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## Development and Assessment of a Computer-Managed Instruction System for Self-Paced Training Programs

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DEVELOPMENT AND ASSESSMENT OF  
A COMPUTER-MANAGED INSTRUCTION SYSTEM  
FOR SELF-PACED TRAINING PROGRAMS

BY

MARC F. ELLIS

A Thesis Submitted to the Faculty of the Graduate School  
of Loyola University of Chicago in Partial Fulfillment  
of the Requirements for the Degree of

Master of Arts

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1986

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## VITA

The author, Marc F. Ellis, was born May 15, 1933 in Boston, Massachusetts.

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## CHAPTER 1

### INTRODUCTION

#### Background

The investigator is a developer of training programs for USG Corporation, a major manufacturer of construction materials and allied products. The proposed research problems have arisen from certain difficulties in the administration of USG Corporation's sales training courses.

The Corporation now has in use over 30 such courses covering all major product lines. These courses are intended for new Sales Representatives as well as experienced Sales Representatives taking on new product lines. The programs are generally print-oriented, with reinforcement via videotape and audiotape. Instruction is individualized and administered with a minimum of supervision.

Sales Representatives take the courses through a nationwide learning center network. The learning centers are located at major sales offices and manufacturing facilities. Each learning center contains videotape and



audiotape playback equipment as well as all necessary course materials.

Though the courses themselves are both comprehensive and well-designed, course utilization has been disappointing. The problem stems from the fact that economics do not permit the use of full-time training supervision in the field. This means that course-completion and test-score records are inadequate. As a result, many trainees now give the programs only perfunctory attention.

It appears that one way to increase trainee commitment to the course material might be to computerize the training. Through computer interaction, the trainee could receive individual attention and supervision. The computer could also make it possible to maintain a centralized electronic record of each trainee's progress and achievement. Both of these features would certainly encourage course participants to take their work more seriously.

Because of economic constraints, the Company would probably adopt a computer-managed instruction (CMI) format rather than a computer-assisted instruction (CAI) format. In other words, existing audio-visual and text teaching materials would remain unchanged while administrative instructions, course tracking information and review examinations would be given via computer. At the same time, the computer would automatically maintain a record of the trainee's progress and achievement.

In the current course format, administrative instructions and review examinations are provided via a printed study guide. To implement the plan just described, then, the printed guide would be replaced with a computerized version. This computerized guide should be relatively inexpensive to develop and administer.

### The Problems

Before implementing full-scale conversion to computerized study guides, USG Corporation would like to have the answers to two key questions -- which are the problems to be addressed in this study:

- (1) Would trainees be resistant to the introduction of a computerized study guide as described?
- (2) Would switching to a computerized study guide as described adversely affect trainee performance in the sales training programs?

The following chapter reviews current literature relevant to the proposed research problems.

## CHAPTER 2

### REVIEW OF THE LITERATURE

#### Introduction

Many studies have been designed to assess attitudinal effects on students learning via CMI. Those appropriate to the current investigation have focused on:

- (1) determining the effect of exposure to CMI on learner attitudes towards working with computers.
- (2) determining how such attitude changes might, in turn, affect attitude towards the content being studied.

CMI testing strategies studied in recent literature focus on the type of feedback presented after the student answers a test item. The completeness of the information given, the timing of it, the degree of personalization and "friendliness" and the response expected of the student have all been shown to affect subsequent student retention of test content.

### Literature Concerned With Assessing Attitudinal Effects

As part of an investigation on instructional strategies for CMI, Lawler and others (1972) administered an instrument designed to provide data on attitude towards content being studied (college level health education). They found no significant difference among treatment groups -- which included a control group taking the course conventionally and three groups exposed to various CMI strategies.

Cartwright and Derevensky (1975) reported an attitudinal study based in part on the work of Bundy (1968), Mathis and others (1970), and Goodman (1968). Bundy had shown that student attitudes towards specific methods of learning are highly correlated with achievement; Goodman had suggested that attitudes towards CAI might be modified by exposure to particular programs and systems; Mathis and others had concluded that exposure to CAI produced positive attitudes towards CAI as a learning method.

Cartwright and Derevensky worked with six sections of an introductory educational psychology course. In three of the sections, all quizzes and exams were given by computer; in the other three, quizzes and exams were conducted in the traditional manner. Students taking the computer quizzes and exams were given immediate feedback

on the correctness of each response.

A teaching methods questionnaire administered at the end of the year showed that:

- (1) The computer sections scored significantly higher than the non-computer sections on scales measuring both attitudes towards computer-assisted instruction and attitudes towards course lectures. The latter result was a surprise to the investigators, and has been interpreted (Barnett, 1974) as a result of students perceiving the instructors who initiated the computer quizzes as better lecturers. The result might also stem from enhanced feelings of achievement expressed by those in the computer sections.
- (2) an analysis of general comments solicited from the students showed that those in computer sections perceived the computer quizzes as being more of a learning than an evaluation experience.

Wooley (1978) investigated attitudes towards CAI as a part of a study aimed at developing three different types of CAI strategy for use in a college-level astronomy course. In his article, Wooley reviewed the reports of Gilman (1969) and Lawler (1972 - as quoted earlier in this

review) -- both of which suggest that variations in CAI strategies do not result in significant attitude variations. Wooley also reported on the work of Judd (1973), who surveyed attitudes of students who had taken a computer-assisted survey course in special education. A neutral score on Judd's instrument was 189, and results ranged from a slightly negative feeling (181) to a very positive one (294). The mean was 241. Wooley also reported on the work of Culp and Lagowski (1971), who obtained very favorable attitudinal responses from students in a computer-assisted organic chemistry course.

Wooley's results supported those of Gilman and Lawler in that student attitudes towards CAI seemed independent of the CAI strategy used. He also found that females scored significantly lower than males in both course achievement and CAI attitude measures. Judging by the responses on the CAI instrument, the negative attitude towards CAI expressed by females is related to what they perceive as the mechanical and impersonal nature of computerized testing.

In a very elegant and thorough study (Steffenson and others, 1982), the attitudes of 64 students enrolled in an introductory biology course utilizing CMI were surveyed. In part, these investigations were concerned with verifying the work of Hausmer and Henderson (1972), who felt that students using CMI tended to view their

instructors as coaches rather than adversaries. The two also found that student anxiety levels in regard to CMI testing were much lower than towards conventional testing. Among the other authors supporting this point of view and quoted by Steffenson et al are Cartwright and Derevensky (1975 -- reviewed earlier in this section) and Torop (1975).

An attitudinal pre-test administered to 64 students consisted of ten questions not requiring a priori knowledge of the CMI experience. The post-test, administered at the end of the course, contained the same ten questions plus thirty additional ones. Twenty of these attempted to measure students' feeling about the CMI experience. The other ten items attempted to ascertain students' attitude towards the computer instructional facilities and operations at the university (South Dakota State) where the study was carried out.

From the overall results of the pre-test and post-test attitudes of students towards CMI, it was apparent that the subjects had demonstrated a significant positive growth in their attitudes towards the CMI method. An analysis of responses to specific test items showed that the subjects did not feel that CMI made learning too mechanical or impersonal. On the other hand they did feel, very strongly, that CMI provided both a testing and a learning experience.

### Literature Concerned With CMI Testing Strategies

Lawler and others (1972 -- see previous section of this review) studied three types of strategies for CMI testing. They found that one strategy was significantly best as indicated by comparing achievements in a final exam on course content. This strategy (called by the authors "Remedial Prescription -- forced Mastery") involved:

- (1) giving students who failed a particular quiz a remedial prescription keyed to the failed objectives.
- (2) requiring such students to reschedule terminal time to retake that particular quiz.
- (3) not allowing these students to take other quizzes (related to other course modules) before passing the failed quiz.

As has already been outlined in the previous section of this review, Cartwright and Derevensky (1975) noted very positive student reaction to a CMI testing method giving immediate item-by-item feedback on the correctness of each test response. In addition to this information, students could request a feedback paragraph telling what the correct response was and why it was correct, as well as the reasons alternative selections were not correct. The paragraph also gave information on source material to be reviewed for information relating to



the test items. This test strategy was based on B.F. Skinner's (1968) argument that the student should have immediate knowledge of test results.

An interesting sidelight on CAI strategy was explored by Lippold (1977). He investigated the effects of "personalization, encouragement and humor" of CAI responses on student attitude and subsequent performance. Lippold developed two CAI programs for his study. The first, or control, program was an interactive drill-and-practice unit in general psychology. The second program was identical to the first except that it was personalized by making frequent referral to the subject's name during the course of the instruction. The second program also contained many comments designed to be encouraging and humorous.

