and Chapman (1971) have noted that one of the most important reinforcers in self-instructional systems may be knowledge of results. In reviewing the literature in this area, different claims are made for the effectiveness of this reinforcer. Anderson, Kulhavy and Andre (1971) have attempted to explain the discrepancy by theorizing a lack of control in previous PI studies. Using the computer to prevent cheating, they examined various methods of providing knowledge of correct results (KCR). Among the treatments were the control group which received no KCR, and five experimental groups which received KCR according to one of the following conditions: 100% of the time, after correct responses only, after right answers but only 10% of the time, after wrong answers only, after wrong answers only with a delay of 15 seconds. In addition, a voluntary group was able to choose the occurence of KCR. By varying the method of KCR they found that the groups receiving KCR (100%, 15 second delay, and voluntary) performed significantly better than the group receiving no KCR.

Apparently the method of presenting KCR alters performance. Would the mode of KCR presentation create similar effects? Would personalizing KCR improve learning performance?

No research has yet examined this question. Personalized feedback statements have been used in many CAI programs. Atkinson (1974) gives some examples used in the Stanford reading program. These vary from "Great," "That's fabulous," "You're doing brilliantly" to recorded cheering and hand clapping. Is it possible that this type of feedback statement would significantly affect learning performance in relation to invariant feedback statements such as "Correct" and "Incorrect"?

Individualization

The educational revolution, as described by Keppel (1966), has been divided into three segments. The first deals with universal education, the second with the equality of educational opportunity, and the last is concerned with the quality of education. For Holtzman (1970), the main idea central to the quality of education revolves around the concept of individualization which can be traced to the work of John Dewey. Holtzman places emphasis upon the learner rather than the teacher, and describes the need to take into account a student's cultural background, life style, values, goals, motivations, mental abilities and personality in order to effectively influence learning. He writes:

> The ultimate in individualized instruction becomes possible only when major segments of the curriculum can be stored in a computer where the student can interact in a highly personal (emphasis added) manner with the material to be learned.

No indication is given, however, as to how a "personal manner" can be defined or achieved.

It has been suggested earlier that CAI seemed to be logical progression from PI. The major difference between CAI, PI, and "traditional" classroom instruction is the former's potential ability to individualize the learning process (c.f. Suppes, 1966; Atkinson and Wilson, 1969). Specifically individualization can be accomplished: by differentiating the learning tasks for various students; by not demanding that the learning rate be identical for all students to proceed at their own pace by presenting material that is appropriate to the student's ability level as demonstrated by past performance; by varying instruction in terms of method and media; and by setting up differential educational objectives (Flanagan, 1967).

If a learner's specific abilities are to be taken into account, it is doubtful whether true individualization can be accomplished in a regular classroom with thirty students. This is especially apparent if Guilford's (1959) conceptualization of intelligence, a model of 120 separate factors or abilities, is used in attempting to individualize the learning process. One major problem immediately surfaces and that is whether or not society desires this high level of individualization (Suppes, 1966). Gentile (1967) in reviewing the relevant research in CAI, concluded that CAI and individualization have not yet been proven to be a better method than using traditional classroom instruction geared to the group

mean. More recent research however suggests that the central question today is not whether to individualize, but how best to achieve individualization.

Barnes (1971) has described CAI's ability to teach to the needs and pace of the individual as its greatest benefit. Both the slow and fast learners can learn at their own speed and not feel bored or frustrated. It has been suggested that elements, known to have an effect on learning, be used in order to enhance learning performance in CAI. Suppes and Morningstar (1970) have listed the following characteristics which they believed to be necessary requirements for effective learning to occur through CAI. There should be an active response mode, immediate feedback, an opportunity to correct responses, total control of the learner's elasped-time, a provision of a hard copy of the lesson material, a relationship between the difficulty of the problems and the capability of the learner, and the control of review material according to an individual's performance history.

Previously, Suppes and Morningstar (1968) have also insisted that if CAI is to functionally affect individualization, the curriculum must be adequately developed and the material should be so presented that "the student-machine interaction becomes a positive component in the student's learning environment." Perhaps the personalization of CAI might be one method of achieving Suppes' last suggestion.

Personality Factors & Individual Differences in Learning

Gagne (1967) has written that:

> At the present time it seems fair to say that we know considerably more about learning, its varieties and conditions, than we did 10 years ago. But we do not know much more about individual differences in learning than we did 30 years ago.

Snow and Solomon (1968) have attempted to explain this problem by blaming it upon psychologists' concern with theory building. Under these conditions, individual differences are averaged out. They proposed that research designs be used whereby the subjects are first divided into sub-groups based upon such variables as I.Q., personality, or aptitudes. Then the treatment effects would be examined in relation to the sub-group performance.

Cronbach (1967) has included four procedures for adapting instruction to individual differences. The first dealt with varying the time given the student to complete a learning task. The second was to match educational goals to the individuals. If individuals had problems in attaining the specified goals, then the goals should be changed and not necessarily eliminated. Thirdly, Cronbach suggested that individual differences should be erased. That is, if a prerequisite ability had not been adequately developed, then attention should be directed to the development of that ability before attempting further instruction. The fourth

procedure mentioned was the altering of instructional methods. Within that framework, it was suggested that consideration be given to the designing of alternative treatments to interact with variables which seem likely to demonstrate differential results. This is attempted in the present study as it is assumed that differential results will be achieved among students experiencing two different CAI styles.

Stolurow (1969) has stated that whenever a CAI system is being designed, the emphasis must be placed on the individual, his aptitudes, personality, pre-existing knowledge and interests. Reinforcement strategies should be geared to the individual, and student responses and response latencies should be used in analyzing the learning process.

Bunderson (1970) pointed out that the task of analyzing or diagnosing preinstructional behavior must go beyond the assessing of behavioral objectives by taking into account some of the more enduring qualities of the learner. He hypothesized that certain character traits of the learner can interact with treatment conditions within a module in such a way as to make alternative versions of the module pay dividends in learning efficiency and motivation. Citing Sutter (1967), he suggested that anxiety is one character trait that interacts significantly in learning through the CAI mode. O'Neill (1970) similarly found that students scoring high on anxiety proneness, as measured by the State-Trait Anxiety Inventory, made more errors on a CAI learning task than did students who scored low on the same scale. This was especially

evident on the simpler sections of the task.

A study carried out by Ingersoll in 1970 was reported by Watson (1972). It was found that medical students who were given a choice of either individualized learning experiences or traditional classroom learning models, chose differentially according to certain personality characteristics. The students who chose individualized instruction scored higher on creativity, intellectual quality, humanity interests, social science and physical science interests. The students who chose the traditional method scored higher in reserved vs. outgoing, emotional stability, conscientiousness, tough mindedness and anxiety.

Watson (1972) has also quoted a study by Tallmadge (1968) where each of two courses was given via two teaching methods, inductive and deductive. Twenty-eight measures of aptitudes, interests and personality variables were collected on sixty men enlisted in the U.S. Navy. Tallmadge concluded that the evidence supported the existence of different learning styles and he also noted that that the measures of individual differences which interacted with the instructional methods were all non-cognitive in nature. Similar conclusions, based on data from the Stanford projects, are drawn by Nagel (1969 cited in Watson, 1972).

The relationship between personality factors and achievement using PI and the lecture as two presentation modes was investigated by Haskell (1971). The ten personality characteristics that were included were: General Activity,

Restraint, Ascendency, Sociability, Emotional Stability, Objectivity, Friendliness, Thoughtfulness, Personal Relations, and Masculinity. It was concluded that students who were slow and methodical and who were sociable performed better using the PI mode. Students who were aggressive favored the use of the lecture. It was found that, regardless of the instructional method, students who scored high on Restraint and Emotional Stability learned better than those students who scored low on the same traits. It was concluded that personality factors can be used to assign people to various instructional methods in order to produce effective learning. Examining CAI, Majer (1970) found that CAI was better suited than traditional instruction for students who were classified as low on maturity, sensitivity and scientific orientation.

In reviewing the Bunderson (1970) article, Glaser (1970) claimed that it is difficult to isolate information on individual differences that may be manipulated by an instructional designer in order to optimize learning. It is necessary to conduct experiments in order to ascertain whether learners measuring high on other abilities, benefit from another treatment. The present study purports to examine one aspect of this suggestion by analyzing the interaction of various personality variables with learning performance with two different styles of CAI.

Student Attitudes In CAI

Students rarely have a choice in the method used in

their instruction. Whatever influence they have been able to exert has been through the expression of attitudes, pro or con, toward instructors, methods of instruction, or instructional materials. The available evidence on students' attitudes toward CAI is spotty but seems to indicate that students who have experienced CAI, react favorably to it.

As mentioned previously, Hess et al. (1970) demonstrated that junior high school students undergoing remedial instruction in mathematics develop positive attitudes toward the computer. Mathis, Smith and Hansen (1970) have found that the exposure to CAI positively affects attitudinal change to that instructional system. And students who were exposed to computer-assisted-testing (CAT) showed a significantly better attitude toward CAI than did students who did not have a similar experience (Cartwright and Derevensky, 1975). It was discovered that the students in this study saw their experience not as a testing situation but rather as a learning situation.

Schoen (1971) concluded that the attitudes of students toward CAI appeared to be better after a personalized treatment in which their first names appeared in the feedback statements as opposed to a non-personalized treatment in which students' first names were not used. The present study has expanded the definition of "personalized" and examines the effect of the two treatments on attitude change.

Learning in CAI

Two CAI units designed to teach the concept of functions were designed by Shoen (1971). Sixty pre-calculus students were randomly assigned to four treatment groups which differed in the type of feedback the students received. Individualization and personalization were the two variables that were crossed to yield four cells: individualized and personalized, non-individualized and personalized, individualized and non-personalized, non-individualized and non-personalized. Individualization was defined as telling the student why his response was incorrect and personalization was defined as using the student's first name in some of the feedback statements. Schoen found that individualization negatively affected learning performance whereas personalization had no significant effect on the learning scores.

A number of other studies have shown that CAI programs are at least as effective as traditional instructional methods. Suppes and Morningstar (1970) have described a study showing a significant improvement ($p = .01$) in arithmetic attainment by a group of Mississippi school children working on the Stanford Math program. Results from this study also seem to indicate that CAI works better with disadvantaged children or where the deficiency is greater. In earlier studies, Suppes (1966) and more recently, Atkinson (1974) showed that CAI improved learning performance. Other studies have failed to demonstrate that CAI is a better mode of instruction than the

traditional classroom method. But where no differences in learning exist, it appears that CAI often increases the variance in learning scores (c.f. Roid, 1971).

It appears that CAI, in general, is effective. It is also apparent that Schoen's (1971) definition of personalization was inadequate. Therefore, it is deemed worthwhile to broaden this definition and re-examine the effect of personalizing CAI on learning performance.

Summary of the Chapter

A review of the literature related to this study was presented in this chapter. A brief history of CAI and some psychological implications of technological innovation were included. Consideration was given to work on learning and attitudes in CAI both generally and specifically to personalized CAI mode. Individualization, individual differences and personality factors on learning were also examined.

CHAPTER III

STATEMENT OF THE PROBLEM AND RESEARCH DESIGN

Statement of the Problem

The central question in this study is "Does the personalization of CAI effectively influence the performance of individuals who are exposed to it?" It is also deemed valuable to examine personality and attitudinal variables in relation to the personalized/non-personalized CAI experience. It is possible that these variables may be interacting in such a fashion that their successful isolation and manipulation may help in designing CAI program material which would optimize learning performance.

Learning Performance

Hypothesis 1 was formulated to test whether or not the personalization of CAI can facilitate learning.

Hypothesis 1

> The learning performance of students taught via a personalized CAI program is equal to or better than the learning performance of students taught via a non-personalized CAI program.

To test this hypothesis, two treatment groups were established both of which used CAI as the instructional medium.

A control group was exposed to a non-personalized CAI program and an experimental group was exposed to a personalized version of the program. It should be pointed out that the material content and structure of all the instructional and test units were identical for both groups. Treatments differed only on the variable of personalization which was operationally defined in the following manner. First each subject in the experimental group was called by his preferred first or "candy" name throughout each lesson whereas each subject in the control group was always called "student". Second, the experimental group was always greeted with a welcome such as "Good morning, John! It's nice to see you get such an early start". This was omitted for the control group who were always branched immediately to the lesson material. Third, the experimental group took part in occasional dialogues with the computer. For example:

> If you wish to terminate this session now,
> but receive full credit for the entire unit
> type "SEXY"
>
> ?
> SEXY
>
> I just hate myself when I do things like
> this, John. Actually, you must work
> through the program if you wish to receive
> credit for it.

These were omitted for the control group. Fourth, the experimental group experienced the computer's use of the personal pronouns "I" and "you". The computer referred to itself as "I" and to the subject as "you". For example:

> Now we know that the syndical unit must give written notice of its intent to submit a grievance to arbitration within 60 days of the school board's decision.
>
> However, John, can you tell me to whom you think that this notice must be given?

The subjects in the control group however, were treated impersonally. No personal pronouns were used; the computer spoke in the third person and referred to the subject as "student". For example:

> It is known that the syndical unit must give written notice of its intention to submit a grievance to arbitration within 60 days of the school board's decision.
>
> Can the student indicate to whom this notice must be given?

The use of reinforcement affords an excellent means of further personalizing the program. Both the experimental and control groups received immediate reinforcement and feedback to their answers. However, the statements following the student responses in the control group were impersonal and simply read "correct" or "incorrect". The statements following the student responses in the control group were varied and personalized to read: "You're right John!" or "You and I agree!" among other variations, to indicate a correct student response. To indicate an incorrect response, the statements might read as "You muffed it, John!" or "Sorry, you goofed!" A list of reinforcement items is given in Appendices F and G. Examples of the personalized and non-personalized

programs are found in Appendices A and B respectively.

It was predicted that the learning performance of students taught by the personalized program would be equal to or excel the learning performance of the students taught by the non-personalized program. It has been suggested that personalization has no effect on learning performance (Schoen, 1971). However in that particular study, personalization was limited in its definition, being defined solely as the use of a student's first name. It was thought that a more complete definition of personalization might include criteria other than simply the use of a student's first name. Moreover, since a rough estimate indicates Schoen used the students' first names in 73% of the frames, it is possible that in his study, this option was over-used.

Attitudes and Attitude Change

It was hypothesized that experiencing CAI directly would change an individual's attitude toward CAI. In naive subjects, attitudes toward CAI would be preconceived and stereotyped but with actual exposure to this instructional system, attitudes would improve and become more realistic. Moreover, it was believed that students exposed to the personalized program might perceive the new learning situation as being less threatening and intimidating than would students in the control group.

Further, it was thought that as a result of their interaction with the personalized program, members of the experimental group would not feel as isolated in this new

learning environment as would members of the control group. Nor might the experimental group be as likely to become overly concerned with the hardware or believe that the learning process was too mechanical. A student working with the personalized program might, however, tend to perceive the learning situation as being individually tailored to meet his needs and would in fact prefer CAI over "traditional" methods of instruction.

Hypothesis 2 was designed to test whether or not there were any significant attitude changes between students working with the personalized CAI program and students working with the non-personalized program in CAI.

Hypothesis 2

> After exposure to CAI, general attitudes toward CAI will improve, and moreover, students who experienced the personalized program will tend to demonstrate a greater positive attitude toward CAI than will those students who experienced the non-personalized CAI program.

It was believed that a direct relationship exists between a positive attitude toward CAI and learning performance, and that increasing positive attitudes toward an instructional medium may be an important step in helping to improve performance.

Personality Variables

Very little variance in learning scores has been accounted for in the past by personality factors. It was

thought however, that certain personality variables may interact with different kinds of instructional programs to affect learning performance.

Hicks and Hunka (1972) stated that a teacher does in fact program his own personality into the instructional units as he takes into account the motivational and psychological needs of his students. Can the personalization of a program interact with the personality characteristics of the subjects to enhance learning?

Hypothesis 3 was designed to compare the differences in learning performance among students classified as either high or low on eighteen personality characteristics. As this aspect of the study was exploratory, it was not deemed necessary to narrow the range of personality variables.

Hypothesis 3

> The learning performance of students classified as "high" or "low" on each of eighteen personality characteristics differ for each of the CAI treatments.

It was assumed that students with certain personality characteristics may react differentially in their attitude toward CAI. For this purpose Hypothesis 4 was designed.

Hypothesis 4

> The attitudes of students classified as "high" or "low" on each of eighteen personality characteristic will differ for each of the CAI treatments.

Subjects

Subjects were drawn from over two hundred education students who were enrolled at McGill University in a one year internship program which led to an elementary school teaching diploma. During the term in which they participated in this study, the students interned in public schools two days a week and took courses during the remaining days. Part of the course load was a compulsory course in Quebec School Law, Education 411-592A, which was mostly prepared by the author, and taught using CAI.

The subjects ranged in age from 21 to 47, with the average age being 24.4. All subjects had an undergraduate degree, usually a B.A., and a few had an M.A. degree. The majority of the subjects were female with only 27 males included in the final sample. None of the subjects had had any previous experience with CAI.

A total of fourteen subjects withdrew from the University during the term. In addition, incomplete data for another six students forced their exclusion from the sample. The data for these twenty subjects was not included in any of the analyses. The number of students who were able to complete the course and for whom complete data is available is given in Table 1.

TABLE 1

TOTAL NUMBER OF STUDENTS YIELDING COMPLETE DATA

Treatment	Original	Withdrawals	Missing Data	Final
Personalized	101	6	2	93
Non-personalized	100	8	4	88
Total				181

Research Design

Subjects were randomly assigned to one of two treatment conditions, and received printed instructions concerning the course and the operation of the computer terminals (See Appendix D). At this time all subjects were asked to fill in and return a biographical data sheet (Appendix E), a 30-item attitude scale (Mathis, Smith and Hansen, 1970) which is found in Appendix H, and the California Psychological Inventory. When these forms were returned, the students' ID numbers were registered in the computer and the subjects were then ready to begin the course. No pretest of learning was given since the course material was new to most subjects and because the random assignment of subjects to the two treatments made this appear unnecessary. The random assignment of students to the two groups also helped to control for the effects of such variables as intelligence and typing ability.

Both treatment conditions were identical in course content and structure, however the control group was exposed to a non-personalized version of the program and the experimental group was exposed to a personalized version of the same program. Both treatment groups used the same terminals, took the same nine instructional units (each unit being composed of a lesson and a short criterion test), and in a tenth session were administered on-line the same 30-item final criterion quiz. The subjects were told that they were permitted to take a unit at any time but no more than one unit per day was allowed. This was done in an attempt to ensure a time interval of at least one day between any two sessions.

The entire randomization procedure and subsequent registration of student numbers was completed during the last two weeks of September, 1974. The first CAI lesson was made available on October 1, 1974 and the last day for completing the course was December 20, 1974.

Procedure

Since the subjects were participants in an internship program and were carrying a heavy course load it was impossible to demand that they observe a strict schedule in taking the ten CAI units. All students however were instructed to reserve the use of the terminals as far in advance as possible.

Subjects in both groups worked individually and had approximately a period of three calendar months to complete the competency-based course. Competency was defined as ob-

taining 70% on each of the nine instructional units and the final quiz. If a subject did not achieve this criterion on any unit, he was required to repeat that particular unit in its entirety.

At the successful completion of the final criterion quiz, the students were asked to fill out and return a post-test attitude scale.

Description of the Measuring Instruments

The California Psychological Inventory (CPI)

The California Psychological Inventory (Gough, 1956) is an instrument intended to measure a wide range of normal rather than abnormal or pathological human behaviors. The instrument is convenient to use with large samples and yields scores on eighteen personality dimensions. The CPI was chosen because it attempts to measure personality characteristics that are deemed important for social living and social interaction, and which might prove to be related to learning performance and attitudinal change in the personalized and non-personalized CAI experience.

The CPI was administered to each subject at the commencement of the course. Only when the completed answer sheet and test booklet were returned were the subjects allowed to begin the course. The answer sheets were hand-scored with the use of scoring templates. The eighteen scales used in this study are classified into four broad catagories described as

follows:

Do (Dominance)

Cs (Capacity for Status)

Sy (Sociability)

Sp (Social Presence)

Sa (Self-acceptance)

Wb (Sense of Well-being)

These first six scales constitute the first class of items and give measures of poise, ascendancy, self-assurance personal adequacy. These scales are intended to represent measures of inter- and intra-personal feelings of adequacy. The next six scales are:

Re (Responsibility)

So (Socialization)

Sc (Self-control)

To (Tolerance)

Gi (Good Impression)

Cm (Communality)

These represent measures of socialization, maturity, responsibility and intrapersonal structuring of values. Measures of achievement potential and intellectual efficiency are given in the next three scales of:

Ac (Achievement via Conformance)

Ai (Achievement via Independence)

Ie (Intellectual Efficiency)

The last three scales

Py (Psychological Mindedness)

Fx (Flexibility)

Fe (Femininity)

are basically independent of each other.

Pre and Post Attitude Scales

The instrument used to measure attitudes was the Mathis, Smith and Hansen (1970) version of the Brown (1966) scale. The thirty-item test was given twice. At the outset of the experiment and before the subjects had had any experience with CAI, Form A, a future tense version of the scale was administered so as to enable the measurement of original attitudes. At the completion of the ten unit course, Form B, the past tense version of the attitude scale, was administered.

The answers to the attitude questionnaire were machine scored by an optical card reader. A Kuder-Richardson Formula 20 reliability of .82 was reported for the second version of the test (Mathis, Smith and Hansen, 1970).

Using these instruments, Mathis, Smith and Hansen (1970) reported that exposure to CAI increased the positive attitude toward CAI. But the magnitude of the change depended upon the quality of the experience. It was believed that this instrument would be sensitive to any attitudinal changes resulting from the differences between the personalized and non-personalized treatment effects. A copy of both Form A and Form B is

found in Appendix H.

Biographical Data Questionnaire

This questionnaire was given out concurrently with the CPI and Form A of the attitude scale. In it, students were asked to identify themselves as to age and sex. It also asked the subjects to indicate their educational background. The last item of the questionnaire was intended to be used to screen out students with previous CAI experience but no such students were found. A copy of this questionnaire is found in Appendix E.

Software

The Programming Language

The CAI lessons used in this study were coded in an author language developed by the Department of Computer Applications of the Ontario Institute for Studies in Education. The language is known as CAN: a Completely Arbitrary Name. CAN-6 is the latest version available at McGill University and was adapted to the McGill University System for Interactive Computing (MUSIC) by the Department of Educational Psychology and Sociology at McGill with the help of the McGill Computing Centre (McCaffery and Cartwright, 1974).

CAN-6 is a CAI author language with format free operation codes. Commas and semicolons are used as delimimiters. Once the lessons have been written and stored on save files,

they are "preprocessed" and saved on disk. The students, having had their student numbers previously registered by the instructor, proceed to take their lessons by "interacting" with the computer.

The CAI Lessons

The lessons that were used in this study were based on the laws and regulations of the Ministry of Education in Quebec and were believed to be relevant to prospective teachers in the Province of Quebec. The ten CAI units were:

Lesson 1 - The Department of Education Act

Lesson 2 - The Regulations of the Department of Education (1 and 7)

Lesson 3 - The Regulations Cont'd. (2, 3 and 6)

Lesson 4 - The Regulations Cont'd. (4 and 5)

Lesson 5 - The Superior Council of Education

Lesson 6 - The Powers and Duties of School Commissioners

Lesson 7 - Bill 71

Lesson 8 - Teachers and the Law

Lesson 9 - The Collective Agreement

Quiz - A 30-item Criterion Test

These nine lessons and final quiz comprised the totality of course 411-592A --- Quebec School Law. The nine lessons each had an accompanying test of ten randomly chosen items on which students were required to achieve a criterion score of at least 70% before proceeding to the next lesson. To suc-

cessfully complete the course, the students were also required to achieve the same criterion level on the final quiz.

The CAI lesson material for this course was written with the assistance of three graduate students from the Department of Educational Administration (McGill University) and one undergraduate student who had just received her teaching diploma. The programming of two lessons, all test material (except Lesson 2), and all editing and debugging was carried out by the author. Debugging of the programs was achieved through the aid of a developmental appraisal of each lesson by an initial group of ten students of varying educational background. The lessons allow for a limited amount of branching and remedial review. At the completion of each lesson a short criterion test was administered. Ten multiple-choice questions were picked at random from a pool of at least twenty possibilities. The final criterion quiz consisted of thirty items and at least three questions from each lesson were included.

The lessons were chosen for this study because of their availability and because it was believed that the Education Diploma students would have little or no familiarity with the technicalities of Quebec School Law.

Hardware

The hardware used in this study consisted of ten Model 33 teletype terminals. These were located in the Education Building of McGill University and were connected by MCNX lines to the McGill IBM 370/158 time-sharing computer.

In addition to this facility, students were permitted, but not encouraged, to take their lessons at any other location in which a connection to the McGill computer could be made. These included the Bronfman Center of McGill University both the Loyola and Sir George Williams campuses of Concordia University, and John Abbott College. There was only one restriction placed on students using outside facilities. These students were asked to use only terminals that had a display of ten characters per second. This was done so that the measure of elapsed time could accurately be compared.

Data Collection

The California Psychological Inventory, Form A and Form B of the Mathis, Smith and Hansen (1970) version of the Brown (1966) attitude questionnaire, and an information questionnaire constituted part of the data collected. The completion of these forms was ensured by delaying the computer registration of the students until all forms were returned. The final course grade was withheld until the post-attitude questionnaire was completed and returned.

Performance data for each on-line session was automatically stored on disk for later retrieval. The data recorded in this manner included the match for each response made, all unanticipated student responses, the number of correct responses per session, the cumulative number of incorrect responses, and the elapsed time for each session.

Summary of the Chapter

A statement of the problem was presented and four hypotheses were formulated to test the relationship between the personalization of CAI and learning performance, attitude change, and personality variables. The research design, procedure, and measuring instruments were described. A short section reviewed the hardware and software used in the study and the method of data collection was described.

CHAPTER IV

ANALYSIS OF THE DATA

Overview of the Chapter

The results of the analyses based on the hypotheses formulated in the previous chapter are presented. The results are presented in a tabular format and correspond to the order of their earlier presentation.

Results of the Analyses

Hypothesis 1 - Learning

Table 2 presents the means and variances of individual learning scores in each of the sessions for the two treatment groups.

On inspection, it appears that a trend in the pattern of scores is evident. In every case, the scores of the personalized treatment group are consistently (though not necessarily significantly) higher than the scores of the non-personalized treatment group.

A two-factor analysis of variance with repeated measures on one factor was used to test hypothesis one, that the learning performance of students experiencing a personalized CAI program is equal to or better than that of students who

experienced a non-personalized program.

TABLE 2

MEANS AND VARIANCES OF INDIVIDUAL LEARNING SCORES FOR EACH OF TEN SESSIONS FOR BOTH TREATMENT GROUPS

	Treatment			
	Personalized		Non-personalized	
Session	Mean	Variance	Mean	Variance
Lesson 1	70.80	322.22	69.53	261.17
Lesson 2	82.23	143.83	82.05	121.57
Lesson 3	85.53	126.56	81.89	181.33
Lesson 4	74.34	180.34	72.23	163.01
Lesson 5	75.48	217.53	73.82	206.12
Lesson 6	84.97	130.78	80.88	146.70
Lesson 7	92.88	78.69	90.17	80.83
Lesson 8	91.34	61.88	91.05	72.40
Lesson 9	89.86	95.34	87.78	84.98
Quiz	78.27	161.05	75.72	129.49
N =	93		N =	88

The results of the analysis of variance of individual learning scores over the ten sessions for both treatment groups is presented in table 3.

TABLE 3

ANALYSIS OF VARIANCE WITH REPEATED MEASURES ON THE LEARNING SCORES OF TEN SESSIONS FOR BOTH TREATMENT GROUPS

Source	SS	df	MS	F	p
Between Subjects	49542.000	180	1949.919	7.333	>0.001
Treatment	1949.919	1	265.916		
$Error_b$	47599.000	179			
Within Subjects	312880.000	1629			
Sessions	94138.625	9	10459.864	77.287	>0.001
Treatment X Ss	610.409	9	67.823	.501	0.874
$Error_w$	218029.000	1611	135.338		
Total	362422.000				

As may be seen from Table 3 significant differences were found for both main effects. The learning scores of individuals in personalized and non-personalized treatment groups differed significantly and subjects scored differentially as a function of the various lessons. No significant interaction was found.

These findings support hypothesis 1, the students who experienced personalized CAI treatment performed significantly better than did those students who were exposed to the non-personalized CAI programs.

The elapsed time was also examined, and again, a two-factor analysis of variance with repeated measures on one factor was used. Table 4 gives the means and variances of the elapsed time in each of the ten sessions for both the personalized and non-personalized treatment groups.

TABLE 4

MEANS AND VARIANCES OF THE ELAPSED TIME FOR EACH OF THE TEN SESSIONS FOR BOTH TREATMENT GROUPS

	Treatment			
	Personalized		Non-personalized	
Session	Mean	Variance	Mean*	Variance
Lesson 1	63.34	222.45	57.79	202.93
Lesson 2	54.32	48.20	45.77	36.88
Lesson 3	37.68	34.85**	37.41	73.63**
Lesson 4	39.31	68.00	37.61	80.77
Lesson 5	62.17	120.11	58.79	90.48
Lesson 6	41.05	44.30**	41.87	145.12**
Lesson 7	22.54	18.36	20.99	22.71
Lesson 8	36.26	32.23	34.63	39.84
Lesson 9	59.43	58.71	52.85	62.13
Quiz	41.70	292.14	40.70	270.53
N =	93		88	

*All measures of time in minutes
** F test for difference between variances significant, p. .001.

From Table 4 it would appear that the students who experienced the personalized CAI treatment consistently took longer to complete each session than did the students of the non-personalized CAI treatment.

The results of the analysis of variance on the elapsed times on each of the ten sessions for the two treatment groups is presented in table 5.

TABLE 5

ANALYSIS OF VARIANCE WITH REPEATED MEASURES ON THE ELAPSED TIMES OF EACH OF THE TEN SESSIONS FOR BOTH TREATMENT GROUPS

Source	SS	df	MS	F	p
Between Subjects	77388.000	180			
Treatment	2741.896	1	2741.896	6.575	0.01
$Error_b$	74634.000	179	417.000		
Within Subjects	355603.000	1629			
Sessions	252814.375	9	28090.484	461.490	>0.01
Treatment X Xs	3566.726	9	396.303	6.511	>0.01
$Error_w$	432991.000	1611	60.869		
Total	432991.000	1709			

As may be seen, significant differences were found for both main effects, treatment and session. A significant interaction between the treatment and the sessions was also found indicating that the subjects of each group had differential rates of learning on the various lessons.