A sample of 61 male and female undergraduate students was randomly assigned to the two program groups. The results of a pre- and post-test showed no significant difference in relative attitude change between the groups. The control group, however, did significantly better on a test of program content -- indicating that the inclusion of personalization, encouragement and humor had a negative effect on the experimental group's recall learning.

In the 1978 article mentioned in the previous section of this review, Wooley based his study of CAI

strategies on the work of Brown (1967) and Gilman (1969).

Brown listed the following options for test item feedback:

- (1) no feedback
- (2) "wrong" if response is incorrect
- (3) "correct" if response is correct
- (4) statement containing the correct response
- (5) statement of why the response is correct
- (6) statement of why the response is incorrect
- (7) repeat question if response is incorrect
- (8) repeat all questions missed until all questions are answered correctly.

Gilman considered a set of options similar to Brown's as follows:

- (A) no feedback (like Brown's #1)
- (B) knowledge of results (like Brown's #2 and #3)
- (C) knowledge of correct response (like Brown's #4)
- (D) response contingent (like Brown's #5 and #6)
- (E) combination of knowledge of results, knowledge of correct response and response contingent feedback (not one of Brown's options).

Gilman tested the effects of his feedback options

on the rate of learning retention, and students' attitude towards instruction, on a CAI program for teaching science concepts. He found that feedback types (C), (D) and (E) -- which guided the learners to the correct response -- were conclusively better than types (A) and (B), which forced the learner to "discover" the correct response.

In Wooley's study, which included two treatment groups and a control group, the treatment subjects were given feedback equivalent to Gilman's type (B) and type (E). No significant difference was found in the performance of the subjects of these two groups, and thus Gilman's findings were not supported.

Many programs for computer-assisted instruction are based on the premise that immediate feedback of the correct response is necessary for learning to occur. However, many authors during the period 1966-1972 showed that delays of 24 or 48 hours in presenting feedback resulted in enhanced retention of the material one to seven days later. In every case, the conditions under which the effect was found were as follows:

- (A) The learning tested was academic material.
- (B) The initial test and informative feedback were presented in a multiple choice format.
- (C) There was only one presentation of informative feedback.

(D) The retention test consisted of the same items as the initial test.

In a study confirming these findings, Sturges (1978) worked with four groups of undergraduate child psychology students. These groups were given, respectively, no feedback (control group), 2-second feedback delay, 20-minute delay, and 24-hour delay. Sturges noted that the 20-minute delay group exhibited about the same enhanced retentivity as the 24-hour delay group. In a similar study (Rankin and Trepper, 1978) the following treatment groups were compared:

- (1) immediate feedback presented after each response.
- (2) feedback presented 15 seconds after each response
- (3) feedback presented only after all test items were completed

Groups (2) and (3) showed significantly greater retentivity than group 1; there was no significant difference in retentivity exhibited by groups (2) and (3).

### Conclusions

A review of this literature led the investigator to believe that learner attitude towards a training program being studied would become more positive, or at least remain unchanged, after exposure to CMI (see,

especially, Lawler and others, 1972; Wooley, 1978). It further appeared that positive attitude change could be maximized if the learner perceived the computer test as a helpful coaching procedure rather than a cold-blooded evaluation. (Cartwright and Derevensky, 1975; Steffenson and others, 1982). However, computer responses that are over-friendly or humorous (Lippold, 1977) might adversely affect recall learning.

The literature also suggests that student performance is not degraded by CMI, and can be improved by proper design of computer responses (feedback) presented during interactive testing. Studies analyzing effects of completeness of feedback have been contradictory (Wooley, 1978). However, Lawler and others (1972) have shown that achievement in CMI programs is improved if the student is given diagnostic information and required to master every quiz before proceeding with other course units. Sturges (1978) and Rankin and Trepper (1978) report that retention of course material can be significantly enhanced by delaying computer feedback.

The following chapter will show how the present study was designed to test some of these ideas and answer the questions posed at the end of Chapter 1.

## CHAPTER 3

### RESEARCH DESIGN

#### Research Questions

Based on the problems posed at the end of Chapter 1, and the results reported by previous investigators, it was decided to address the following research questions:

- 1 (a) Do learners in self-study sales training programs better retain course material when working with printed study guides containing pencil-and-paper self-testing exercises, or when working with computerized study guides incorporating simple CMI procedures?
- (b) What is the effect, on attitude towards CMI, of working with computerized study guides incorporating simple CMI procedures?
2. How would the results obtained from investigation (1) be changed if the simple CMI procedures were enhanced using some of the techniques described in academic literature?

### Definition of Terms

In this study, the term CMI (computer-managed instruction) refers to instructional programs containing self-testing exercises of one of the two following types: nominal computer testing or enhanced Computer testing. Both of these types of testing are fully described in the "Instrumentation" section of this chapter. Retention of course material is measured by the results of a paper-and-pencil examination taken one week after completion of the experimental instruction. Attitude towards CMI is defined as relative performance on a specified attitude test. (See "Instrumentation" section.)

### Hypotheses

The following null hypotheses were formulated for use in studying the research questions previously described:

1. The experience of taking nominal computer tests has no significant effect on the learner's attitude towards CMI.
2. The experience of taking enhanced computer tests has no significant effect on the learner's attitude towards CMI.
3. There is no significant difference in retention of course material between learners who have taken pen-and-pencil tests and

- learners who have taken nominal computer tests.
4. There is no significant difference in retention of course material between learners who have taken pencil-and-paper tests and learners who have taken enhanced computer tests.
  5. There is no significant difference in retention of course material between learners who have taken nominal computer tests and learners who have taken enhanced computer tests.

### Subjects

It was decided to confine the study to subjects typical of entry-level participants in industrial sales training programs. But it was not possible to obtain the required forty-five subjects from the population of newly-hired Sales Representatives at USG Corporation. There were simply not enough such individuals in any one place at any one time. Instead, volunteer subjects were obtained from the first- and second-year classes at the J.L. Kellogg Graduate School of Management of Northwestern University (Evanston, IL). It is not unusual for entry-level Sales Representatives in large industrial organizations to have an advanced business background, and it was judged that the Kellogg students would not be too different in attitudes, interests and maturity from such new hires.



### Experimental Procedure

The 45 experimental subjects were randomly assigned to three groups of 15 each -- Group 1, Group 2, and Group 3. Each member of each group studied the same excerpt from a USG Corporation course used in the training of Inside Sales Representatives. As is standard for USG training programs, the excerpt contained print, video and audio segments. The excerpt required a study time of between two and three hours, and included two self-testing exercises.

The self-testing exercises used by each group varied. All contained the same set of multiple choice questions. However, the Group 1 set were in standard pencil-and-paper form; the Group 2 set were in nominal computer form; the Group 3 set were in enhanced computer form. (See "Instrumentation" section for descriptions of nominal and enhanced computer tests.) The three self-test variations are the independent variables of this investigation.

Just prior to beginning study of the training program, members of Group 2 and Group 3 were asked to take a pretest measuring attitude towards CMI. Just after completing the training program, members of Group 2 and Group 3 took a posttest form of the same instrument. At the conclusion of the test sessions, each participant

was informally interviewed by the investigator and encouraged to freely express his/her reactions to the study and test materials.

One week after finishing the training program, each subject was mailed an identical "retention test" for completion at home and instructed to mail it back within 24 hours. This paper-and-pencil test contained the same set of multiple-choice questions used in the original self-test exercises. The retention test scores and attitude change scores are the dependent variables of the study.

#### Instrumentation

The paper-and-paper self-test exercises used by Group 1 during the treatment sessions (and by all groups as a retention test) were slightly modified versions of the standard USG Corporation instruments. The modification consisted of making all questions conform to a multiple-choice format -- thus making them easily convertible to the computerized versions required for Group 2 and Group 3. As is typical for USG Corporation self-test exercises, the correct answers to all questions were printed in the back of the test booklet.

The nominal computer self-test exercises used by Group 2 were designed to give the learner immediate feedback on each test response. Just as with the

pencil-and-paper exercises, however, the feedback concerned only the correctness of the responses. The correct answer was supplied when the learner gave an incorrect response, but no further information was provided. The "correct" and "incorrect" feedback messages were brief and never varied; only one form of each was used. The learner was allowed to proceed to the next test item whether or not he/she had answered correctly.