The scores of the final criterion quiz were examined separately. The means and variances of these scores are presented in table 6.

TABLE 6

MEANS AND VARIANCES OF FINAL CRITERION QUIZ SCORES FOR BOTH TREATMENT GROUPS

Treatment	N	Mean	Variance	t	p
Personalized	93	78.28	12.69	1.422	0.0784
Non-personalized	88	75.73	11.38		

A "t" test was used to test for the significance of the difference between means. It is noted that while the scores of the personalized treatment group are higher than the scores of the non-personalized treatment group, as predicted, the difference is not significant. The means and variances of the elapsed time of the final criterion quiz were examined. No significant differences were found.

The number of attempts required to achieve criterion can also be thought of as a crude measure of learning. Table 7 presents the mean number of attempts required to achieve criterion on the nine lessons and the final quiz. The associated variances are also given.

TABLE 7

MEANS AND VARIANCES OF THE NUMBER OF ATTEMPTS REQUIRED TO ACHIEVE CRITERION ON THE NINE LESSONS AND THE FINAL QUIZ BY BOTH TREATMENT GROUPS

	Lessons			Quiz		
Treatment	N	Mean[1]	Variance[2]	N	Mean[3]	Variance[4]
Personalized	93	10.04	1.30	93	1.18	0.24
Non-personalized	88	10.15	1.78	88	1.32	0.63

1 t-test for difference between means, (p=.286)
2 F-test for the difference between variances, (p=.138)
3 t-test for the difference between means, (p=.086)
4 F-test for the difference between variances, (p=.0002)

Results for this analysis indicate no significant differences between the treatment groups on the number of attempts that were required to achieve criterion. However a significant difference between the variances on the number of attempts that were required to achieve criterion on the final quiz was found with the non-personalized treatment group having the larger variance.

Hypothesis 2 - Attitudes

Hypothesis 2 was basically concerned with whether or not exposure to CAI produced a significantly greater increase in positive attitudes toward CAI among students who experienced the personalized treatment than among those students who experienced the non-personalized treatment. To enable the testing of this hypothesis, the research design included a pretest of attitudes toward CAI as well as a post-test of the same attitudes. The means and variances for all subjects for both pre- and post-attitudes test scores are presented in Table 8.

TABLE 8

MEANS AND VARIANCES OF PRE-TEST AND POST-TEST ATTITUDE SCORES FOR ALL SUBJECTS

Attitudes	N	Mean	Variance	t*	p
Pre-test	181	64.751	108.118	3.625	0.001
Post-test	181	68.050	122.153		

* "t" test for difference between means

The analysis indicated that exposure to CAI significantly improved the subjects' positive attitudes toward CAI.

The pre- and post-testattitude scores were then separated into the personalized and non-personalized treatment groups and analyzed. The results are presented in Table 9.

TABLE 9

MEANS AND VARIANCES OF PRE-TEST AND POST-TEST ATTITUDE SCORES FOR THE PERSONALIZED AND NON-PERSONALIZED TREATMENT GROUPS

Attitudes	Treatment							
	Personalized			Non-personalized				
	N	Mean	Variance	N	Mean	Variance	t*	p
Pre-test	93	64.87	91.22	88	64.63	128.42	0.158	0.437
Post-test	93	69.04	105.87	88	67.00	123.52	1.284	0.100

As shown, no significant differences exist between the two groups on the pre-test. The attitude scores of both groups increased after the ten sessions with the personalized treatment group showing a larger mean increase than the non-personalized treatment group as predicted. This difference however was not significant and so did not confirm the latter part of hypothesis 2.

In an effort to explain the failure to confirm the latter part of hypothesis 2, the individual items of the post-attitude test were examined by comparing the mean scores of each item for both treatment groups. An analysis of this

data is found in table 10.

TABLE 10

MEANS AND VARIANCES OF THE 30 ITEM* POST-ATTITUDE TEST FOR BOTH TREATMENT GROUPS

	Personalized		Non-personalized			
Item	Mean	Variance	Mean	Variance	t**	p
A	3.51	1.53	3.27	1.48	1.295	0.098
B	3.24	1.38	3.11	1.65	0.718	0.237
C	3.83	1.20	3.56	1.61	1.512	0.066
D	3.96	1.21	3.67	1.48	1.611	0.050
E	3.88	1.12	3.84	1.22	0.220	0.413
F	3.10	1.71	3.05	1.53	0.263	0.396
G	2.72	0.90	2.80	1.12	-0.540	0.295
H	3.56	0.99	3.27	1.29	1.769	0.039
I	3.93	1.05	3.70	1.18	1.480	0.070
J	2.87	1.56	3.04	1.57	-0.891	0.187
K	4.03	1.07	3.89	1.36	0.854	0.197
L	4.19	1.23	4.11	1.33	0.458	0.324
M	3.33	1.21	3.22	1.41	0.652	0.258
N	3.00	1.19	2.78	1.16	1.326	0.093
O	2.83	1.51	2.49	1.12	1.967	0.025
P	3.59	1.14	3.29	1.47	1.703	0.045
Q	3.46	1.40	3.61	1.52	-0.837	0.202
R	3.69	1.31	3.50	1.59	1.025	0.153
S	2.58	1.73	2.50	2.15	0.367	0.357
T	3.38	1.34	3.28	1.24	0.561	0.288
U	3.47	1.60	3.34	1.71	0.638	0.262
V	2.89	1.20	2.80	1.25	0.498	0.309
W	3.56	1.31	3.48	1.41	0.450	0.326
X	3.90	1.08	3.82	1.21	0.508	0.306
Y	2.73	1.14	2.70	1.28	0.228	0.410
Z	3.47	1.94	3.28	2.13	0.856	0.197
AA	3.14	1.29	3.20	1.29	-0.292	0.385
BB	3.97	0.93	3.80	1.17	1.036	0.151
CC	4.53	0.63	4.61	0.51	-0.660	0.255
DD	3.53	1.26	3.32	1.55	1.197	0.117
N =	90		82			

*Negative items were reverse-scored so that a higher score indicates a more positive attitude toward CAI for all items.
** "t" test for the difference between means.

The analysis revealed that the personalized treatment group achieved a higher mean score than did the non-personalized treatment group on 25 of the 30 items of the post attitude test. On four of these items (D, H, O and P), the difference was found to be significant. The non-personalized group had a higher mean score on five of the 30 items but none of these differences was found to be significant.

To test whether or not a relationship existed between attitudes and learning, the subjects of each treatment group were divided into two groups representing those who scored either low or high on the pre-test of attitudes. The scores of the subjects' first experience with CAI (lesson 1) were chosen as a criterion to examine whether or not preconceived attitudes towards CAI had any effect on learning with that instructional method. The means and variances of the individual learning scores for lesson 1 of these subjects are presented in table 11.

TABLE 11

MEANS AND VARIANCES OF INDIVIDUAL LEARNING SCORES FOR LESSON 1 FOR BOTH TREATMENT GROUPS DIVIDED ON PRE-ATTITUDE SCORES

	Attitude to CAI					
	Low			High		
Treatment	N	Mean	Variance	N	Mean	Variance
Personalized	46	68.67	334.67	47	72.89	308.05
Non-personalized	44	67.50	335.46	44	71.57	184.48

A two-way analysis of variance performed on these data indicated no significant differences for interaction or main effects.

The analysis was repeated using post-attitude scores as the classification variable and scores on the last lesson (lesson 9) as criterion variable. No significant results were found.

Using the low and high groups on post-attitude test scores, a further analysis was performed using the average scores of the nine lessons as criterion. Table 12 presents the means and variances of the mean learning scores of nine lessons for both the personalized and non-personalized treatment groups. Table 13 gives the results of the ensuing two way analysis of variance.

TABLE 12

MEANS AND VARIANCES OF THE INDIVIDUAL MEAN SCORES OVER NINE LESSONS FOR BOTH TREATMENT GROUPS DIVIDED ON POST-ATTITUDE TEST SCORES

	Attitude					
	Low			High		
Treatment	N	Mean	Variance	N	Mean	Variance
Personalized	46	83.36	24.68	47	83.17	31.66
Non-personalized	44	80.05	28.98	44	81.67	24.71

TABLE 13

ADJUSTED ANALYSIS OF VARIANCE[1] USING INDIVIDUAL MEAN SCORES OF NINE LESSONS AS CRITERION WITH BOTH GROUPS DIVIDED ON POST-ATTITUDE TEST SCORES

Source	SS	df	MS	F	p
Treatment	260.553	1	260.553	9.456	0.002
Attitude	21.553	1	21.553	0.782	0.378
Treat. X Att.	36.447	1	36.447	1.323	0.252
Error	4877.000	177	27.553		

As may be seen from table 13, the treatment condition was found to be significant. However attitude was not found to be a significant factor nor was there a significant interaction between attitude and learning.

A further analysis used the scores of the final quiz as the criterion. The means and variances of the final quiz scores for subjects of both treatments divided into low and high groups on post-attitude test scores are found in table 14. A two way analysis of variance using the scores of the final quiz as the criterion with the personalized and non-personalized treatment groups divided into low and high categories on post-attitude test scores yielded no significant results.

[1] This and all proceeding analyses of variance are based on the adjusted sum of squares.

TABLE 14

MEANS AND VARIANCES OF FINAL QUIZ WITH BOTH TREATMENT GROUPS DIVIDED ON POST ATTITUDE TEST SCORES

	Attitude					
	Low			High		
Treatment	N	Mean	Variance	N	Mean	Variance
Personalized	46	77.54	213.99	47	79.00	111.70
Non-personalized	44	74.45	162.81	44	77.00	95.86

Hypothesis 3 - Personality Variables and Learning

Hypothesis 3 dealt with the effect of eighteen personality variables on learning performance under the varying treatments of personalized and non-personalized CAI. It was predicted that students who were classified as either low or high on any one of the eighteen personality characteristics of dominance, capacity for status, sociability, socialization, self-control, tolerance, good impression, communality, achievement via conformance, achievement via independence, intellectual efficiency, psychological mindedness, flexibility and femininity, would vary with respect to learning performance when using various CAI methods of instruction.

An analysis of variance design was used to determine the effect of each of these eighteen personality variables on learning under the varying treatment conditions. Both

treatment groups were equally divided into low-high categories on each of the eighteen personality variables and eighteen separate analyses of variance were carried out using the mean scores of the nine lessons as the criterion. Tables 15-36 include the means and variances of the individual mean scores with the personalized and non-personalized treatment groups divided into low-high categories on each of the eighteen personality variables. In addition, the results of the significant analyses of variance using the individual mean scores as the criterion with both treatment groups divided on each of the eighteen personality variables are included.

TABLE 15

MEANS AND VARIANCES OF INDIVIDUAL MEAN SCORES OF NINE LESSONS FOR BOTH TREATMENT GROUPS DIVIDED ON DOMINANCE

	Dominance					
	Low			High		
Treatment	N	Mean	Variance	N	Mean	Variance
Personalized	46	83.498	24.232	47	83.040	32.017
Non-personalized	44	80.522	27.795	44	81.175	27.036

TABLE 16

MEANS AND VARIANCES OF INDIVIDUAL MEAN SCORES OF NINE LESSONS FOR BOTH TREATMENT GROUPS DIVIDED ON CAPACITY FOR STATUS

	Capacity for status					
	Low			High		
Treatment	N	Mean	Variance	N	Mean	Variance
Personalized	46	82.569	31.251	47	83.949	24.298
Non-personalized	44	79.070	30.271	44	82.657	18.179

TABLE 17

ADJUSTED ANALYSIS OF VARIANCE USING INDIVIDUAL MEAN SCORES OF NINE LESSONS AS CRITERION FOR BOTH TREATMENT GROUPS DIVIDED ON CAPACITY FOR STATUS (Cs)

Source					
Treatment	258.943	1	258.943	9.949	0.002
Cs	272.943	1	272.943	10.486	0.001
Treatment X Cs	55.057	1	55.057	2.115	0.148
Error	4607.000	177	26.028		

TABLE 18

MEANS AND VARIANCES OF INDIVIDUAL MEAN SCORES OF NINE LESSONS FOR BOTH TREATMENT GROUPS DIVIDED ON SOCIABILITY

		Sociability				
Treatment	N	Mean	Variance	N	Mean	Variance
Personalized	46	82.961	28.789	47	83.566	27.482
Non-personalized	44	80.220	26.676	44	81.508	27.509

TABLE 19

MEANS AND VARIANCES OF INDIVIDUAL MEAN SCORES OF NINE LESSONS FOR BOTH TREATMENT GROUPS DIVIDED ON SOCIAL PRESENCE

		Social presence				
		Low			High	
Treatment	N	Mean	Variance	N	Mean	Variance
Personalized	46	83.030	23.539	47	83.498	32.694
Non-personalized	44	80.072	27.597	44	81.654	26.154

TABLE 20

MEANS AND VARIANCES OF INDIVIDUAL MEAN SCORES OF NINE LESSONS FOR BOTH TREATMENT GROUPS DIVIDED ON SELF-ACCEPTANCE

	Self-acceptance					
	Low			High		
Treatment	N	Mean	Variance	N	Mean	Variance
Personalized	46	82.548	30.071	47	83.970	25.390
Non-personalized	44	80.461	24.305	44	81.266	30.394

TABLE 21

MEANS AND VARIANCES OF INDIVIDUAL MEAN SCORES OF NINE LESSONS FOR BOTH TREATMENT GROUPS DIIDED ON SENSE OF WELL-BEING

	Sense of well-being					
	Low			High		
Treatment	N	Mean	Variance	N	Mean	Variance
Personalized	46	83.369	26.494	47	83.165	29.892
Non-personalized	44	80.466	32.238	44	81.261	22.468

TABLE 22

MEANS AND VARIANCES OF INDIVIDUAL MEAN SCORES OF NINE LESSONS FOR BOTH TREATMENT GROUPS DIVIDED ON RESPONSIBILITY

	Responsibility					
	Low			High		
Treatment	N	Mean	Variance	N	Mean	Variance
Personalized	46	82.317	29.903	47	84.196	24.796
Non-personalized	44	80.750	32.552	44	80.977	22.452

TABLE 23

MEANS AND VARIANCES OF INDIVIDUAL MEAN SCORES OF NINE LESSONS FOR BOTH TREATMENT GROUPS DIVIDED ON SOCIALIZATION

	Socialization					
	Low			High		
Treatment	N	Mean	Variance	N	Mean	Variance
Personalized	46	83.080	31.769	47	83.449	24.685
Non-personalized	44	80.634	35.390	44	81.093	19.531

TABLE 24

MEANS AND VARIANCES OF INDIVIDUAL MEANS SCORES OF NINE LESSONS FOR BOTH TREATMENT GROUPS DIVIDED ON SELF-CONTROL

	Self-control					
	Low			High		
Treatment	N	Mean	Variance	N	Mean	Variance
Personalized	46	83.317	33.842	47	83.217	22.720
Non-personalized	44	81.227	30.469	44	80.499	24.295