The enhanced computer self-test exercises used by Group 3 were designed to incorporate some of the features reported in the literature as enhancing student performance. Feedback messages were deliberately delayed for several seconds after each response. The messages were given in informal, conversational style and occasionally referred to the learner by name.

In the enhanced exercises, if repeated wrong answers to a test item were given, the learner was prompted twice to rethink the response and try again. Information on where to look in the course for the correct answer was given at the second prompt. Only after the third unsuccessful attempt at answering the question was the correct answer supplied and the learner allowed to move to the next test item. The feedback messages in response to right or wrong answers were varied in style.

The multiple-choice question set used for these exercises, as well as the computer feedback messages for

both nominal and enhanced test styles, are given in the Appendix at the end of this study.

All computer self-test exercises were prepared by the investigator on a Commodore 64 computer using the authoring language "Pilot." The computer is an inexpensive home model and the language is one designed for the preparation of interactive learning materials by computer lay people. These choices were made, in part, to determine whether computer tests for USG Corporation training programs could be developed using inexpensive equipment and by non-professional personnel.

The same computer was used to administer the self-test exercises. However, to avoid the necessity for orienting the subjects to the computer keyboard, and to avoid experimental errors caused by differences in keyboard skills, a simplified response system was used. During the test sessions, the keyboard was kept covered, and the student entered test responses via a small, separate keypad.

The keypad contained a small number of alphabetically labeled keys, an "ENTER" key, and a key labeled "?." The subject simply pressed the key corresponding to the letter of the selected answer, then pressed the "ENTER" key. The subject had the option of changing his/her answer by pressing the "?" key prior to pressing "ENTER." This cleared the original selection so

that a new one could be made.

The instrument measuring student attitude towards computer-managed testing (both pretest and posttest forms) was derived from similar tests used by Steffenson and others (1982), Hagerty (1970) and Brown (1967). In most test items, the subject was asked to indicate -- on a 5-point scale -- the degree of his agreement, or disagreement, with a particular attitudinal statement. Informal questions were added at the end of each test to get a general idea of the subject's previous experience with computers (pretest) and to solicit reactions to procedures used in this study (posttest). The posttest contained the same ten formal questions used in the pretest, and also contained thirty additional ones designed to elicit responses concerning the specific study environment and method of testing. Both pretest and posttest forms will be found in the Appendix at the end of this study.

### Statistical Analysis

To test hypotheses 1 and 2, which are concerned with the effect of the test-taking experience on the learner's attitude towards CMI, the investigator studied pretest-posttest changes in the subjects' responses to the first ten questions in the attitude assessment instrument. Separate t-tests (of hypothesis about two

dependent means) were run to determine statistical significance of the change scores on each test question for each of the two groups tested (Group 2 and Group 3). The results for Group 2 (nominal computer testees) were used to assess hypothesis 1; the results for Group 3 (enhanced computer testees) were used to assess hypothesis 2.

Scores on the remaining 30 formal questions in the attitude instrument (which appeared on the posttest only) were simply averaged on a question-by-question basis for each of the two groups tested (Group 2 and Group 3). These averages were then used (in conjunction with the informal questions asked on the pretest and posttest) to make qualitative judgements concerning the attitudes of each group towards the learning and testing experiences.

Separate t-tests (of hypothesis about two independent means) were used to determine statistical significance of difference between retention test scores of Group 1 and Group 2 (to assess hypothesis 3); between the retention test scores of Group 1 and Group 3 (to assess hypothesis 4); and between the retention test scores of Group 2 and Group 3 (to assess hypothesis 5).

The following chapter will present the results obtained from analysis of the data obtained in this study.

## CHAPTER 4

### RESULTS

#### Pretest-Posttest Attitude Change

Following are the ten questions that appeared both on the pretest and the posttest versions of the attitude evaluation instrument:

1. In a situation where I am trying to learn, it is important to me to know where I stand in relation to others.
2. I feel perfectly comfortable about answering test questions by pressing buttons on a computer.
3. Being tested and evaluated by computer makes me feel that no one really cares whether I learn.
4. I am concerned that I might not understand the material presented by computer.
5. I am concerned that computer-managed testing might make learning too mechanical.
6. The mechanics of working with the computer might be more difficult than learning the material presented.

7. I like to know immediately whether or not my answers to test questions are correct.
8. I feel that I can work satisfactorily at my own pace with computer-managed testing.
9. Computer-managed testing will make me feel isolated and alone during part of the course.
10. Computer-managed testing will use a student's time more effectively.

As is apparent, these questions were designed to determine if the subject felt that being tested by computer might be too impersonal (questions 1,3,5,9), was concerned about the mechanics of interacting with a computer (questions 2, 4, 6), and agreed that the computer might be helpful in the testing process (7,8,10).

For each question, the subject was asked to indicate degree of agreement/disagreement by circling one of the responses on the following Likert-type scale:

|          |          |           |       |          |
|----------|----------|-----------|-------|----------|
| strongly | disagree | uncertain | agree | strongly |
| disagree |          |           |       | agree    |
| 1        | 2        | 3         | 4     | 5        |

The numbers below the responses did not appear on the question sheet, but were assigned as indicated in order to carry out the statistical analyses summarized on the following pages.



TABLE 1  
ANALYSIS OF PRETEST-POSTTEST RESPONSES TO  
ATTITUDE EVALUATION QUESTIONS 1 THROUGH 10

Experimental Group 2 -- nominal computer  
n = 15

| Question | $\bar{X}$ | $\bar{Y}$ | $\bar{D}$ | $S_D$ | $t_D$ |
|----------|-----------|-----------|-----------|-------|-------|
| 1        | 3.40      | 3.20      | .20       | .41   | 1.82  |
| 2        | 4.80      | 4.53      | .27       | .59   | 1.80  |
| 3        | 1.67      | 1.80      | -.13      | .52   | -1.00 |
| 4        | 1.80      | 1.93      | 0         | .76   | 0     |
| 5        | 2.27      | 2.13      | .13       | .83   | .72   |
| 6        | 1.40      | 1.33      | .07       | .26   | 1.00  |
| 7        | 3.60      | 4.07      | -.47      | .92   | -1.96 |
| 8        | 4.27      | 4.60      | -.33      | .72   | -1.74 |
| 9        | 1.80      | 2.00      | -.20      | .77   | -1.00 |
| 10       | 3.67      | 3.80      | -.20      | .41   | -1.82 |

$\bar{X}$ =mean of pretest responses

$\bar{Y}$ =mean of posttest responses

$\bar{D}$ =mean of difference (X-Y) scores

$S_D$ =standard deviation of difference (X-Y) scores

$t_D$ =result of t-test on mean of difference scores

$t_{crit}$ =2.145 for 5% significance level

$t_{crit}$ =2.977 for 1% significance level

TABLE 2  
ANALYSIS OF PRETEST-POSTTEST RESPONSES TO  
ATTITUDE EVALUATION QUESTIONS 1 THROUGH 10

Experimental Group 3 -- enhanced computer  
n = 15

| Question | $\bar{X}$ | $\bar{Y}$ | $\bar{D}$ | $S_D$ | $t_D$  |
|----------|-----------|-----------|-----------|-------|--------|
| 1        | 3.47      | 3.27      | .20       | .68   | 1.11   |
| 2        | 4.33      | 4.47      | 0         | .38   | 0      |
| 3        | 1.93      | 1.87      | 0         | .65   | 0      |
| 4        | 2.13      | 2.00      | .13       | .88   | .57    |
| 5        | 2.47      | 2.60      | -.13      | .49   | -1.00  |
| 6        | 1.80      | 1.60      | .20       | .49   | 1.54   |
| 7        | 3.33      | 4.07      | -.73      | .96   | -2.92* |
| 8        | 4.33      | 4.40      | -.07      | .46   | -.58   |
| 9        | 2.27      | 2.20      | .07       | .46   | .58    |
| 10       | 3.73      | 3.93      | -.20      | .56   | -1.43  |

$\bar{X}$ =mean of pretest responses

$\bar{Y}$ =mean of posttest responses

$\bar{D}$ =mean of difference (X-Y) scores

$S_D$ =standard deviation of difference (X-Y) scores

$t_D$ =result of t-test on mean of difference scores

$t_{crit}$ =2.145 for 5% significance level

$t_{crit}$ =2.977 for 1% significance level

A study of the pretest score means suggests a similar attitudinal profile for both experimental groups. In both cases, there is definite agreement with the statements of questions 2, 8, and 10 and definite disagreement with the statements of questions 3, 4, 6, and 9. This suggests that both groups were at home with computers and had positive feelings about their usefulness as an aid to learning. In the case of the remaining three questions, response for both groups was in the uncertain range.

The t test results for pretest-posttest attitude score differences showed statistically significant change in only one case. This was question seven as answered by Group 3 -- where the t value indicates an increase in agreement with the statement that is significant at the 5% level (and is very close to being significant at the 1% level). The t test for the same question as answered by Group 2 also showed an increase in agreement. Though not quite statistically significant, the increase represented the greatest attitude change in the question set.

Based on the results of the t-tests, Hypothesis 1, "The experience of taking nominal computer tests has no significant effect on the learner's attitude towards CMI," must be accepted for all ten of the questions studied. Hypothesis 2, "The experience of taking enhanced computer

tests has no significant effect on the learner's attitude towards CMI," must be accepted for all questions but 7. For question 7, the hypothesis is rejected because of an attitude change (increase in agreement) significant at the 5% level. While not being able to reject Hypothesis 1 for question 7, it's certainly worth noting that the increase in agreement was almost significant at the 5% level.

#### Responses To Remaining Posttest Questions

The remaining 30 post-test items are direct questions concerning the subjects' reactions to participation in the study. Thus, there are no matching pretest questions and no change scores. As in the case of the test items already discussed, each question consists of a statement to which the subject is asked to respond on a 5-point, Likert-type scale. Three different variations of this response scale are used.

The following three tables summarize the subjects' responses to the questions. For ease in analyzing the results, each table contains the statements associated with a particular response scale. The statements are abbreviated here for presentation in tabular form. For the complete statements, see the posttest instrument itself, which is reprinted in its entirety in the Appendix at the end of this study.

TABLE 3  
SUMMARY OF ANSWERS TO QUESTIONS  
USING THE FOLLOWING RESPONSE SET  
(numerical value assigned shown below each response)

See APPENDIX For Complete Summary Of Statistics

|          | strongly<br>disagree  | disagree | uncertain | agree | strongly<br>agree |           |
|----------|---|----------|-----------|-------|-------------------|-----------|
|          | 1   | 2        | 3         | 4     | 5                 |           |
| Question | Statement (abbreviated)                                       |          |           |       | $\bar{X}$         | $\bar{Y}$ |
| 11       | felt challenged to do my best work                            |          |           |       | 3.47              | 3.73      |
| 12       | no one cared if I learned or not                              |          |           |       | 1.67              | 1.93      |
| 13       | computer response became monotonous                           |          |           |       | 2.40              | 2.60      |
| 14       | didn't mind missing questions<br>because no one was looking   |          |           |       | 2.80              | 3.07      |
| 20       | was encouraged by responses given<br>to my answers            |          |           |       | 3.47              | 3.60      |
| 21       | am now interested in finding out<br>more about subject matter |          |           |       | 3.73              | 3.53      |
| 24       | learning was too mechanical                                   |          |           |       | 1.80              | 2.27      |
| 25       | felt as if I had a private tutor                              |          |           |       | 3.33              | 3.00      |
| 26       | testing made me feel quite tense                              |          |           |       | 1.60              | 1.80      |
| 27       | computer instruction uses<br>student's time inefficiently     |          |           |       | 2.33              | 2.60      |
| 31       | computer testing made it<br>possible to learn quickly         |          |           |       | 3.93              | 3.80      |
| 32       | felt frustrated by computer testing                           |          |           |       | 2.00              | 1.93      |

$\bar{X}$  = mean response for Group 2 (nominal computer)  
 $\bar{Y}$  = mean response for group 3 (enhanced computer)

(continued on next page)

TABLE 3 (CONTINUED)

|          | strongly disagree   | disagree | uncertain | agree | strongly agree |           |
|----------|---|----------|-----------|-------|----------------|-----------|
|          | 1   | 2        | 3         | 4     | 5              |           |
| Question | Statement (abbreviated)   |          |           |       | $\bar{X}$      | $\bar{Y}$ |
| 33       | even interesting material would be boring when presented through computer testing |          |           |       | 1.80           | 1.93      |
| 34       | was satisfied with what I learned with help of the computer                       |          |           |       | 3.73           | 3.87      |
| 35       | computer testing teaches more than conventional testing                           |          |           |       | 3.73           | 3.53      |
| 36       | computer testing is too depersonalized  |          |           |       | 1.87           | 2.07      |
| 37       | computer testing enhances learning  |          |           |       | 3.80           | 3.73      |
| 38       | computer operating instructions were clear  |          |           |       | 4.47           | 4.40      |
| 39       | it was easy to read the screen  |          |           |       | 4.53           | 4.47      |
| 40       | it was easy to change incorrect answers   |          |           |       | 4.00           | 4.53      |

$\bar{X}$  = mean response for Group 2 (nominal computer)

$\bar{Y}$  = mean response for group 3 (enhanced computer)

TABLE 4  
 SUMMARY OF ANSWERS TO QUESTIONS  
 USING THE FOLLOWING RESPONSE SET  
 (numerical value assigned shown below each response)

See APPENDIX For Complete Summary Of Statistics

|          | all<br>the time  | most of<br>the time | some of<br>the time | only<br>occasionally | never     |           |
|----------|--|---------------------|---------------------|----------------------|-----------|-----------|
|          | 5  | 4                   | 3                   | 2                    | 1         |           |
| Question | Statement (abbreviated)  |                     |                     |                      | $\bar{X}$ | $\bar{Y}$ |
| 15       | felt as if someone were engaged<br>in conversation with me                   |                     |                     |                      | 2.87      | 2.67      |
| 16       | responses to my answers<br>seemed appropriate                                |                     |                     |                      | 3.87      | 3.87      |
| 17       | found myself trying just to get<br>through the material rather<br>than learn |                     |                     |                      | 1.87      | 1.93      |
| 22       | the hardware interfered with<br>my concentration                             |                     |                     |                      | 1.07      | 1.33      |
| 23       | was more involved with running the<br>equipment than with studying           |                     |                     |                      | 1.00      | 1.13      |

$\bar{X}$  = mean response for Group 2 (nominal computer)

$\bar{Y}$  = mean response for group 3 (enhanced computer)

TABLE 5  
SUMMARY OF ANSWERS TO QUESTIONS  
USING THE FOLLOWING RESPONSE SET  
(numerical value assigned shown below each response)

See APPENDIX For Complete Summary Of Statistics

|          | quite<br>often  | often | occasionally | seldom | very<br>seldom |           |
|----------|---|-------|--------------|--------|----------------|-----------|
|          | 5   | 4     | 3            | 2      | 1              |           |
| Question | Statement (abbreviated)   |       |              |        | $\bar{X}$      | $\bar{Y}$ |
| 18       | I knew if answers were correct before I was told                |       |              |        | 4.27           | 4.40      |
| 19       | I guessed at answers to questions                               |       |              |        | 1.73           | 1.87      |
| 28       | I put in wrong answers to get information from the machine      |       |              |        | 1.07           | 1.20      |
| 29       | I was given answers, but still did not understand the questions |       |              |        | 1.33           | 1.27      |
| 30       | during testing, I encountered mechanical malfunctions           |       |              |        | 1.00           | 1.20      |

$\bar{X}$  = mean response for Group 2 (nominal computer)

$\bar{Y}$  = mean response for group 3 (enhanced computer)

Once again, the attitudes expressed by Group 2 closely paralleled those expressed by Group 3, with the response means being quite similar for each question.

As a whole, the students did not feel that learning was too impersonal or mechanical (questions 12, 13, 24, 33, 36) and had no trouble interacting with the computer (questions 16, 17, 18, 19, 26, 27, 28, 29, 32)





or working with the hardware (questions 22, 23, 30, 38, 39, 40). Responses to frankly positive statements about computer testing were more guarded, but still generally in agreement (questions 11, 20, 21, 25, 31, 34, 35, 37). Where disagreement was indicated, it was not very strong (questions 14 and 15).

Both Group 1 and Group 2, then, were at home with the computer and did not see it as a threat or as an impediment to learning. While not willing to wholeheartedly endorse the computer as a learning aid, most could perceive beneficial effects.

#### Retention Of Course Material

The following two tables summarize the results of the retention test for all three experimental groups. While it is obvious by inspection that there are no significant differences between the mean scores reported in Table 6, differences between the means were also studied by means of t-tests. The results of these tests are reported in Table 7.