TABLE 25

MEANS AND VARIANCES OF INDIVIDUAL MEAN SCORES OF NINE LESSONS FOR BOTH TREATMENT GROUPS DIVIDED ON TOLERANCE

	Tolerance					
	Low			High		
Treatment	N	Mean	Variance	N	Mean	Variance
Personalized	46	83.052	29.771	47	83.476	26.615
Non-personalized	44	79.864	31.461	44	81.863	21.526

TABLE 26

MEANS AND VARIANCES OF INDIVIDUAL MEAN SCORES OF NINE LESSONS FOR BOTH TREATMENT GROUPS DIVIDED ON GOOD IMPRESSION

	Good Impression					
	Low			High		
Treatment	N	Mean	Variance	N	Mean	Variance
Personalized	46	84.239	28.174	47	82.314	26.397
Non-personalized	44	81.782	23.685	44	79.945	29.624

TABLE 27

ADJUSTED ANALYSIS OF VARIANCE USING INDIVIDUAL MEAN SCORES OF NINE LESSONS AS CRITERION FOR BOTH TREATMENT GROUPS DIVIDED ON GOOD IMPRESSION (Gi)

Source	SS	df	MS	F	p
Treatment	263.913	1	263.913	9.785	0.002
Gi	160.913	1	160.913	5.966	0.016
Treatment X Gi	.087	1	.087	0.003	0.955
Error	4774.000	177	26.972		

TABLE 28

MEANS AND VARIANCES OF INDIVIDUAL MEAN SCORES OF NINE LESSONS FOR BOTH TREATMENT GROUPS DIVIDED ON COMMUNALITY

	Communality					
	Low			High		
Treatment	N	Mean	Variance	N	Mean	Variance
Personalized	46	82.267	31.696	47	84.245	22.851
Non-personalized	44	79.977	35.235	44	81.750	18.186

TABLE 29

ADJUSTED ANALYSIS OF VARIANCE USING INDIVIDUAL MEAN SCORES OF NINE LESSONS AS CRITERION FOR BOTH TREATMENT GROUPS DIVIDED ON COMMUNALITY (Cm)

Source	SS	df	MS	F	p
Treatment	259.527	1	259.527	9.620	0.002
Cm	159.527	1	159.527	5.913	0.016
Treatment X Cm	.473	1	.473	0.018	0.895
Error	4775.000	177	26.977		

TABLE 30

MEANS AND VARIANCES OF INDIVIDUAL MEAN SCORES OF NINE LESSONS FOR BOTH TREATMENT GROUPS DIVIDED ON ACHIEVEMENT VIA CONFORMANCE

	Achievement via Conformance					
	Low			High		
Treatment	N	Mean	Variance	N	Mean	Variance
Personalized	46	83.126	28.521	47	83.404	27.893
Non-personalized	44	81.475	28.381	44	80.252	25.844

TABLE 31

MEANS AND VARIANCES OF INDIVIDUAL MEAN SCORES OF NINE LESSONS FOR BOTH TREATMENT GROUPS DIVIDED ON ACHIEVEMENT VIA INDEPENDENCE

	Achievement via Independence					
	Low			High		
Treatment	N	Mean	Variance	N	Mean	Variance
Personalized	46	83.150	29.351	47	83.381	27.090
Non-personalized	44	79.029	29.297	44	82.698	18.853

TABLE 32

ADJUSTED ANALYSIS OF VARIANCE USING INDIVIDUAL MEAN SCORES OF NINE LESSONS AS CRITERION FOR BOTH TREATMENT GROUPS DIVIDED ON ACHIEVEMENT VIA INDEPENDENCE (Ai)

Source	SS	df	MS	F	p
Treatment	259.448	1	259.448	9.903	0.002
Ai	164.448	1	164.448	6.277	0.013
Treatment X Ai	133.551	1	133.551	5.098	0.025
Error	4637.000	177	26.198		

TABLE 33

MEANS AND VARIANCES OF INDIVIDUAL MEAN SCORES OF NINE LESSONS FOR BOTH TREATMENT GROUPS DIVIDED ON INTELLECTUAL EFFICIENCY

	Intellectual Efficiency					
	Low			High		
Treatment	N	Mean	Variance	N	Mean	Variance
Personalized	46	82.978	27.732	47	83.549	28.539
Non-personalized	44	80.049	32.641	44	81.677	21.036

TABLE 34

MEANS AND VARIANCE OF INDIVIDUAL MEAN SCORES OF NINE LESSONS FOR BOTH TREATMENT GROUPS DIVIDED ON PSYCHOLOGICAL MINDEDNESS

	Psychological Mindedness					
	Low			High		
Treatment	N	Mean	Variance	N	Mean	Variance
Personalized	46	83.965	31.428	47	82.583	24.121
Non-personalized	44	80.166	27.874	44	81.561	26.160

TABLE 35

MEANS AND VARIANCES OF INDIVIDUAL MEAN SCORES OF NINE LESSONS FOR BOTH TREATMENT GROUPS DIVIDED ON FLEXIBILITY

	Flexibility					
	Low			High		
Treatment	N	Mean	Variance	N	Mean	Variance
Personalized	46	83.663	25.958	47	82.879	30.126
Non-personalized	44	79.850	28.863	44	81.877	24.064

TABLE 36

MEANS AND VARIANCES OF INDIVIDUAL MEAN SCORES OF NINE LESSONS FOR BOTH TREATMENT GROUPS DIVIDED ON FEMININITY

	Femininity					
	Low			High		
Treatment	N	Mean	Variance	N	Mean	Variance
Personalized	46	83.022	22.310	47	83.506	33.893
Non-personalized	44	80.516	34.445	44	81.211	20.339

The results of each of the analyses of variances indicate that a significant difference between the treatment conditions existed ($p < .003$ or better) with the personalized treatment group scoring higher than the non-personalized treatment group. The personality factor was found to be significant ($p < .016$ or better) in four of the analyses. Subjects who scored high on capacity for status, communality and achievement via independence achieved significantly higher overall scores than did the subjects who scored low on these same personality variables. It was also seen that the subjects who scored low on good impression had higher mean scores ($p = .016$) on the nine lessons than did those subjects who were classified as high on that particular variable. Only one significant interaction, treatment by achievement via independence, was found to be significant.

The same type of analyses were performed using both lesson 1 and the final quiz as criterion measures. In lesson 1 fifteen of the smallest means were found in the cells noted as "non-personalized - low on personality characteristic". The results of the analysis of variance using the individual scores of lesson 1 as criterion did not totally correspond to the above observation. The personality factor was found to be significant ($p_i = .05$ or better) in only four of the analyses. The subjects who scored high on capacity for status, sociability, social presence, and achievement via independence achieved higher overall scores than did the subjects who scored low on the same personality variables. No treatment factors or interactions were found to be significant.

It was seen that the lowest mean scores of the final quiz are all to be found in the "non-personalized - low on personality characteristic" cells whereas the largest cell means are found on the personalized level of the treatment factor with fourteen of these located on the level of the personality factors described as high.

However the results of the analyses of variance indicate only two of the personality factors to be significant ($p < .022$ or better). The subjects who were classified as high on sociability and communality performed better than the subjects who were described as low on the same personality variables. No significant differences were found for the treatment factor, nor were any of the interactions found to be significant.

Hypothesis 4 - Personality Variables and Attitude

Hypothesis 4 dealt with the effect of the eighteen personality variables on attitude toward CAI under the personalized and non-personalized treatments. It was predicted that the subjects who were classified as either low or high on the same eighteen personality variables that had been described earlier, would vary with respect to post-attitude test scores.

An analysis of variance design was used in order to determine the effect of the eighteen personality variables on the post-attitude test scores. Both treatment groups were equally divided into low and high categories on each of the eighteen personality variables and eighteen separate analyses of variance were carried out using the post-attitude test scores as the criterion. Tables 37 - 59 include the means and variances of the post-attitude test scores with the personalized and non-personalized treatment groups having been divided on each of the eighteen personality variables. The results of the significant analyses of variance using the post attitude test scores as criterion measures with both treatment groups having been divided into low and high categories on the eighteen personality variables are also included.

TABLE 37

MEANS AND VARIANCES OF INDIVIDUAL POST-ATTITUDE SCORES FOR TREATMENT GROUPS DIVIDED ON DOMINANCE

	Dominance					
	Low			High		
Treatment	N	Mean	Variance	N	Mean	Variance
Personalized	46	67.521	114.967	47	70.532	94.690
Non-personalized	44	67.273	73.831	44	66.727	175.924

TABLE 38

MEANS AND VARIANCES OF INDIVIDUAL POST-ATTITUDE SCORES FOR TREATMENT GROUPS DIVIDED ON CAPACITY FOR STATUS

	Capacity for Status					
	Low			High		
Treatment	N	Mean	Variance	N	Mean	Variance
Personalized	46	67.261	91.175	47	70.787	116.258
Non-personalized	44	65.205	104.725	44	68.795	138.586

TABLE 39

ADJUSTED ANALYSIS OF VARIANCE USING POST-ATTITUDE SCORES AS CRITERION FOR BOTH TREATMENT GROUPS DIVIDED ON CAPACITY FOR STATUS (Cs)

Source	SS	df	MS	F	p
Treatment	185.328	1	185.328	1.647	0.201
Cs	572.765	1	572.765	5.091	0.025
Treatment X Cs	0.047	1	0.047	0.000	0.984
Error	19913.120	177	112.504		

TABLE 40

MEANS AND VARIANCES OF INDIVIDUAL POST-ATTITUDE FOR TREATMENT GROUPS DIVIDED ON SOCIABILITY

	Sociability					
	Low					
Treatment	N	Mean	Variance			
Personalized	46	66.670	92.394	47	71.340	110.447
Non-personalized	44	65.750	95.866	44	68.250	150.843

TABLE 41

ADJUSTED ANALYSIS OF VARIANCE USING POST-ATTITUDE SCORES AS CRITERION FOR BOTH TREATMENT GROUPS DIVIDED ON SOCIABILITY (Sy)

Source	SS	df	MS	F	p
Treatment	185.192	1	185.192	1.652	0.200
Sy	587.129	1	587.129	5.236	0.023
Treatment X Sy	51.996	1	51.996	0.464	0.497
Error	19846.810	177	112.129		

TABLE 42

MEANS AND VARIANCES OF INDIVIDUAL POST-ATTITUDE SCORES FOR TREATMENT GROUPS DIVIDED ON SOCIAL PRESENCE

	Social Presence					
	Low			High		
Treatment	N	Mean	Variance	N	Mean	Variance
Personalized	46	67.609	101.311	47	70.447	108.557
Non-personalized	44	66.841	101.720	44	67.159	148.138

TABLE 43

MEANS AND VARIANCES OF INDIVIDUAL POST-ATTITUDE SCORES FOR TREATMENT GROUPS DIVIDED ON SELF-ACCEPTANCE

	Self-acceptance					
	Low			High		
Treatment	N	Mean	Variance	N	Mean	Variance
Personalized	46	67.565	107.585	47	70.489	102.168
Non-personalized	44	68.750	93.029	44	65.250	150.611

TABLE 44

ADJUSTED ANALYSIS OF VARIANCE USING POST-ATTITUDE SCORES AS CRITERION FOR BOTH TREATMENT GROUPS DIVIDED ON SELF-ACCEPTANCE (Sa)

Source	SS	df	MS	F	p
Treatment	189.084	1	189.084	1.672	0.198
Sa	1.897	1	1.897	0.017	0.897
Treatment X Sa	466.478	1	466.478	4.125	0.044
Error	20017.560	177	113.094		

TABLE 45

MEANS AND VARIANCES OF INDIVIDUAL POST-ATTITUDE SCORES FOR TREATMENT GROUPS DIVIDED ON SENSE OF WELL-BEING

	Sense of well-being					
	Low			High		
Treatment	N	Mean	Variance	N	Mean	Variance
Personalized	46	68.391	98.067	47	69.681	114.962
Non-personalized	44	66.591	117.597	44	67.409	131.970

TABLE 46

MEANS AND VARIANCES OF INDIVIDUAL POST-ATTITUDE SCORES FOR TREATMENT GROUPS DIVIDED ON RESPONSIBILITY

	Responsibility					
	Low			High		
Treatment	N	Mean	Variance	N	Mean	Variance
Personalized	46	67.109	96.056	47	70.936	110.366
Non-personalized	44	65.182	98.644	44	68.818	144.478

TABLE 47

ADJUSTED ANALYSIS OF VARIANCE USING POST-ATTITUDE SCORES AS CRITERION FOR BOTH TREATMENT GROUPS DIVIDED ON RESPONSIBILITY (Re)

Source					
Treatment	185.150	1	185.150	1.651	0.201
Re	631.087	1	631.087	5.626	0.019
Treatment X Re	0.413	1	0.413	0.004	0.952
Error	19854.440	177	112.172		

TABLE 48

MEANS AND VARIANCES OF INDIVIDUAL POST-ATTITUDE SCORES FOR TREATMENT GROUPS DIVIDED ON SOCIALIZATION

	Socialization					
	Low			High		
Treatment	N	Mean	Variance	N	Mean	Variance
Personalized	46	67.500	115.678	47	70.553	93.861
Non-personalized	44	66.341	132.278	44	67.659	116.743

TABLE 49

MEANS AND VARIANCES OF INDIVIDUAL POST-ATTITUDE SCORES FOR TREATMENT GROUPS DIVIDED ON SELF-CONTROL

	Self-control					
	Low			High		
Treatment	N	Mean	Variance	N	Mean	Variance
Personalized	46	70.022	107.844	47	68.085	104.341
Non-personalized	44	66.455	116.440	44	67.545	132.859

TABLE 50

MEANS AND VARIANCES OF INDIVIDUAL POST-ATTITUDE SCORES FOR TREATMENT GROUPS DIVIDED ON TOLERANCE

	Tolerance					
	Low			High		
Treatment	N	Mean	Variance	N	Mean	Variance
Personalized	46	68.348	129.121	47	69.723	84.466
Non-personalized	44	66.250	101.401	44	67.750	147.355

TABLE 51

MEANS AND VARIANCES OF INDIVIDUAL POST-ATTITUDE SCORES FOR TREATMENT GROUPS DIVIDED ON GOOD IMPRESSION

	Good Impression					
	Low			High		
Treatment	N	Mean	Variance	N	Mean	Variance
Personalized	46	69.065	91.040	47	69.021	122.674
Non-personalized	44	66.000	107.023	44	68.000	140.837

TABLE 52

MEANS AND VARIANCES OF INDIVIDUAL POST-ATTITUDE SCORES FOR TREATMENT GROUPS DIVIDED ON COMMUNALITY

	Communality					
	Low			High		
Treatment	N	Mean	Variance	N	Mean	Variance
Personalized	46	66.957	111.332	47	71.085	94.211
Non-personalized	44	67.068	146.810	44	66.932	103.089

TABLE 53

MEANS AND VARIANCES OF INDIVIDUAL POST-ATTITUDE SCORES FOR TREATMENT GROUPS DIVIDED ON ACHIEVEMENT VIA CONFORMANCE

	Achievement via Conformance					
	Low			High		
Treatment	N	Mean	Variance	N	Mean	Variance
Personalized	46	69.196	113.894	47	68.894	100.272
Non-personalized	44	66.727	106.994	44	67.273	142.762