TABLE 6  
RESULTS OF RETENTION TEST  
FOR ALL THREE EXPERIMENTAL GROUPS

|                            | <u>Group 1</u><br>(paper & pencil) | <u>Group 2</u><br>(nominal computer) | <u>Group 3</u><br>(enhanced computer) |
|----------------------------|------------------------------------|--------------------------------------|---------------------------------------|
| mean score                 | 83.3                               | 85.7                                 | 83.0                                  |
| median score               | 88.8                               | 85.5                                 | 82.5                                  |
| standard deviation of mean | 10.3                               | 7.8                                  | 10.3                                  |

TABLE 7  
RESULTS OF t-TESTS BETWEEN MEAN SCORES  
OF ALL EXPERIMENTAL GROUPS

|                 | <u>Group 1</u><br>(paper & pencil) | <u>Group 2</u><br>(nominal computer) | <u>Group 3</u><br>(enhanced computer) |
|-----------------|------------------------------------|--------------------------------------|---------------------------------------|
| $t(1,2) = -.70$ | $t(1,3) = .08$                     | $t(2,3) = .79$                       |                                       |

$t_{crit} = 2.048$  for 5% significance level

$t_{crit} = 2.763$  for 1% significance level

The results of table 7 verify that there is no significant difference between the means of Groups 1 and 2, Groups 1 and 3, or Groups 2 and 3. This requires acceptance of the last three hypotheses to be tested. (Hypothesis 3, "There is no significant difference in

retention of course material between learners who have taken pen-and-pencil tests and learners who have taken nominal computer tests."; Hypothesis 4, "There is no significant difference in retention of course material between learners who have taken pen-and-pencil computer tests and learners who have taken enhanced computer tests."; Hypothesis 5, "There is no significant difference in retention of course material between learners who have taken nominal computer tests and learners who have taken enhanced computer tests.")

#### Response To Informal Questions

A group of informal questions concerning previous experience with computers was included at the end of the attitude evaluation Pretest. The results of these showed that 14 of the 15 participants in Group 2 (nominal computer testees) and 13 of the 15 participants in Group 3 (enhanced computer testees) had some prior experience with computers -- usually through use of word processing and financial analysis programs in connection with school assignments. Seven of the participants in Group 2 actually had prior experience in taking computerized tests, as did three of the participants in Group 3.

A blank area at the end of the posttest was provided for the participant to write down any comments

he/she might like to express concerning the procedures used in the study. Prior to leaving the test room, each participant was also informally interviewed and invited to discuss his/her reactions. At these sessions, participants were encouraged to make spontaneous comments about points they felt were important, but no leading questions were asked. Following are the participant comments that seem especially significant to this study:

Reported by five people in Group 2 and four people in Group 3: "I found it frustrating to have the computer tell me I was wrong, but not why I was wrong. Would have liked to discuss my answer."

Reported by two people in Group 2 and two people in Group 3: "I liked the computer's immediate feedback regarding correctness of answers."

Reported by two people from Group 2: "Would be nice if the computer could call me by name and give me "pats on the back" for correct responses."

Reported by four people from Group 3: "Liked the personal touch of having the computer call me by name and respond enthusiastically to the correct answer."

The next chapter will analyze the implications of the experimental results and recommend guidelines for the use of computer-managed instruction.

## CHAPTER 5

### CONCLUSIONS AND RECOMMENDATIONS

This study was designed to provide answers to two basic research questions:

1. Do learners in self-study sales training programs better retain course material when working with printed study guides containing pencil-and-paper self-testing exercises, or when working with computerized study guides incorporating simple CMI procedures?
2. What is the effect, on attitude towards CMI, of working with computerized study guides incorporating simple CMI procedures?

#### Conclusions Concerning Attitude Evaluation Tests

Analysis of the attitude evaluation pretests for the two experimental groups exposed to computer-managed instruction (CMI) suggested that both groups were at home with computers and had positive feelings about their usefulness as an aid to learning. Comparison of the pretest and posttest responses to ten key questions showed

an important attitude change in just one case. This was a strong positive reaction to the immediate feedback offered by the computer. (The attitude change of the "nominal" group was not quite strong enough to be statistically significant, but the reaction of the "enhanced" group was.) The remaining posttest items (which asked direct questions concerning the subjects' reactions to the experimental treatment) turned up few negative reactions from either group.

#### Conclusions Concerning Retention Tests

The results of the retention tests (follow-up tests on course content administered about a week after the experimental treatment) were almost identical for all three experimental groups. There were no significant differences between any two of the "pencil and paper," "nominal computer," and "enhanced computer" groups. Hence, under the conditions of this study, the type of study guide used made no difference in retention of course material

It is interesting to note that the "enhanced" computer test instrument (see Chapter 3) was no more effective in promoting learner retention of course material than the "nominal" computer test instrument. However, responses to the questionnaires and interviews indicated that the participants had positive reactions to

many of the "enhanced" features.

More than one participant favorably mentioned the personal touch of being called by name, the variety of informal responses and the enthusiastic and encouraging tone. In fact two participants from the "nominal" group (with no knowledge of the contents of the "enhanced" test) commented independently that they missed having just such features in their test.

On the other hand, the artificial delay introduced into the answer evaluation process (found by some researchers to promote retention of course material) was specifically mentioned by one student as being annoying. This investigator recommends, then, that all of the features of the "enhanced" test, except for the artificial delay, should be considered for inclusion in the design of any computerized review exercises of this type.

It is also worth noting that several participants wished they had been able to discuss their incorrect answer choices with the computer instead of having them unilaterally branded as "wrong." One way to avoid causing such participant frustration -- and at the same time make the tests better learning tools -- would be to have the computer explain why incorrect choices are wrong. This will be even more effective if the multiple choice distractors are carefully selected to represent common misconceptions about the answer.

### Recommendations

The results of this study show that computerized study guides incorporating simple CMI procedures can be substituted for printed study guides containing pencil-and-paper self-testing exercises with no adverse effects on learner attitude or learner performance. This investigator believes that a second study should now be designed and implemented to build on these results.

In this new study, the "computerized" study guide format would be introduced into a real course being taught over a period of several days in an actual Company setting. Self-test exercises would incorporate all the features of the "enhanced" test used in this study, except for the artificial delay. If possible, the learner would also receive feedback on why each incorrect answer choice was considered wrong. The study would be designed to determine if participant commitment (and therefore performance) is indeed increased through the factors outlined in Chapter 1 (individual attention received through computer interaction and knowledge that learning progress is being evaluated and recorded).



## REFERENCES

- Barnett, G. 1974. An analytical report of the 1C Elementary Education Project. Unpublished report submitted to McGill University.
- Brown, R. 1967. An instrument for the measurement of expressed attitude toward computer-assisted instruction. In H. Mitzal (Ed.) Semi-annual progress report. Experimentation with CAI. University Park, Pa.: Penn State University.
- Bundy, R.F. 1968. Computer-assisted instruction -- where are we? Phi Delta Kappan. 49:424-429.
- Cartwright, Glenn F., and Derevensky, Jeffry L. 1975. An attitudinal study of computer-assisted testing as a learning method. Washington, D.C.: National Citizen's Conference on Rehabilitation of the Disabled and Disadvantaged. (Eric Document Reproduction Service No. ED107721).
- Culp, G.H., and Lagowski, J.H. 1971. Studies involving the application of computer techniques to undergraduate organic chemistry instruction. Journal of Research in Science Teaching. 8:357-362.
- Gilman, D.A. 1969. The effect of feedback on learners' certainty of response and attitude toward instruction in a computer-assisted instruction program for teaching science concepts. Journal of Research in Science Teaching. 6:171-184.
- Goodman, H.J. 1968. The effects of team learning and counteracting of misinformation upon attitudes towards computer-instructed learning. Unpublished doctoral dissertation. Los Angeles: University of California.
- Hagerty, N.K. 1970. Development and implementation of a computer-managed instruction system in graduate training. Tech. Report No. 11. Tallahassee: Florida State CAI Center.

Hausmer, M., and Henderson, C.O. 1972. Improved large enrollment undergraduate instruction with computer-generated, repeatable tests. Pullman, Wash.: Washington State University. (Eric Document Reproduction Service No. ED076027).

Judd, W.A. 1973. The University of Texas at Austin Computer Instruction Laboratory: A program of research and development. In K. Zinn (Ed.) Computers in the instructional process, report of an international school. Ann Arbor, Mich.: EXTEND Publications.

Lawlor, R. Michael, and others. 1972. Selected instructional strategies in computer-managed instruction. Tallahassee: Florida State University Computer-Assisted Instruction Center. (Eric Document Reproduction Service No. ED064880).