TABLE 54

MEANS AND VARIANCES OF INDIVIDUAL POST-ATTITUDE SCORES FOR TREATMENT GROUPS DIVIDED ON ACHIEVEMENT VIA INDEPENDENCE

	Achievement via Independence					
	Low			High		
Treatment	N	Mean	Variance	N	Mean	Variance
Personalized	46	68.957	121.065	47	69.128	93.288
Non-personalized	44	65.091	129.621	44	68.909	112.830

TABLE 55

MEANS AND VARIANCES OF INDIVIDUAL POST-ATTITUDE SCORES FOR TREATMENT GROUPS DIVIDED ON INTELLECTUAL EFFICIENCY

	Intellectual Efficiency					
	Low			High		
Treatment	N	Mean	Variance	N	Mean	Variance
Personalized	46	68.196	104.828	47	69.872	107.766
Non-personalized	44	64.977	103.744	44	69.023	137.791

TABLE 56

MEANS AND VARIANCES OF INDIVIDUAL POST-ATTITUDE SCORES FOR TREATMENT GROUPS DIVIDED ON PSYCHOLOGICAL MINDEDNESS

	Psychological Mindedness					
	Low			High		
Treatment	N	Mean	Variance	N	Mean	Variance
Personalized	46	70.348	116.810	47	67.766	94.096
Non-personalized	44	66.818	102.385	44	67.182	147.455

TABLE 57

MEANS AND VARIANCES OF INDIVIDUAL POST-ATTITUDE SCORES FOR TREATMENT GROUPS DIVIDED ON FLEXIBILITY

	Flexibility					
	Low			High		
Treatment	N	Mean	Variance	N	Mean	Variance
Personalized	46	70.239	103.297	47	67.872	107.853
Non-personalized	44	66.636	89.632	44	67.363	160.004

TABLE 58

MEANS AND VARIANCES OF INDIVIDUAL POST-ATTITUDE SCORES FOR TREATMENT GROUPS DIVIDED ON FEMININITY

	Femininity					
	Low			High		
Treatment	N	Mean	Variance	N	Mean	Variance
Personalized	46	66.413	123.315	47	71.617	77.416
Non-personalized	44	65.068	144.391	44	68.932	97.879

TABLE 59

ADJUSTED ANALYSIS OF VARIANCE USING POST-ATTITUDE SCORES AS CRITERION FOR BOTH TREATMENT GROUPS DIVIDED ON FEMININITY (fe)

Source	SS	df	MS	F	p
Treatment	184.256	1	184.256	1.670	0.198
Fe	937.693	1	937.693	8.499	0.004
Treatment X Fe	20.307	1	20.307	0.184	0.668
Error	19527.940	177	110.327		

The examination of the cell means and variances seems to indicate differences in both factors since in 16 of the 18 tables, the largest mean scores were found in the cell depersonalized as "personalized - high on personality characteristic" and 16 of the lowest means were located in the cell noted as "non-personalized - low on personality characteristic."

However the results of the analysis of variance indicate four personality factors to be significantly related to attitudes ($p < .025$ or better). Subjects who were classified as high on capacity for status, sociability, responsibility and femininity demonstrated more positive attitudes toward CAI than did those subjects who were classified as low on these four personality variables. The main treatment effect was found to be not significant. However, one interaction,

treatment by self-acceptance, was found to be significant ($p < .044$).

Summary of the Chapter

This chapter presented the results of the statistical analyses performed on the data. The results suggest that personalized CAI improves learning performance but also takes a significantly longer time to complete. The results suggest that personalized CAI does not significantly affect attitudes. Some evidence exists to suggest that certain personality variables affect learning performance and that certain personality variables affect attitudes.

CHAPTER V

DISCUSSION

Overview of the Chapter

This chapter presents a detailed discussion of the results of the analyses reported in Chapter IV. Some interpretation of the findings is given and implications for education are discussed. Practical applications are considered and suggestions are given for further research in the area.

Learning and the CAI Lessons

The experimental design of this study necessitated the use of subjects who had no prior knowledge of the material to be learned. Students enrolled in a one-year internship program and who were entering the Faculty of Education for the first time were chosen for the experiment. No pretest of learning based on the material covered in the CAI lessons was administered as it was unlikely that the highly technical nature of the school law material would be familiar to the subjects.

Significant Learning Score Differences Between Treatments

As shown in table 3, significant differences in

learning scores were found between the two treatment groups. It would appear that the personalization of CAI had positive effects on learning. The personalization variable considered in this study is one in which most developers of CAI may be interested. One of the major criticisms of using the computer as an instructional tool focuses on the idea that CAI is impersonal and dehumanizing. An extreme position that is held by some indicates a belief that human learning cannot occur in the absence of a human teacher. Effective personalization of CAI may alleviate some of this criticism. Results of this study suggest that personalizing the CAI lessons can significantly improve the learning performance.

The development of CAI programs which include personalization should be seriously considered. Although the personalized program takes a significantly longer time to complete than the non-personalized program, the gains in learning scores may overcome any additional costs that may result from the storage of longer programs, slightly larger CPU times or longer elapsed lesson times.

Lack of Significant Differences on Final Criterion Quiz

The relatively high mean scores of both groups on the final quiz may be questioned since the students were examined on material which had been learned from the computer up to four weeks previously. These high mean scores and the lack of significant differences between the two groups may be explained with reference to the motivational level

of the students.

First, there was a great incentive for learning under the CAI mode. The course grade was a direct consequence of the students' performance on the CAI programs. The course was graded on a pass/fail basis with a 70% mark set as the criterion level. The successful completion of this course was a prerequisite for the granting of both a Quebec Teaching Permit and McGill Diploma in Education. If the students failed this course they would not be granted either document and would be unable to teach in the Province of Quebec. It might be concluded that the high mean scores on the final quiz for both treatment groups arose due to the high motivational level of the subjects involved.

Even more important than the overall motivational level of the subjects, was the fact that students received different instructions regarding the manner in which the final quiz was to be approached. The experimenter encouraged the subjects to take the final quiz without studying the printouts of the previous nine lessons. However, the professor in charge of the course, wishing to lessen the anxiety level of his students, did not discourage them from studying these printouts. It may be assumed, especially after noting that the difference between the two treatment groups was in the hypothesized direction, that a true measure of learning differences between the two groups was in part camouflaged by these instructions and by the fact that all students were highly motivated to succeed. It might be

that original differences in learning were masked by later make-up study of the lesson printouts. This is one reason why on-line scores were analyzed as well as final criterion scores.

The Personalization of CAI

Overall achievement of students who experienced the personalized CAI lessons was found to be significantly better than that of students who were exposed to the non-personalized program. These findings would seem to support the position that a "human" element in technological instruction enhances learning performance.

One explanation as to the effectiveness of the personalized programs may be that these programs, because of their unique quality, were generally more reinforcing than the non-personalized programs. Even though the content structure of both programs was identical, it would appear that the quality of the feedback (degree of personalization) in the reinforcement statements of the personalized program had an influence in creating the observed differences in learning between the two treatment groups.

To be more specific, it is possible that the personalization of the CAI lessons made it possible to create a pseudo "social-interaction" between the students and the computer. It may be thought that the computer, especially in a course which is totally taught with CAI, takes the place of the teacher in ways other than being solely a

dispenser of information. As Geis and Chapman (1971) have noted, the human teacher is more than an "exposer of material." Interacting with the students, the teacher at times mediates reinforcement and at other times, administers the reinforcers. In a course such as was the basis of this study, the teacher as a reinforcing agent has been removed and replaced with two other degrees of reinforcing agents: a personalized CAI system and a non-personalized CAI system. In both systems the reinforcement contingencies were identical. However the group of students who interacted with the personalized program consistently achieved higher mean scores than did the students who were interacting with the non-personalized system. Since the students had been randomly assigned to the treatment groups, one possible explanation is that the treatments themselves had an effect on learning performance, and that personalization was a significant variable in CAI by apparently creating a pseudo "social interaction" to facilitate learning.

Attitudes

It had been hypothesized that the personalization of CAI might reduce the possible anxiety and frustration that may be associated with the idea of entering into an interaction with a machine. For this reason, it was thought that those students who experienced the personalized programs would develop significantly greater positive attitudes toward CAI than would those students who experienced the

non-personalized programs.

It was found that for all subjects exposure to CAI significantly improved the students positive attitudes toward CAI. The difference between the two groups however was not found to be significant though the direction of the difference was as predicted.

A closer examination of the data did, however, disclose that the students who experienced the personalized treatment did not feel as isolated or alone in their new learning situation, felt more at ease in answering the questions posed by the computer, felt that efforts were being made to individually tailor the learning material to their specific needs and did not find that the machinery interfered with their concentration (Table10, items D,H,O, and P). Apparently some evidence does exist to support the view that personalization can positively affect attitudes toward CAI.

It was interesting to note that attitudes toward CAI were not related to scores on the CAI lessons or quiz. No differences were found between the treatments or low/high attitudes on any of the learning scores that were used as criterion. This finding is contrary to many research findings (c.f. Cartwright, 1973) but consistent with the findings of Postlethwaite (1971) and may be due in part, to the overriding high motivational levels described earlier. Cartwright's (1973) students were in fact described as having low motivation.

It would appear that the relationship between

attitude and successful learning is more complex than first anticipated. One explanation may be postulated. It is possible that the low correlation between attitudes and learning scores might result from the inability to measure a possible confounding variable. Could it be that a higher correlation would be achieved if it were possible to measure students' perceived learning and relate this, rather than the actual scores, to the attitude scores? It would then be interesting to correlate "perceived learning" with actual learning scores in an attempt to discover the relationship between learning and attitudes.

Personality and Learning

Even though only one significant interaction was found between the personality variables and the treatments, it is interesting to note that there were a number of significant differences on the overall performance of students who were classified as either "low" or "high" on the eighteen personality characteristics measured.

It was found that students who were self-centered, inhibited and cautious performed significantly better than did those students who were sociable and interested in making a good impression. Students who were conventional and restricted in their outlook and interests did not do as well as students who were ambitious, resourceful and insightful. Students who were outgoing, spontaneous, enthusiastic, dependable, patient and realistic tended to achieve higher criterion

scores than did students who could be described as awkward, conventional, quiet, deliberate, impatient, changeable and restless.

Although not significant, a trend was noted that students on the personalized treatment level and on the "high" personality trait level tended to achieve the highest scores. Neither was there found to be an interaction between the levels of the personalization variable and the high-low categories of the personality variables.

Even though some significant results were found, it would appear that certain personality variables had little effect on learning. In this study, there was a significant difference between students who were classified as low or high on capacity for status, sociability, social presence, good impression, communality and achievement via independence. No definite conclusions can be drawn at this time since the variance in learning scores accounted for by most of these variables was small. It is possible that personality variables are in fact unrelated to learning. A second possible explanation is that if true personality characteristics are indeed related to learning, then the measures that are used to gauge these characteristics are inadequate.

Personality and Attitude

It was thought that personality might play a part in the development of attitudes. It was found that the level of the personality trait appeared to be related to attitudes

toward CAI but there was very little interaction between the levels of the personalization and personality variables.

The one significant interaction that occured was found when students were divided on the personality variable of self-acceptance. Students who experienced personalized CAI and who were classified as high on this personality trait, had a more positive attitude toward CAI than did the students of the same treatment who were classified as "low" on the same personality variable. The relationship between the personality level and the non-personalized treatment level was reversed with the students who were classified as "low" on this personality variable having a more positive attitude toward CAI than students who were classified as "high". It was also found that students, regardless of their treatment, who scored high on capacity for status, sociability, responsibility, and femininity demonstrated more positive attitudes toward CAI than did the students who were classified as "low" on these same personality variables.

It may be concluded that personality is somewhat related to attitude. However the variance that is accounted for by this variable is small and a detailed interpretation of these findings would be futile. It would appear that more research is required with the research design concentrating on closer control of the personality variables perhaps by choosing to study in detail a smaller number of these.

Practical Applications

It should be noted that regardless of how experienced or clever an author is, it will take a longer time to construct personalized CAI programs, as yet another variable must be taken into account in the preparing of good instructional material. The results of this study imply that even though some additional time may be required, it should become necessary for course authors to concentrate on more than the material content. A good program is more than just content. As the result of this study would seem to indicate, a program should also be "personable".

To what extent can the results of this particular study be generalized? It is probable that personalization is independent of the subject matter so that programs in most subject areas can be personalized to enhance learning performance. It is probable that the implementation of the personalization variable might demonstrate similar learning gains with different age groups. This is especially true with younger children as they may not be as aware of the superficial aspect of this variable as might older students.

Suggestions for Further Research

The significant differences on learning performance between the two treatment groups suggests the need for further research in this area. In discussing the results of the analyses many issues could have been raised which should lead to further investigation.

Motivation and Retention

It was suggested that the motivational level of the students may have played a large part in influencing the students' performance. Future studies in this area of CAI may wish to examine whether or not varying motivational levels would differentially affect learning among individuals working on personalized and non-personalized CAI.

This study did not examine the possible effects of short-term versus long-term retention factors. Future research may wish to examine the operation of retention factors in relation to personalized CAI.

Experimental Design

A. Pre-test of Learning

It was suggested earlier that the design of this experiment may have been improved had a pre-test of learning been included. Future research may include a pre-test to ascertain whether in fact this would be a necessity.

B. Positive and Negative Personalization

The reinforcement statements that were used in this study were, even when incorrect responses were encountered, generally of a positive nature. It may be interesting to set up two personalized conditions so that one is reinforced with positiviely reinforced statements such as the ones used in this study; and the other with negatively personalized statements such as "That's ridiculous, John!" or "You're

not as big a dummy as you let on, are you John?" It might be found that the quality of personalization also has an effect on learning performance. The positive and negative personalizations may have differential effects on learning.

Age Levels and Subject Area

It is possible that the age level of students or subject area used in personalized CAI would not change the results of studies examining this aspect of CAI since it is believed that personalization is an independent variable. However it may be worthwhile if future research would examine this aspect much closer. It may be found that younger children's attitudes may be positively affected by a personalized program whereas this study, using college graduates, found no significant differences in attitude between the two treatments.

Classroom Study

The possibility of generalizing this study to a classroom setting suggests some interesting ideas for research. A study could be designed so that some teachers are "personable" dispensers of information and reinforcement, and others are non-personable dispensers of information and reinforcement.

If the results of this type of research corresponds with the results of this study, certain implications would become evident both for teacher education and teacher selection. It might become necessary to choose teachers who are

"personable" and extroverted, and match these with specific student personality types.

Computer Simulation of Personality

A logical extension of the concept of personalized CAI gives rise to interesting possibilities for future research in this area. This study simply "personalized" the CAI programs that were used in this study. It may be possible, however, to use the computer to simulate specific personalities and examine how these might interact with students' personalities and learning styles. It may be that various computer "personalities" would differentially affect learning performance of students with differing personality make-ups and that particular students could be matched to certain computer "personalities".

Personality

Eighteen personality traits as measured by the California Psychological Inventory were used in this study. It is suggested that future research might prove fruitful if researchers concentrate on two specific traits; anxiety and self-concept. It is possible that a personalized program may reduce the anxiety level of students more than a non-personalized program and thereby significantly affect learning performance. The study of self-concept is suggested due to the frequent use of students' first names in the personalized program. A personalized program may affect a

student's perception of himself and thus affect long term retention.