Lippold, G.A. 1977. The relationship of personalization, encouragement, and humor to student attitudes and posttest performance on a computer-assisted instructional program. Unpublished doctoral dissertation. University of Northern California.

Mathis, A., Smith, T., and Hanson, D. 1970. College Students' Attitudes Toward Computer-Assisted Instruction. Journal Of Educational Psychology. 41:46-51.

Rankin, R.J., and Trepper, T. 1978. Retention and delay of feedback in a computer-assisted instructional task. Journal Of Experimental Education. 46,4:67-70.

Skinner, B.F. 1968. The technology of teaching. New York: Appleton-Century-Crofts.

Steffenson, M.B., and others. 1982. College student attitude toward computer-managed instruction in an introductory biology course. South Dakota State University. (Eric Document Reproduction Service No. ED216899).

Sturges, P.T. 1978. Delay of informative feedback in computer-assisted testing. Journal Of Educational Psychology. 70,3:378-387.

Torop, W. 1975. An analysis of individualized learning system chemistry. West Chester, Penn.: West Chester State University. (Eric Document Reproduction Service No. ED110321).

Wooley, Jon K. 1978. Factors affecting student attitudes and achievement in an astronomy computer-assisted instruction program. Journal Of Research In Science Teaching. 15,2:173-178.

**APPENDIX A**

## STUDENT ATTITUDE TOWARDS COMPUTER-MANAGED TESTING

## \*\*PRETEST\*\*

There is no one "right" or "wrong" response to any of the statements below. We are simply interested in your opinions. Please circle the response that corresponds closest to your feeling about each statement.

1. In a situation where I am trying to learn, it is important to me to know where I stand in relation to others.

strongly disagree    disagree    uncertain    agree    strongly agree

2. I feel perfectly comfortable about answering test questions by pressing buttons on a computer.

strongly disagree    disagree    uncertain    agree    strongly agree

3. Being tested and evaluated by computer makes me feel that no one really cares whether I learn.

strongly disagree    disagree    uncertain    agree    strongly agree

4. I am concerned that I might not understand the material presented by computer.

strongly disagree    disagree    uncertain    agree    strongly agree

5. I am concerned that computer-managed testing might make learning too mechanical.

strongly disagree    disagree    uncertain    agree    strongly agree

6. The mechanics of working with the computer might be more difficult than learning the material presented.

strongly disagree    disagree    uncertain    agree    strongly agree

7. I like to know immediately whether or not my answers to test questions are correct.
- strongly disagree    disagree    uncertain    agree    strongly agree
8. I feel that I can work satisfactorily at my own pace with computer-managed testing.
- strongly disagree    disagree    uncertain    agree    strongly agree
9. Computer-managed testing will make me feel isolated and alone during part of the course.
- strongly disagree    disagree    uncertain    agree    strongly agree
10. Computer-managed testing will use a student's time more effectively.
- strongly disagree    disagree    uncertain    agree    strongly agree

PLEASE ANSWER THE FOLLOWING QUESTIONS CONCERNING YOUR PAST EXPERIENCE WITH COMPUTERS:

1. Have you ever used a computer as part of a learning program? \_\_\_\_\_ (if yes, please explain briefly below)
2. Have you ever taken a computerized test? \_\_\_\_\_ (if yes, please explain briefly below)

3. Do you regularly use a personal computer for any purpose? \_\_\_\_\_ (if yes please explain briefly below)

4. Please briefly describe any other computer experience you may have had...

**APPENDIX B**



## STUDENT ATTITUDE TOWARDS COMPUTER-MANAGED TESTING

## \*\*POSTTEST\*\*

There is no one "right" or "wrong" response to any of the statements below. We are simply interested in your opinions. Please circle the response that corresponds closest to your feeling about each statement.

1. In a situation where I am trying to learn, it is important to me to know where I stand in relation to others.  

|                      |          |           |       |                   |
|----------------------|----------|-----------|-------|-------------------|
| strongly<br>disagree | disagree | uncertain | agree | strongly<br>agree |
|----------------------|----------|-----------|-------|-------------------|
  
2. I feel perfectly comfortable about answering test questions by pressing buttons on a computer.  

|                      |          |           |       |                   |
|----------------------|----------|-----------|-------|-------------------|
| strongly<br>disagree | disagree | uncertain | agree | strongly<br>agree |
|----------------------|----------|-----------|-------|-------------------|
  
3. Being tested and evaluated by computer makes me feel that no one really cares whether I learn.  

|                      |          |           |       |                   |
|----------------------|----------|-----------|-------|-------------------|
| strongly<br>disagree | disagree | uncertain | agree | strongly<br>agree |
|----------------------|----------|-----------|-------|-------------------|
  
4. I am concerned that I might not have understood the material presented by computer.  

|                      |          |           |       |                   |
|----------------------|----------|-----------|-------|-------------------|
| strongly<br>disagree | disagree | uncertain | agree | strongly<br>agree |
|----------------------|----------|-----------|-------|-------------------|
  
5. I am concerned that computer-managed testing might make learning too mechanical.  

|                      |          |           |       |                   |
|----------------------|----------|-----------|-------|-------------------|
| strongly<br>disagree | disagree | uncertain | agree | strongly<br>agree |
|----------------------|----------|-----------|-------|-------------------|
  
6. The mechanics of working with the computer are more difficult than learning the material presented.  

|                      |          |           |       |                   |
|----------------------|----------|-----------|-------|-------------------|
| strongly<br>disagree | disagree | uncertain | agree | strongly<br>agree |
|----------------------|----------|-----------|-------|-------------------|

7. I like to immediately whether or not my answers to test questions are correct.

strongly disagree    disagree    uncertain    agree    strongly agree

8. I feel that I can work satisfactorily at my own pace with computer-managed testing.

strongly disagree    disagree    uncertain    agree    strongly agree

9. Computer-managed testing has made me feel isolated and alone during part of the course.

strongly disagree    disagree    uncertain    agree    strongly agree

10. Computer-managed testing seems to use a student's time more effectively.

strongly disagree    disagree    uncertain    agree    strongly agree

11. While being tested by computer, I felt challenged to do my best work.

strongly disagree    disagree    uncertain    agree    strongly agree

12. The material presented to me by computer-managed testing caused me to feel that no one really cared whether I learned or not.

strongly disagree    disagree    uncertain    agree    strongly agree

13. The method by which I was told whether I had given a right or wrong answer became monotonous.

strongly disagree    disagree    uncertain    agree    strongly agree

14. I didn't mind missing a question now and then because nobody was looking over my shoulder.

strongly disagree    disagree    uncertain    agree    strongly agree

15. While taking computer-managed instruction, I felt as if someone were engaged in conversation with me.

all the time    most of the time    some of the time    only occasionally    never

16. The responses to my answers seemed appropriate.

all the time    most of the time    some of the time    only occasionally    never

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

all the time    most of the time    some of the time    only occasionally    never

18. I knew whether my answers were correct or not before I was told.

quite often    often    occasionally    seldom    very seldom

19. I guessed at the answers to questions.

quite often    often    occasionally    seldom    very seldom

20. I was encouraged by the responses given to my answers of questions.

strongly disagree    disagree    uncertain    agree    strongly agree

21. As a result of having studied some material with the help of computer-managed testing, I am interested in trying to find out more about the subject matter.
- strongly disagree    disagree    uncertain    agree    strongly agree
22. I found it difficult to concentrate on the course material because of the hardware.
- all the time    most of the time    some of the time    only occasionally    never
23. I was more involved in running the machine than in understanding the material.
- all the time    most of the time    some of the time    only occasionally    never
24. Computer-managed testing makes the learning too mechanical.
- strongly disagree    disagree    uncertain    agree    strongly agree
25. I felt as if I had a private tutor while on computer-managed testing.
- strongly disagree    disagree    uncertain    agree    strongly agree
26. The computer-managed testing made me feel quite tense.
- strongly disagree    disagree    uncertain    agree    strongly agree
27. Computer-managed instruction is an inefficient use of the student's time.
- strongly disagree    disagree    uncertain    agree    strongly agree



35. In view of what I learned, I would say that computer-managed testing is superior to traditional pencil-and-paper testing.

strongly disagree    disagree    uncertain    agree    strongly agree

36. I am not in favor of computer-managed testing because it is just another trend towards depersonalized instruction.

strongly disagree    disagree    uncertain    agree    strongly agree

37. Computer-managed testing enhances the learning experience.

strongly disagree    disagree    uncertain    agree    strongly agree

38. The instructions given for operating the computer were clear.

strongly disagree    disagree    uncertain    agree    strongly agree

39. It was easy to read the questions on the screen.

strongly disagree    disagree    uncertain    agree    strongly agree

40. I found that changing incorrect answers was an easy process.

strongly disagree    disagree    uncertain    agree    strongly agree

41. Please use some of the space below to jot down your general reactions to the computer-managed review exercises you have just taken.

**APPENDIX C**

## INTRODUCTION TO THE REVIEW EXERCISES

These two sets of multiple choice review exercises (Review 1 and Review 2) will help you evaluate your progress through the "Inside Selling" course. For each question, circle -- or identify as directed -- the letter(s) corresponding to the correct answer. Unless otherwise indicated, each question has only one correct answer.

To make it easy for you to check your work, we've listed the correct answers on the last page of this test booklet. Please wait until you've finished a complete set of exercises before checking your answers for those exercises. If some of your answers are incorrect, review the appropriate course material to make sure you understand the ideas involved. Don't change your marks in the test booklet, however. Incorrect answers will help us identify course material that is not properly explained.

REVIEW 1:

1.

The inside selling concept was developed to help us better serve:

- A. mass merchandisers in urban areas.
- B. groups of big customers near the city center.
- C. home centers in shopping malls.
- D. smaller independent dealers away from large cities.

2.

Two important advantages of the inside selling concept are:

- A. customer has more frequent contact with Sales Representatives.
- B. larger loads can be received.
- C. delivery times are shorter.
- D. orders and inventories can be smaller.



3.

Select your answers for Parts 1 - 4 from the group of descriptions below:

- A. Supplies major builders and contractors; orders in truckload quantities.
- B. Relatively small business operation; sells retail/wholesale.
- C. Large chain of retail building material outlets; some have central purchasing department.
- D. May sell to major builders and also operate supermarket-style outlet.

PART 1. Which letter best identifies the lumberyard/building supply dealer? \_\_\_\_\_

PART 2. Which letter best identifies the mass merchandiser? \_\_\_\_\_

PART 3. Which letter best identifies the large board dealer? \_\_\_\_\_

PART 4. Which letter best identifies the combination dealer? \_\_\_\_\_

4. Select your answers for parts 1-3 from the group of descriptions below:

- A. Relies on the Inside Sales Rep for special services, but probably does not buy from the rep directly.
- B. Relies on the Inside Sales Rep to replace depleted stocks on short notice and to provide special product information.
- C. Relies on the Inside Sales Rep to supply wholesale and retail needs simultaneously.

PART 1. Which letter best identifies the lumberyard/building supply dealer? \_\_\_\_\_

PART 2. Which letter best identifies the mass merchandiser? \_\_\_\_\_

PART 3. Which letter best identifies the large board dealer? \_\_\_\_\_

5.

The A-Z file gets its name from the fact that:

- A. it contains everything the Inside Sales Rep can possibly find out about the customers.
- B. it contains key product knowledge arranged in alphabetical order.
- C. it organizes all of the rep's customers in alphabetical order.

6.

Which two statements best describe the account profile sheet?

- A. It records business transactions with customers on a call-by-call basis.
- B. It is found in the rep's A-Z file.
- C. It provides a complete rundown on each customer's characteristics.

7.

Which two statements best describe the call/order record?

- A. It organizes customer calls by date and results.
- B. It is found in the rep's A-Z file.
- C. It contains shipping, billing and credit information.
- D. It lists the sales approach used to obtain each order.

This completes REVIEW 1.

Please go now to TEXT SECTION 4 in your text booklet.

Turn to the next page when instructed to begin REVIEW 2.

REVIEW 2:

8.

Which statements best describe the phone call and letter system?

- A. It might involve sending a letter first, then following with a call.
- B. It might involve making a call first, then following with a letter.
- C. It is an effective means for the inside rep to meet new customers.

9.

When talking with a new customer, the Inside Sales Rep should have an opening statement ready for use when the introductions are over. The statement should (pick the three best answers):

- A. identify the person being called.
- B. focus the customer's attention on the rep's products and services.
- C. include firm price quotes.
- D. establish rapport with the customer.
- E. refer to the introductory mailing.

10.

The goal of a well-planned call objective is to:

- A. get a definite answer from the customer.
- B. establish good customer rapport.
- C. give clear answers to all customer questions.
- D. get specific, measurable results.

11.

Which two of the following are well-planned call objectives?

- A. Call Ace Lumber to get an order.
- B. Find out when Ace Lumber will need another truck of half-inch board.
- C. Call Ace Lumber to wish Marge a happy birthday.
- D. Call Ace Lumber to obtain necessary credit information.

12.

If properly planned and carried out, the sales message should:

- A. be completed within the prospect's attention span.
- B. take into account the prospect's personal characteristics.
- C. anticipate all customer questions.
- D. achieve your call objectives.

13.

Which statements best identify an effective sales message?

- A. It stresses how the customer will benefit by taking the action you propose.
- B. It tailors the benefits you offer to the customer's needs.
- C. It makes good use of the information in the account profile sheet and the call/order record.

14.

From the list below, select the three key steps for handling customer objections or negative remarks and list them in correct order of usage. \_\_\_\_\_

- A. Restate the problem.
- B. Loosen up the customer with a funny story.
- C. Stress a benefit of your product or service.
- D. Counter the objection.

15.

Identify the three best sources of new prospects in the list below.

- A. phone directory listings
- B. inactive customer files
- C. Dodge Reports
- D. word of mouth
- E. county courthouse records
- F. inquiry calls

16.

The following is not true of the Dodge Reports Service:

- A. It can be used to sell before the construction contract is awarded.
- B. It often lists contractor's phone.
- C. It identifies new construction jobs.
- D. It lists major materials required in the construction.

17.

To "qualify" a potential customer, you must find out about:

- A. the customer's sales volume and credit rating.
- B. the customer's understanding of product installation methods.
- C. the customer's willingness to purchase our products.
- D. the size of the customer's staff.

18.

The best way to obtain credit information from a customer is to:

- A. avoid direct questions that might upset the customer.
- B. explain that we can't do business unless the customer proves that he has a good credit rating.
- C. explain that the credit department needs the information in order to set up the account.

19.

When making an introductory call on an account that has become inactive, you should:

- A. use a different approach than you would with a new account.
- B. use the same approach you would with a new account. But you must also find, and deal with, the reason the customer stopped buying.
- C. realize that you probably won't get very far if the account was once serviced by a Field Sales Representative.

20.

If a prospect is unpleasant and tells you not to call back:

- A. Wait several weeks and try again.
- B. Don't worry about it. Forget him and call a friendly account.
- C. Keep calling. Be even tempered and pleasant. You have nothing to lose and persistence could pay off.
- D. Don't hang up until you find out why the customer is angry.

This completes your study  
of the INSIDE SELLING program

Thanks for participating!

turn page for answers to review exercises

## ANSWERS TO REVIEW EXERCISES

Review 1

- 1. D
- 2. AD
- 3-1. B
- 3-2. C
- 3-3. A
- 3-4. D
- 4-1. C
- 4-2. A
- 4-3. B
- 5. C
- 6. BC
- 7. AB

Review 2

- 8. ABC
- 9. BDE
- 10. D
- 11. BD
- 12. D
- 13. ABC
- 14. ADC
- 15. BCF
- 16. D
- 17. A
- 18. C
- 19. B
- 20. C



**APPENDIX D**

RESPONSE PATTERNS - COMPUTER SELF-TESTING EXERCISES

Opening Screen

The opening screen for the "nominal" self-testing exercises was worded as follows:

INTRODUCTION TO THE REVIEW EXERCISES  
 These computerized review exercises  
 will help you evaluate your progress  
 through the "Inside Selling" course.  
 All questions are multiple choice.

To register an answer, press the key(s)  
 corresponding to the correct letter(s),  
 then press the ENTER key. To change  
 your answer, press "?" before pressing  
 ENTER. Pressing ENTER will then clear  
 your answer and allow you to make a new  
 selection.

-----  
 When a text instruction asks you to  
 begin REVIEW 1, press the ENTER key.  
 -----

The opening screen for the "enhanced" self-testing exercises was identical, except that it was prefaced with a greeting using the subject's first name ("Hello name"). Subject names were entered into the "enhanced" computer program, on an individual basis, prior to the subjects' arrival in the testing room. This made it possible to personalize occasional computer responses throughout the "enhanced" exercises as will be discussed later.