Summary of Findings

The major findings of this study are summarized below:

Learning

1. Individuals who experienced personalized CAI achieved significantly higher learning scores than did students who experienced non-personalized CAI.
2. The personalized course took significantly longer to complete than did the non-personalized course.

Attitudes

3. Attitudes toward CAI were significantly increased due to exposure to CAI.
4. Attitudes toward CAI were not significantly affected by the treatments.
5. Students who experienced personalized CAI, when compared with students who experienced non-personalized CAI, did not feel as isolated in their learning situation, felt more at ease in answering questions posed by the computer, felt the instruction to be more individualized and did not feel that the machinery interfered with their learning.

6. No significant overall relationship was found to exist between learning and attitudes.
7. Attitudes did not interact with the treatment to significantly affect learning.

Personality and Learning

8. Students who were classified as high on capacity for status, communality, and achievement via independence attained higher mean scores for the nine lessons than did students who were classified as low on these same personality variables.
9. Students who were classified as high on good impression attained lower mean scores for nine lessons than did students who were classified as low on this personality variable.
10. A significant interaction was found to exist between the treatment, and achievement via independence. The scores of subjects on the personalized treatment level did not differ in relation to the levels of the personality characteristic but the scores of students on the non-personalized treatment did differ significantly with the students on the high personality level tending to surpass the scores of the subjects on the personalized treatment level.

Personality and Attitudes

11. Students who were classified as high on capacity for

status, sociability, responsibility and femininity demonstrated a more positive attitude toward CAI than did students who were classified as low on these same personality variables.

12. One interaction, treatment by self-awareness, was found to be significant. Students who were classified as "personalized/high on personality characteristics" and "non-personalized/low on personality characteristics" had a more positive attitude toward CAI than did students who composed the other two cells.

Conclusion

This study has attempted to determine if the personalization of CAI is effective in improving learning performance. This study has considered the effect of personalized CAI and several personality variables on learning and attitude.

The results of the study suggest that the personalization of CAI may prove to be a more effective means of presenting instruction through the use of the computer. Moreover the threat of depersonalization may tend to be somewhat reduced with the introduction of personalized CAI. There is no single answer to improving instruction. However the personalization of CAI may be a means of 1) improving learning and 2) lessening feelings of depersonalization due to the dehumanization that is inherent in the concept of mechanized teaching.

REFERENCES

Alpert, D. and Bitzer, D. L. Advances in computer-based instruction. Science, 1970, 167, 1582-1590.

Anderson, R. C., Kulhavy, R. W. and Andre, T. Feedback procedures in programmed instruction. Journal of Educational Psychology, 1971, 62, 148-156.

Atkinson, R. C. CAI and the learning process. American Psychologist, 1968, 23, 225-239.

Atkinson, R. C. Teaching children to read using the computer. American Psychologist, 1974, 29, 169-178.

Atkinson, R. C. and Wilson, H. A. Computer-assisted instruction, Science. 1968, 162- 73-77.

Atkinson, R. C. and Wilson, H. A. Computer-assisted instruction. In: R. C. Atkinson and H. A. Wilson (eds.) Computer-Assisted Instruction: A Book of Readings. New York: Academic Press, 1969, 3-14.

Barnes, D. E. Humane benefits for education: Some directions in technology. Educational Technology, 1971, 11(6), 2.-23.

Bright, L. R. Preface. In: J. B. Margolin and M. R. Misch (eds.) Computers in the Classroom. New York: Spartan Books, 1970, x-xii.

Bunderson, C. R. The computer and instructional design. In: W. Holtzman (ed.), Computer-Assisted Instruction, Testing and Guidance. New York: Harper and Row, 1970, 45-73.

Canfield, J. T. Dear machine: Don't call us, we'll call you! Educational Technology, 1971, 11(6), 23-26.

Carpenter, C. R. Computer regulated learning. In: J. B. Margolin and M. R. Misch (eds.). Computers in the Classroom. New York: Spartan Books, 1970, 163-176.

Cartwright, G. F. Social, Personality, and Attitudinal Dimensions of Individual Learning with Computer-Assisted Group Instruction. Unpublished Doctoral Dissertation. Edmonton, Alberta: University of Alberta, 1973.

Cartwright, G. F. and Derevensky, J. L. An Attitudinal Study of Computer-Assisted Testing as a Learning Method. Paper presented at the 59th Annual Convention of the American Educational Research Association, Washington, D. D., April, 1975.

Cronbach, L. J. How can instruction be adapted to individual differences. In: R. M. Gagné (ed.). Learning and Individual Differences. Columbus, Ohio: Charles E. Merrill Books, Inc., 1967.

Crowder, N. A. Intrinsic and extrinsic programming. In: J. E. Coulson (ed.). Programmed Learning and Computer-Based Instruction. New York: John Wiley and Sons, 1962, 58-67.

Flanagan, J. C. Using Research and Development to Improve Education. Paper presented at the meeting of the American Educational Research Association, New York. 1967.

Gagné, R. M. (ed.). Learning and Individual Differences. Columbus, Ohio: Merrill Publishers, 1967.

Geis, G. L. and Chapman, R. Knowledge of results and other possible reinforcers in self-instructional systems. Educational Technology, 1971, 11(4), 38-51.

Gentile, J. R. The first generation of computer-assisted instruction systems: An evaluative review. A-V Communication Review, 1967, 15, 23-55.

Gerard, R. W. Computers and Education. New York: McGraw Hill, 1967.

Gerard, R. W. Shaping the mind: Computers in education. In: R. C. Atkinson and H. A. Wilson (eds.). Computer-Assisted Instruction: A Book of Readings. New York: Academic Press, 1969, 26-33.

Glaser, R. Psychological questions in the development of computer-assisted instruction. In: W. Holtzman (ed.). Computer-Assisted Instruction, Testing and Guidance. New York: Harper and Row, 1970, 74-93.

Goshen, C. E. The humanizing process. Educational Technology, 1971, 11(6), 12-14.

Gough, H. G. Manual for the California Psychological Inventory. Palo Alto, California: Consulting Psychologists Press, Inc., 1957.

Guilford, J. P. Three faces of intellect. American Psychologist, 1959, 14, 469-479.

Haskell, R. W. Effect of certain individual learner personality differences on instructional methods. A-V Communication Review, 1971, 19, 287-297.

Hess, R. D., Tenezakis, M. D. et al. The Computer as a Socializing Agent: Some Socio-affective Outcomes of CAI. Technical Report No. 13, Stanford Center for Research and Development in Teaching. 1970, Eric Document ED 044 942.

Hicks, B. L. and Hunka, S. The Teacher and the Computer. Toronto: W. B. Saunders Company, 1972.

Holtzman, W. (ed.). Computer-Assisted Instruction, Testing and Guidance. New York: Harper and Row, 1970.

Holtzman, W. Computers in education. In: W. Holtzman (ed.), Computer-Assisted Instruction, Testing and Guidance. New York: Harper and Row, 1970, 1-13.

Jerman, M. Promising developments in computer-assisted instruction. Educational Technology, 1969, 9(8), 10-18.

Jerman, M. Computers, instruction and the curriculum. Educational Technology, 1970, 10(5), 53-56.

Keppel, F. The Necessary Revolution in American Education. New York: Harper and Row, 1966.

Kropp, R. P. Making CAI work. In: J. B. Margolin and M. R. Misch (eds.), Computers in the Classroom. New York: Spartan Books, 1970, 205-222.

Landers, R. R. An approach to humanize education through technology. Eduational Technology, 1971, 11(6), 9-11.

Majer, K. Differential relationships between personality and performance under dissimilar modes of instruction. A-V Communication Review, 1970, 18, 169-170.

Margolin, J. B. and Misch, M. R. (eds.), Computers in the Classroom. New York: Spartan Books, 1970.

Martin, H. J. Self-growth and self-enhancement through technology. Educational Technology, 1971, 11(6), 15-18.

Mathis, A., Smith, T. and Hansen, D. College students' attitudes toward computer-assisted instruction. Journal of Educational Psychology, 1970, 61, 46-51.

McCaffrey, D. and Cartwright, G. F. The CAN VI System as Adapted to MUSIC. Montreal: McGill Computing Centre, 1974.

Meierhenry, W. C. Computers in education. In: J. B. Margolin and M. R. Misch (eds.). Computers in the Classroom. New York: Spartan Books, 1970, 141-162.

Mesthene, E. G. Computers and the purpose of education. In: W. H. Holtzman (ed.), Computer-Assisted Instruction, Testing and Guidance. New York: Harper and Row, 1970, 384-392.

Muller, L. Reports from industry. In: J. B. Margolin and M. R. Misch (eds.). Computers in the Classroom. New York: Spartan Books, 1970, 79-86.

Mumford, L. The automation of knowledge. A-V Communication Review, 1964, 12 - 261-276.

Nagel, T. C. A descriptive study of cognitive and affective variables associated with achievement in CAI learning situations, 1969. Cited by: P. G. Watson. Using the Computer in Education. Englewood Cliffs, New Jersey: Educational Technology Publications, 1972.

Noble, G. A study of the relationship between ability, performance, attitudes, inclinations and speed of progress using intrinsic programmed instruction. Programmed Learning and Educational Technology, 1969, 6, 109-120.

Oettinger, A. G. Run, Computer, Run. Cambridge, Mass.: Harvard University Press, 1969.

O'Neill, H. F. Effects of Stress on State Anxiety and Performance in CAI. Unpublished Doctoral Dissertation. Florida State University, 1970.

Perseelin, L. E. Humanizing education through technology: The view from an ivory foxhole. Educational Technology, 1971, 11 (6), 18-20.

Postlethwaite, T. N. International association for the evaluation of educational achievement (IEA) -- The mathematics study. Journal for Research in Mathematics Education, 1971, 2, 69-103.

Pressey, S. L. A simple apparatus which gives tests and scores -- and teaches. School and Society, 1926, 23, 373-376.

Roid, G. H. Covariates of Learning in CAI. Paper presented at the annual meeting of the American Educational Research Association. New York, 1971.

Schoen, H. L. A Comparison of Four Types of Feedback to Student Responses in a CAI Unit Designed to Teach the Concept of Function to Pre-calculus College Students. Unpublished Doctoral Dissertation. Ohio State University, 1971.

Silberman, H. F. Applications of computers in education. In: R. C. Atkinson and H. A. Wilson (eds.), Computer-Assisted Instruction: A Book of Readings. New York: Academic Press, 1969, 49-61.

Skinner, B. F. The science of learning and the art of teaching. Harvard Educational Review, 1954, 24. Reprinted in Lumsdaine and Glaser (eds.). Teaching Machines and Programmed Learning. A Source Book. Washington, D. C.: National Educational Association, 1960, 99-113.

Skinner, B. F. Teaching Machines. Science. 1958, 128. Reprinted in Lumsdaine and Glaser (eds.). Teaching Machines and Programmed Learning. A Source Book. Washington, D. C.: National Educational Association, 1960, 137-158.

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

Snow, R. E. and Solomon, G. Aptitudes and Instructional Media. A-V Communication Review, 1968, 16, 341-357.

Stansfield, D. The computer and education. Educational Technology. 1968, 8, 3-8.

Stolurow, L. M. What is computer-assisted instruction? Educational Technology, 1968, 8(15), 10-11.

Stolurow, L. M. CAI: Theory and Practice. Harvard University, 1969. Eric Document ED 034 409.

Suppes, P. The users of computers in education. Scientific American, 1966, Sept., 206-220.

Suppes, P. Computer technology and the future of education. In: R. C. Atkinson and H. A. Wilson (eds.). Computer-Assisted Instruction: A Book of Readings. New York: Academic Press, 1969, 41-47.

Suppes, P. Computer technology and individualized technology. In: H. F. Clarizo, R. C. Craig and W. A. Mehrens (eds.). Contemporary Issues in Educational Psychology. Boston: Allyn and Bacon, Inc. 1970, 488-497.

Suppes, P. and Morningstar, M. Four programs in computer-assisted instruction, 1968. In: W. Holtzman (ed.). Computer-Assisted Instruction, Testing and Guidance, New York: Harper and Row, 1970, 233-265.

Suppes, P. and Morningstar, M. Technological innovations: Computer-assisted instruction and compensatory education. In: F. F. Korten, S. W. Cook and J. I. Lacey (eds.), Psychology and the Problems of Society. Washington: American Psychological Association, Inc., 1970, 221-236.

Sutter, E. Individual differences and social conditions as they affect learning by computer-assisted instruction, 1967. Cited by C. V. Bunderson. In: The computer and instructional design. In: W. Holtzman (ed.). Computer-Assisted Instruction, Testing and Guidance. New York: Harper and Row, 1970, 45-73.

Tallmadge, G. K. Study of training equipment and individual differences. 1968. Cited in: P. G. Watson. Using the Computer in Education. Englewood Cliffs, New Jersey: Educational Technology Publications, 1972.

Tobias, S. Effect of creativity, response mode, and subject matter familiarity on achievement from PI. Journal of Educational Psychology. 1969, 60, 453-460.

Watson, P. G. Using the Computer in Education. Englewood Cliffs, New Jersey: Educational Technology Publications, 1972.

Williamson, M. A. Some reservations about humanizing education through technology. Ecuational Technology, 1971, 11(6), 26-27.

APPENDICES

APPENDIX A

Lesson 2: An example of a Personalized Program in CAI

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*MCGILL - MUSIC,  SIGN ON.
LID B2, IBO 8
*MCGILL - MUSIC,  SIGN ON.
/ID B2, IBO 8P
*MCGILL - MUSIC,  SIGN ON.
/ID B2, IBO 8
*PASSWORD?
*IN PROGRESS
*SIGN ON  TUE OCT 29, 1974  TIME= 8:30  PORT = 052 RESTART =055
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CAN VI -- MCGILL UNIVERSITY:  VER 2

PLESE TYPE YOUR STUDENT NUMBER:
?
7410285

ARE YOU SURE IT'S 7410285
?
YES

HELLO,  DORIS,

DO YOU WANT TO CONTINUE FROM WHERE YOU
LEFT OFF IN LAW
?
YES

LET'S CONTINUE NOW.

************************ LESSON 2 ****************************

GOOD MORNING, DORIS.  NICE TO GET SUCH AN EARLY START!

AS YOU ARE PROBABLY AWARE, THE PURPOSE OF THIS PROGRAMME
IS TO PROVIDE YOU WITH A BASIC KNOWLEDGE OF REGULATIONS
ONE AND SEVEN OF THE MINISTRY OF EDUCATION OF THE PROVINCE
OF QUEBEC.  (THE MAJOR EMPHASIS WILL BE ON REGULATION SEVEN,
WHICH WILL BE HANDLED FIRST).

AS A FUTURE TEACHER, DORIS YOU ARE PROBABLY AWARE OF THE
FACT THAT LEARNING IS A PAINFUL EXPERIENCE, WHICH IS NOT
TO BE ENJOYED.  IN LIGHT OF THIS KNOWLEDGE, YOU ARE EXPECTED
NOT TO ENJOY THIS LESSON IN ANY WAY, SHAPE, OR FORM.  IN THE
TRUE SPIRIT OF EDUCATION, ANY EVIDENCE OF ENJOYMENT MAY BE
INDICATIVE OF THE FACT THAT YOU MAY FEEL THAT LEARNING CAN
BE FUN, AND THUS YOU ARE NOT SUITABLE FOR THE TEACHING
PROFESSION.

.....
```

ADVANCEMENT FROM THE ELEMENTARY LEVEL TO THE SECONDARY LEVEL NORMALLY OCCURS AFTER HOW MANY YEARS?

C) 5 YEARS
D) 5 YEARS
E) 7 YEARS
F) 8 YEARS

?
7 YEARS

TRY A SIMPLE C, D, E OR F, PLEASE!
?
E

NOPE. YOUR TIMING IS OFF!
SIX YEARS IS THE NORMAL LENGTH OF A PUPIL'S JOURNEY THROUGH THE ELEMENTARY LEVEL.
THE PUPIL SHOULD BE APPROXIMATELY 12 WHEN HE ENTERS SECONDARY SCHOOL.

THE MAXIMUM LENGTH OF STUDIES IN THE ELEMENTARY SCHOOL IS FIXED AT SEVEN YEARS, AFTER WHICH ADVANCEMENT TO THE SECONDARY LEVEL IS OBLIGATORY. (THAT'S HOW I MADE IT TO HIGH-SCHOOL, BY THE WAY!)

IF AFTER FIVE YEARS AT THE ELEMENTARY LEVEL A CHILD HAS COMPLETED THE ELEMENTARY PROGRAMME, HE MAY ADVANCE TO THE SECONDARY LEVEL IF WHICH ONE OF THE FOLLOWING IS TRUE?

T) HIS FATHER IS MINISTER OF EDUCATION
U) HE HAS THE NECESSARY EMOTIONAL AND SOCIAL MATURITY
V) HE PROMISES TO DO ALL OF HIS HOMEWORK.

?
U

GOOD STUFF, DORIS
THIS, OF COURSE REQUIRES A SUBJECTIVE JUDGEMENT ON THE PART OF THE TEACHER OR PRINCIPAL.

.....

WELL,

I'D LIKE TO INFORM YOU, DORIS, THAT A MULTIPLE-CHOICE TEST ON LESSON 2 (REGS. 1 AND 7) IS AVAILABLE.
THE TEST CONSISTS OF 10 MULTIPLE-CHOICE QUESTIONS SELECTED AT RANDOM FROM THE MATERIAL WHICH HAS BEEN PRESENTED IN THE FOREGOING LESSON.

********** QUEBEC SCHOOL LAW -- TEST **********

NOTE, DORIS, THAT EACH OF THE QUESTIONS THAT FOLLOW HAS ASSOCIATED WITH IT AN ANSWER LIST. IN GIVING YOUR RESPONSES, PLEASE TYPE ONLY THE LETTER ASSOCIATED WITH THE ANSWER THAT YOU THINK IS CORRECT.

THANK YOU, DORIS, AND GOOD LUCK.

QUESTION NO. 1.

ELEMENTARY PUPILS 9 YEARS OF AGE AND OLDER MUST ATTEND SCHOOL FOR A MINIMUM OF HOW MANY MINUTES PER WEEK?

R) 750
T) 1250
S) 1500
X) 1575

?
S

RIGHT ON, DORIS!

.....

QUESTION NO. 10.

JOHN HAS FAILED MATH 201, ENGLISH 201, AND FRENCH 201. DOES HE FAIL THE YEAR?

Y) YES
N) NO

?
N

GREAT GUNS!

YOU'RE SCORE IS 10 OUT OF 10. WHAT DO YOU KNOW ABOUT THAT? THAT'S 100%!

WELL DORIS,
SINCE YOU HAVE ACHIEVED THE CRITERION OF AT LEAST 70% I ADVISE YOU TO PROCEED TO LESSON 3.

RESERVE A TERMINAL FOR YOUR NEXT SESSION. OK?

THAT'S IT FOR NOW.
THANKS FOR COMING ALONG DORIS.
STOP
*END

/OFF ******
*GOOD-BYE

APPENDIX B

Lesson 2: An example of a Depersonalized Program in CAI

```
*MCGILL - MUSIC,  SIGN ON.
/ID B4, IBO8
*PASSWORD?

*MUSIC WILL SHUTDOWN AT 22.00 TONIGHT (08/10/74)
*IN PROGRESS
*SIGN ON  TUE OCT 08, 1974  TIME= 19:39 PORT=05B  RESTART=064
/EX DLAW   ******
*IN PROGRESS

CAN VI -- MCGILL UNIVERSITY:  VER 2

PLEASE TYPE YOUR STUDENT NUMBER:
?
6312008

ARE YOU SURE IT'S 6312008
?
YES

HELLO,  STUDENT

DO YOU WANT TO CONTINUE FROM WHERE YOU
LEFT OFF IN LAW
?
YES

LET'S CONTINUE NOW.

THE PURPOSE OF THIS PROGRAM
IS TO PROVIDE THE STUDENT WITH A BASIC KNOWLEDGE OF REG-
ULATIONS ONE AND SEVEN OF THE MINISTRY OF EDUCATION OF THE
PROVINCE OF QUEBEC.  (THE MAJOR EMPHASIS WILL BE ON REG-
ULATION SEVEN, WHICH WILL BE HANDLED FIRST).


REGULATION SEVEN:
-----------------

FOR INSTANCE:  REGULATION SEVEN STATES THAT A CHILD OF FIVE
YEARS OLD, BEFORE OCTOBER FIRST OF THE SCHOOL YEAR IN PROGRESS,
IS TO BE ADMITTED TO KINDERGARTEN.  (SIX YEARS OF AGE FOR
ELEMENTARY-LEVEL ONE).

LITTLE JOHN BECAME SIX ON JULY 18.  SHOULD HE BE ADMITTED
TO KINDERGARTEN OR LEVEL ONE IN SEPTEMBER?
        K) KINDERGARTEN
        L) LEVEL ONE

        TYPE K OR 1.
?
K

INCORRECT
```

THE REG SAYS THAT A CHILD WHO BECOMES SIX YEARS OF AGE BEFORE OCTOBER FIRST OF THE YEAR IN PROGRESS IS PLACED IN LEVEL ONE. REMEMBER: THE SCHOOL-YEAR BEGINS ON JULY FIRST.

FURTHER,

ALL TEACHERS ARE REQUIRED TO BE AWARE OF THE FACT THAT ALL CHILDREN FROM KINDERGARTEN TO SECONDARY FIVE MUST REGISTER FOR CLASSES EACH YEAR.

SCHOOL YEAR = 200 DAYS

"TEACHING DAYS" = 180

200 - 180 = 20 PROFESSIONAL DAYS

"TEACHING DAYS" EXCLUDE WHICH ONE OF THE FOLLOWING ACTIVITIES?

A) PUPILS PLAN THEIR WORK
B) FORMAL AND INFORMAL LESSONS
C) REPORTS ON VARIOUS TOPICS
D) TEACHERS PLAN AND EVALUATE THEIR WORK
E) PUPIL RESEARCH
F) OTHER EDUCATIONAL ACTIVITIES OF THE PUPILS

?
D

CORRECT

ADVANCEMENT FROM THE ELEMENTARY LEVEL TO THE SECONDARY LEVEL NORMALLY OCCURS AFTER HOW MANY YEARS?

C) 5 YEARS
D) 6 YEARS
E) 7 YEARS
F) 8 YEARS

?
E

?
E

SIX YEARS IS THE NORMAL LENGTH OF A PUPIL'S JOURNEY THROUGH THE ELEMENTARY LEVEL.
THE PUPIL SHOULD BE APPROXIMATELY 12 WHEN HE ENTERS SECONDARY SCHOOL.

THE MAXIMUM LENGTH OF STUDIES IN THE ELEMENTARY SCHOOL IS

FIXED AT SEVEN YEARS, AFTER WHICH ADVANCEMENT TO THE SECONDARY LEVEL IS OBLIGATORY.

IF AFTER FIVE YEARS AT THE ELEMENTARY LEVEL A CHILD HAS COMPLETED THE ELEMENTARY PROGRAMME, HE MAY ADVANCE TO THE SECONDARY LEVEL IF WHICH ONE THE FOLLOWING IS TRUE?

T) HIS FATHER IS MINISTER OF EDUCATION
U) HE HAS THE NECESSARY EMOTIONAL AND SOCIAL MATURITY
V) HE PROMISES TO DO ALL OF HIS HOMEWORK.

?
UQ

WHAT?

T, U, OR V. TRY AGAIN.

?
U

CORRECT

THIS, OF COURSE REQUIRES A SUBJECTIVE JUDGEMENT ON THE PART OF THE TEACHER OR PRINCIPAL.

A MULTIPLE-CHOICE TEST ON
LESSON 2 (REGS. 1 AND 7) IS AVAILABLE.
THE TEST CONSISTS OF 10 MULTIPLE-CHOICE QUESTIONS SELECTED AT RANDOM FROM THE MATERIAL WHICH HAS BEEN PRESENTED IN THE FOREGOING LESSON.

********** QUEBEC SCHOOL LAW -- TEST **********

EACH OF THE QUESTIONS THAT FOLLOW HAS ASSOCIATED WITH IT AN ANSWER LIST. IN GIVING RESPONSES, TYPE ONLY THE LETTER ASSOCIATED WITH THE ANSWER CHOSEN AS CORRECT.

QUESTION NO. 1.

ON WHICH OF THE FOLLOWING DO THE MARKS OF A STUDENT NOT NECESSARILY APPEAR?

W) SCHOOL REPORT
X) PERSONAL RECORD
Y) CUMULATIVE SCHOOL RECORD

?
X

CORRECT

.....

```
QUESTION NO. 10

SECONDARY LEVEL CONSISTS OF LEVELS:
        S) 7 TO 11 INCLUSIVE
        E) 8 TO 11 INCLUSIVE
        N) 8 TO 12 INCLUSIVE

?
S

CORRECT

CORRECT = 9
SCORE = 90%
SINCE THE CRITERION OF AT LEAST 70% HAS BEEN ACHIEVED
PROCEED TO LESSON 3.


RESERVE A TERMINAL FOR THE NEXT SESSION.

THAT'S IT FOR NOW.
THANKS FOR COMING ALONG STUDENT.
STOP
*END

/OFF ******
*GOOD-BYE
```

APPENDIX C

An Example of CAN-VI Coding:

Personalized Program - Lesson 9

```
117     IA,ZSARCH,1
118     T,
119     T,@2 ************************************************************
120     T, *  THERE ARE TWO ASPECTS OF THIS SECTION ON GRIEVANCES *
121     T, *  THAT ARE IMPORTANT.                                 *
122     T, *                                                      *
123     T, *          ONE:  THE ACTUAL PROCEDURE                  *
124     T, *                                                      *
125     T, *          TWO:  THE DEADLINES TO BE FOLLOWED          *
126     T, ************************************************************
127     T,@2   ***  REMEMBER THAT BOTH POINTS SHOULD BE TAKEN
128     T,          INTO ACCOUNT.
129     T,@2 IF THE SYNDICAL UNIT WISHES (IT'S UP TO THEM YOU KNOW,
130     T, THEY'RE THE EXPERTS ON THE COLLECTIVE AGREEMENT) TO SUB-
131     T, MIT THE GRIEVANCE TO ARBITRATION, THEY MUST GIVE WRITTEN
132     T, NOTICE OF THEIR INTENT WITHIN  --- DAYS.
133     T,@2       HINT:  BETWEEN 45 AND 90.
134   126 A, 60,SIXTY: 128
135     U,O,301
136     T,TRY THAT AGAIN PLEASE
137     G,126
138   301 CN,IV7;127
139     IF,IV7,LT,60;129
140     IF,IV7,EQ,60;128
141     IF,IV7,GT,60;130
142   127 U,O,131
143     T,EH ?
```

```
144     T, TRY AGAIN.
145     G,126
146 128 T,@2 HOW ABOUT THAT
147     T, YOU'VE HIT THE NAIL ON THE HEAD
148     G,132
149 129 T,@2 HOW ABOUT THAT,
150     T, YOU'VE MUFFED IT.  YOUR GUESS WAS TOO LOW.
151     G,132
152 130 T,@2 HOW ABOUT THAT,
153     T, YOU'VE MUFFED IT.  YOUR GUESS WAS TOO HIGH.
154     G,132
155 131 T,@2 @A, IS NOT THE CORRECT ANSWER.
156 132 T,@2 THE CORRECT ANSWER, IN FACT, IS 60 DAYS.
157     CO, IV30,133
158     RA,LAW,9000
159     IA,ZSARCH,1
160 133 T,@2 NOW WE KNOW THAT THE SYNDICAL UNIT MUST GIVE
161     T, WRITTEN NOTICE OF ITS INTENT TO SUBMIT A GRIEVANCE
162     T, TO ARBITRATION WITHIN 60 DAYS OF THE SCHOOL BOARD'S
            DECISION.
163     T,@2 HOWEVER, @N, TO WHOM DO YOU THINK THAT THIS NOTICE
164     T, MUST BE GIVEN?
165     T,@2 1) THE SCHOOL BOARD
166     T, 2) THE PLAINTIFF
167     T, 3) THE MINISTRY OF EDUCATION
168     T, 4) THE SCHOOL PRINCIPAL
169 134 T,@2 PLEASE TYPE 1, 2, 3 OR 4
```

```
170     A,1;135
171     A,2,3,4;136
172     U,O,137
173     T,WHAT?
174     G,134
175 135 T, @2 THAT'S IT
176     G,138
177 136 T,@2 NO WAY
178     G,138
179 137 T,@2 ALL YOU HAD TO DO WAS TYPE A 1, 2, 3 OR 4.
180 138 T,@2 THE NOTICE, ACCORDING TO THE COLLECTIVE AGREEMENT,
181     T, MUST BE GIVEN TO THE SCHOOL BOARD AND TO ONE MORE
182     T, PERSON (NOT APPEARING IN THE ABOVE LIST) --- MR.
183     T, LUCIEN BOUCHARD, THE FIRST CHAIRMAN OF THE COUNCIL
          OF ARBITRATION.
184     CO,IV30,139
185     RA,LAW,9000
186     IA,ZSARCH,1
187 139 T,@2  THE COUNCIL OF ARBITRATION SHALL BE COMPOSED
188     T, OF THE FOLLOWING MEMBERS:
189     T,          * A CHAIRMAN
190     T,          * AN ARBITRATOR  APPOINTED BY THE UNION
191     T,          * AN ARBITRATOR APPOINTED BY THE FEDERATION (OF
192     T,            SCHOOL COMMISSIONS) AND THE GOVERNMENT.
193     T,@2 THEREFORE, @N, HOW MANY PEOPLE WOULD SIT
194     T, ON THE COUNCIL OF ARBITRATION?
195 140 A,3, THREE;141
```

```
196     U;O,142
197     T,YOU'RE NOT PAYING ATTENTION
198     T,JUST TAKE A GANDER AT THE ASTERISKS.
199     T,COUNT THEM.
200     T,AND TRY AGAIN
201     G,140
202 141 T,@2 I'M GLAD TO SEE THAT YOU'RE ALERT
203     T,AND WIDE AWAKE.
204     G,143
205 142 T,@2 NO NO NO
206     T, IF YOU JUST WOULD HAVE COUNTED, YOU'D SEE THAT
207 143 T, THERE ARE IN FACT THREE PEOPLE SITTING ON THE COUNCIL.
208     T,@2 WHY THREE?
209     T,@2 WELL THAT'S ELEMENTARY, MY DEAR @N
210     T, YOU SEE WITH THREE PEOPLE ON THE COUNCIL,
211     T, THERE CANNOT POSSIBLY BE A TIE.
212     CO,IV30,144
213     RA,LAW,9000
214     IA,ZSARCH,1
215 144 T,@2 WOULD YOU LIKE TO KNOW HOW THE ARBITRATORS ARE
            CHOSEN?
216 145 A,YES,YEP,YAP,OK;148
217     A,NO,NOPE,NO SIR, NO WAY, NOT REALLY;147
218     U,O,146
219     T,A. SIMPLE YES OR NO WOULD DO.
220     T, PLEASE TRY AGAIN
221     G,145
```

222 146 T,@2 STILL MESSING AROUND, ARE YOU?
223 T, WELL I'LL TELL YOU ANYWAY
224 G,149
225 147 T,@2 ARE YOU SURE?
226 T, WELL YOU SAID IT, SO LET'S MOVE ON TO SOMETHING ELSE.
227 G,150
228 148 T,@2 OK IF YOU INSIST
229 149 T,@2 THE FIRST CHAIRMAN FORWARDS A COPY OF THE NOTICE (OF
230 T, GRIEVANCE) TO
231 T, 1) THE CORPORATION (THE UNION INVOLVED)
232 T, AND 2) THE FEDERATION AND GOVERNMENT
233 T, WHO APPOINT A PERSON OF THEIR CHOCE TO SIT ON THE
234 T, ARBITRATION COUNCIL. THEY MUST SUBMIT THESE NAMES
235 T, WITHIN 15 DAYS OF THE ENTRY OF THE CASE ON THE
ARBITRATION ROLL.
236 T,@2 THE FIRST CHAIRMAN, MR. LUCIEN BOUCHARD, APPOINTS
237 T, A THIRD PERSON (FROM A DETERMINED LIST) TO BE THE
238 T, CHAIRMAN HEARING THAT PARTICULAR CASE .
239 CO,IV30,150
240 RA,LAW,9000

APPENDIX D

Information Sheets Given to Students at Outset of Course

1. General Course Description
2. Operation of the Terminal

EDUCATION 411-592A

May we take this opportunity to welcome you to the start of your course in school law.

In this envelope you will find the following:

1. A general information sheet (you're reading it now!)
2. A sheet of instructions on the operation of the model 33 terminals.
3. A biographical data sheet.
4. A general questionnaire concerning your expectations toward computer-assisted instruction.
5. A copy of the California Psychological Inventory with an answer sheet.
6. A questionnaire concerning your attitude toward some given names.

*** It is essential that both questionnaires, the biographical data sheet and the California Psychological Inventory be filled out completely and be returned to Room 527(E) on or before September 20, 1974.

The answers given to these questionnaires will in no manner affect your grade in this course. Moreover, you can be assured that total anonymity will be preserved.

This is the first time that a course of this nature is being taught through the computer-assisted instruction method. We will use the data collected in evaluating and improving this course. IT WILL NOT BE USED FOR ANY OTHER PURPOSE!

When the required forms have been filled out and returned to Room 527(E), your student number will be registered on the computer and you will be ready to begin your course.

You will receive information concerning course content and grading procedures during your first lesson.

Please Take Note

1. You may take the required course at any time you wish.

WITH ONE EXCEPTION

YOU MAY TAKE ONLY ONE SESSION PER DAY!!!

The computer will keep your score automatically and should do so without error if only one session is taken per day.

If this regulation is not followed, and some of your scores are lost, you will be required to re-do the course in the second semester.

2. Computers do occasionally break down. To insure that you are given credit for your work, please keep all your printouts until you have been informed that your course is complete.

3. An information retrieval program is available. A number of short summaries of the laws and regulations concerning education in Quebec are listed.

   You may gain access to these during your computerized lessons by typing - @B - whenever a question mark appears. This is available only in the lesson section and not the quiz.

4. A reservation board will be found on the bulletin board in Room 533(E). Eight (8) of the ten (10) terminals can be used only when reserved. The remaining two are to be used on a first come, first served basis with one exception.

   When one of the 8 reserved terminals experiences mechanical problems, the persons who had reserved that terminal have priority in the use of the unreserved terminals.

   300-400 students will be using the terminals each week. USE THE RESERVATION SYSTEM and make your reservations early.

5. Last day to complete this course - Wed. Dec. 18, 1974.

OPERATING THE TERMINAL

Education Building, Room 533

Teletype Model 33 Terminals, Gandalf Data Set

HAVING RESERVED YOUR TERMINAL AHEAD OF TIME,
YOU PROCEED IN THE FOLLOWING MANNER:

1. Turn on the terminal by turning the switch (lower right front) to the left to "line".

2. Establish connection with the computer by switching the switch on the blue gandalf box (on the left side of the terminal) to the up position. A light appears.

   The machine then types

   *MCGILL - MUSIC, SIGN ON

3. You then type (exactly as shown)

   /ID TN,USER

   N.B. TN = the terminal number (found on the front of the terminal)
   USER = your computer identification code which you will find attached to this sheet -- the upper left corner

4. Hold down the control button (Ctrl) and type "Q" after each line. This will return the carriage to the starting position.

   The machine then types:

   PASSWORD?
   XXXXXXXX

5. Type in your password over the mask. Then type "Ctrl - Q" to reset the carriage.

   N.B. You will find the password under the USER's code.

   The machine then types

   *IN PROGRESS
   *SIGN ON MON SEP 16, 1974 TIME=11:36 PORT=05β RESTART=064
   *GO
   CANVI MCGILL UNIVERSITY

6. You may now proceed with your work.

***If you have any difficulty, contact J. Kolano, Rm. 527.

N.B. remember to type "crtl-Q" after each line.

APPENDIX E

Biographical Data Sheet

BIOGRAPHICAL DATA SHEET

Please fill in or check ( ) the appropriate information.

Name: _____
(Family) (Given) (Preferred Name)

Student Number: _____

Sex:

Male ( )

Female ( )

Marital Status:

Single ( )

Married ( )

Other ( )
Specify: _____

Educational Background:

	Diploma	Major-Honors	Institution	Year Graduated
High School				
College				
University				
Other				

Have you had any prior experience with computer-assisted instruction?

Yes ( )

No ( )

Have you had any prior experience studying/working with computers?

Yes ( )

No ( )

APPENDIX F

Sample Feedback Statements Used in the Personalized Program

1. For Correct Responses
2. For Incorrect Responses
3. For Unanticipated Responses

Feedback Statements for Correct Responses

Right on! You're really sharp, John!

That's the ticket!!!

You're darn right!

You bet!!!

But of course!!!

You and I are on the same wavelength!

Hey! The kid's a genius!!!

You and I agree!

Are you correct?
...Most certainly!!!

Great! Let's proceed.

Good for you, John!

That's for sure!

I see you're right!

Right choice, John!

You've done it again! Good!!!

That's it, John!

Right on! You're a winner!!!

** Right on **

Good show, John!

I couldn't have done better myself,...And I'm a computer!!!

You're a genius, John!

You'd better believe it!!!

Feedback Statements for Incorrect Responses

No! You're wrong, John!

Sorry, but you missed that one!

You could do better than that!

Not quite, John!

Sorry, John ...
You've made an error!

No sir, John!

Sorry, John!

Not a chance, John!

Nope, you're timing is off!

Almost, but not quite!

Not so, John!

You missed this one!

That's incorrect, John!

Nope ... you've got to try harder!

I think you muffed that one!

You and I don't agree!

You're off target!

C'est pas bon!

That doesn't look right to me.
You're wrong!

Feedback Statements for Unanticipated Responses

That doesn't make sense!

Want to try that again!

You must follow the instructions, John!

Should I repeat the instructions, John?

What happened that time?

You messed that one up, John! Try it again!

What did you do? You must ...

I'll repeat the instructions again, John!

I can only read your thoughts when you follow the instructions!

How about another try at that?

You messed that up! try again!!!

I missed that. Let's have a rerun!

Did you read my instructions carefully? Try it again.

What did you say? Remember, true or false only!

I still don't understand you!

Do you need some help?

What's up doc?

Was that a typing error?

You don't know the answer? Just say so!

What? All I wanted was a yes or no! Try it again, John!

APPENDIX G

Feedback Statements Used in the Depersonalized Program

Feedback Statements for Correct Responses

Correct

Feedback Statements for Incorrect Responses

Incorrect

Feedback Statements for Unanticipated Responses

What?

APPENDIX H

Mathis, Smith, and Hansen Attitude Scales

1. Form A - Pretest
2. Form B - Posttest

QUESTIONNAIRE ON COMPUTER-ASSISTED INSTRUCTION

INSTRUCTIONS

On the following pages, you will find statements on computer-assisted instruction.

Read each of the statements carefully and indicate your opinion on them according to the following scales:

1	2	3	4	5
Strongly Agree				Strongly Disagree

USE THE ANSWER SHEET PROVIDED - PLEASE USE AN HB PENCIL.

Circle the number representing your choice.

BE SURE TO ANSWER EVERY ITEM. Do not leave any blanks.

STATEMENTS

A. While taking computer-assisted instruction, I will feel challenged to do my best work.

B. I will be concerned that I may not be understanding the material.

C. I will not be concerned when I miss a question because no one will be watching me anyway.

D. While taking computer-assisted instruction, I will feel isolated and alone.

E. I will feel uncertain about my performance in the programmed course relative to the performance of others.

F. I will find myself just trying to get through the material rather than trying to learn.

G. I will know whether my answers will be correct or not before I will be told.

H. I will guess at the answers to the questions.

I. In a situation where I am trying to learn something, it is important to me to know where I stand relative to others.

J. As a result of studying some material by computer-assisted instruction, I will be interested in trying to find out more about the subject matter.

K. I will be more involved with running the machine than with understanding the material.

L. I will feel that I will be able to work at my own pace with computer-assisted instruction.

M. Computer-assisted instruction will make the learning too mechanical.

N. I will feel as though I had a private tutor while on computer-assisted instruction.

O. I will be aware of efforts to suit the material specifically to me.

P. I will find it difficult to concentrate on the course material because of the machinery.

Q. Questions will be asked which I will feel will not be relevant to the material presented.

R. Computer-assisted instruction will be an inefficient use of the student's time.

S. While on computer-assisted instruction, I expect to encounter mechanical malfunctions.

T. Computer-assisted instruction will make it possible for me to learn quickly.

U. I will feel frustrated by the computer-assisted instruction situation.

V. The computer-assisted instruction approach is inflexible.

W. No matter how interesting the material, it will be boring when presented by computer-assisted instruction.

X. In view of the effort I plan to put into it, I will be satisfied with what I will learn while taking computer-assisted-instruction.

Y. In view of the amount I should learn, I would say that computer-assisted instruction is superior to traditional instruction.

Z. With a course such as I am about to take, I would prefer computer-assisted instruction to the traditional method.

AA. I am not in favor of computer-assisted instruction because it is just another step toward the depersonalization of instruction.

BB. Computer-assisted instruction will be too fast.

CC. Typing experience will be necessary in order to perform easily on computer-assisted instruction.

DD. Computer-assisted instruction will be boring.

QUESTIONNAIRE ON COMPUTER-ASSISTED INSTRUCTION

Answer Sheet

	Strongly Agree				Strongly Agree
A	1	2	3	4	5
B	1	2	3	4	5
C	1	2	3	4	5
D	1	2	3	4	5
E	1	2	3	4	5
F	1	2	3	4	5
G	1	2	3	4	5
H	1	2	3	4	5
I	1	2	3	4	5
J	1	2	3	4	5
K	1	2	3	4	5
L	1	2	3	4	5
M	1	2	3	4	5
N	1	2	3	4	5
O	1	2	3	4	5
P	1	2	3	4	5
Q	1	2	3	4	5
R	1	2	3	4	5
S	1	2	3	4	5
T	1	2	3	4	5
U	1	2	3	4	5
V	1	2	3	4	5
X	1	2	3	4	5
Y	1	2	3	4	5
Z	1	2	3	4	5
AA	1	2	3	4	5
BB	1	2	3	4	5
CC	1	2	3	4	5
DD	1	2	3	4	5

NAME: _____

STUDENT NUMBER: _____

QUESTIONNAIRE ON COMPUTER-ASSISTED INSTRUCTION (2)

Instructions

On the following pages, you will find statements on computer-assisted instruction.

You answered similar questions at the beginning of this course. Now that you have had the experience of taking an entire course via CAI, you are asked again to read each of the statements carefully and indicate your opinion on them according to the following scale:

1	2	3	4	5
Strongly Agree				Strongly Disagree

USE THE ANSWER SHEET PROVIDED.

Circle the number representing your choice.

BE SURE TO ANSWER EVERY ITEM. Do not leave any blanks.

STATEMENTS

A. While taking Computer-Assisted Instruction I felt challenged to do my best work.

B. I was concerned that I might not be understanding the material.

C. I was not concerned when I missed a question because no one was watching me anyway.

D. While taking Computer-Assisted Instruction I felt isolated and alone.

E. I felt uncertain as to my performance in the programmed course relative to the performance of others.

F. I found myself just trying to get through the material rather than trying to learn.

G. I knew whether my answer was correct or not before I was told.

H. I guessed at the answers to questions.

I. In a situation where I am trying to learn something, it is important to me to know where I stand relative to others.

J. As a result of having studied some material by Computer-Assisted Instruction, I am interested in trying to find out more about the subject matter.

K. I was more involved in running the machine than in understanding the material.

L. I felt I could work at my own pace with Computer-Assisted Instruction.

M. Computer-Assisted Instruction makes the learning too mechanical.

N. I felt as if I had a private tutor while on Computer-Assisted Instruction.

O. I was aware of efforts to suit the material specifically to me.

P. I found it difficult to concentrate on the course material because of the hardware.

Q. Questions were asked which I felt were not relevant to the material presented.

R. Computer-Assisted Instruction is an inefficient use of the student's time.

S. While on Computer-Assisted Instruction I encountered mechanical malfunctions.

T. Computer-Assisted-Instruction made it possible for me to learn quickly.

U. I felt frustrated by the Computer-Assisted Instruction situation.

V. The Computer-Assisted Instruction Approach is inflexible.

W. Even otherwise interesting material would be boring when presented by Computer-Assisted Instruction.

X. In view of the effort I put into it, I was satisfied with what I learned while taking Computer-Assisted Instruction.

Y. In view of the amount I learned, I would say Computer-Assisted Instruction is superior to traditional instruction.

Z. With a course such as I took by Computer-Assisted Instruction I would prefer Computer-Assisted-Instruction to traditional instruction.

AA. I am not in favor of Computer-Assisted Instruction because it is just another step toward depersonalized instruction.

BB. Computer-Assisted Instruction is too fast.

CC. Typing experience is necessary in order to perform easily on Computer-Assisted Instruction.

DD. Computer-Assisted Instruction is boring.

STUDENT NO. .....

Please enter your final grade and return all sheets to Room 527. Upon doing this, full credit will be given for this course.

Circle your code:

IB01 IB08

If you have any additional comments please use this space to write them down. Objective questionnaires are fine but nothing replaces your personal opinion. Please describe your experiences with Computer-Assisted-Instruction.