Response To Answers -- Nominal

In the "nominal" self-testing exercises, the computer responded immediately to every answer entered by the

subject. The complete question and set of possible answers remained on the screen during all responses. If the answer entered was correct, the response was always as follows:

Your answer was (letter entered). That's Correct.

Press ENTER to continue.

If the answer was incorrect, the response was always as follows:

Your answer was (letter entered)

The correct answer is (correct letter)

Press ENTER to continue.

Pressing ENTER following either computer response caused the next question to appear on the screen.

#### Response To Answers -- Enhanced

In the "enhanced" self-testing exercises, the computer delayed for six seconds before responding to an answer entered by the subject. The complete question and set of possible answers remained on the screen during all delays and responses. During each delay, the following message appeared on the screen:

ANSWER BEING EVALUATED

If the answer was correct, one of the following two

responses appeared on the screen:

That's right! (letter entered) is the best answer.

Please press ENTER to continue.

or

Nice going, (subject name), (letter entered) is correct.

Please press ENTER to continue.

Pressing ENTER following either computer response caused the next question to appear on the screen.

If the answer was incorrect, one of the following two responses appeared on the screen:

(letter entered) isn't the best answer, (subject name).

Read the problem over and try again.

or

There's a better answer than (letter entered)

Read the problem over and try again.

If the second try was also incorrect, the computer would prompt the subject as follows:

(letter entered) isn't the best answer either.

Review (appropriate course element) and try again.

If the wrong answer were entered on the third try, the computer would respond:

(letter entered) isn't correct, either, (subject name)  
(correct letter) is the best answer.

Please press ENTER to continue.

Pressing ENTER would then cause the next question to appear on the screen.

### Closing Messages

Pressing ENTER after completing the last question in Review 1 (either "nominal" or "enhanced" version) caused the question to be replaced by the following message:

Please go to TEXT SECTION 4  
in your printed booklet.

Then press ENTER when instructed to  
begin REVIEW 2.

Pressing ENTER after completing the last question in Review 1 (either "nominal" or "enhanced" version) caused the question to be replaced by the following message:

This completes your study  
of the INSIDE SELLING training program

Thanks for participating!

**APPENDIX E**

SAMPLE "PILOT" PROGRAMS  
FOR  
COMPUTERIZED SELF-TESTING EXERCISES

Following are samples of the programs, as written in the authoring language "Pilot" (Commodore 64 version), for both "nominal" and "enhanced" forms of the computerized self-testing exercises. Shown are the opening portions of each program (which include all necessary subroutines), as well as the programming for the first few questions. Programming for all remaining questions follows the same pattern.

Nominal Version

```

TS:
: INTRODUCTION TO THE REVIEW EXERCISES
:
:These computerized review exercises
:will help you evaluate your progress
:through the "Inside Selling" course.
:All questions are multiple choice.
:
:To register an answer, press the key(s)
:corresponding to the correct letter(s),
:then press the ENTER key. To change
:your answer, press "?" before pressing
:ENTER. Pressing ENTER will then clear
:your answer and allow you to make a new
:selection.
:
:-----
:When a text instruction asks you to
:begin REVIEW 1, press the ENTER key.
:-----
A:
TS:1. The inside selling concept was de-
:veloped to help us better serve:
:
: A. Mass merchandisers in urban areas.

```

- :  
 :B. Groups of big customers near  
 : the city center.  
 :  
 :C. Home centers in shopping malls.  
 :  
 :D. Smaller independent dealers  
 : away from large cities.  
 :

-----  
 :  
 : WHICH LETTER IDENTIFIES  
 : THE BEST ANSWER?  
 :  
 :  
 :-----

J:@P  
 \*OPEN  
 G:S5  
 TS:  
 A:  
 M:?  
 TSY:  
 JY:@A  
 E:  
 \*YES  
 TSY:  
 :Your answer was \$%B. That's Correct.  
 :Press ENTER to continue.  
 AY:  
 TSY:  
 TSN:  
 :Your answer was \$%B  
 THN:The correct answer is  
 E:  
 \*OUT  
 TN:  
 THN:Press ENTER to continue.  
 AN:  
 TSN:  
 G:SO  
 E:  
 PR:  
 U:OPEN  
 M:%D%  
 U:YES  
 TN:D  
 U:OUT  
 TS:2. Two important advantages of the  
 :inside selling concept are:  
 :  
 : A. Customer has more frequent con-



: tact with sales representatives.  
 :  
 : B. Larger loads can be received.  
 :  
 : C. Delivery times are shorter.  
 :  
 : D. Orders and inventories can be  
 : smaller.

-----  
 :  
 : WHICH LETTERS IDENTIFY THE  
 : TWO BEST ANSWERS (ANY ORDER)?  
 :  
 :  
 :-----

U:OPEN  
 M:%AD%!\*DA%  
 U:YES  
 TN:AD  
 U:OUT  
 J:@P

### Enhanced Version

D:N\$(15)  
 TS:  
 :  
 :  
 :ENTER STUDENT'S FIRST NAME  
 A:\$N\$  
 TS:  
 : INTRODUCTION TO THE REVIEW EXERCISES  
 :  
 :Hello \$N\$,  
 :  
 :These computerized review exercises  
 :will help you evaluate your progress  
 :through the "Inside Selling" course.  
 :All questions are multiple choice.  
 :  
 :To register an answer, press the key(s)  
 :corresponding to the correct letter(s),  
 :then press the ENTER key. To change  
 :your answer, press "?" before pressing  
 :ENTER. Pressing ENTER will then clear  
 :your answer and allow you to make a new  
 :selection.  
 :

:-----  
 :When a text instruction asks you to  
 :begin REVIEW 1, press the ENTER key.  
 :-----

A:

TS:1 The inside selling concept was de-  
 :veloped to help us better serve:

- :  
 : A. mass merchandisers in urban areas.  
 :  
 : B. groups of big customers near  
 : the city center.  
 :  
 : C. home centers in shopping malls.  
 :  
 : D. smaller independent dealers  
 : away from large cities.  
 :

:-----  
 :  
 : WHICH LETTER IDENTIFIES  
 : THE BEST ANSWER?  
 :  
 :-----

J:@P

\*O M?

G:S5

TSY:

THY:ENTER YOUR CORRECTED ANSWERS HERE

CY:%A=%A-1

E:

\*m1

TS:

:

: ANSWER BEING EVALUATED

W:80

TSY:

:That's right! %B is the best answer.

:

THY:Please press ENTER to continue.

AY:

E:

\*m2

TS:

:

: ANSWER BEING EVALUATED

W:80

TSY:

:Nice going, %B is correct.

:

THY:Please press ENTER to continue.

:  
: B. larger truckloads can be received.  
:  
: C. delivery times are shorter.  
:  
: D. orders and inventories can  
: be smaller.  
:  
:-----

:  
: WHICH LETTERS IDENTIFY THE  
: TWO BEST ANSWERS (ANY ORDER)?  
:  
:-----

PR:  
\*2  
A:  
U:0  
JY:2  
M:%AD%!%DA%  
U:m2  
JY:@P  
U:ma2  
J1:@A  
U:mb  
T2:Review TEXT 1 and try again.  
U:mc  
J2:@A  
U:md  
T3:AD is the best answer  
U:c  
J:@P

**APPENDIX F**

## Participant's Orientation Sheet

### Participant's Instructions

#### USG SALES TRAINING EFFECTIVENESS STUDY

You are about to study a portion of a training program designed for newly-hired sales representatives at USG Corporation. Like all USG sales training programs, it is intended to be studied by the trainee independently and at his/her own pace. We think you'll find the program interesting because of its multimedia approach; the course material is presented not only through a printed text, but with the help of audio and video segments. Before starting your study, you will receive a briefing on the operation of any necessary audio/visual equipment.

Included in the program are two sets of Review Exercises -- one about halfway through the program and one at the conclusion. These are designed to help the learner assess his/her progress through the course and, for that reason, the correct answers to the questions are made available for checking. It is the purpose of this study to test the effectiveness of different styles of review exercises. All participants will study the same course materials, but review exercise styles will be varied.

As you study the course materials and complete the review questions, try to assume the point of view of a newly-hired sales representative who is enthusiastic about his/her new job and trying to learn it as thoroughly as possible. Go over each course element carefully and answer each review question in a thoughtful manner.

To orient yourself to the organization of the course, look at the first page of your text booklet. It lists each course element in the order to be studied. In addition, as you complete each course element, you'll be instructed concerning which element to study next.

One week after your appointment here, you'll receive in the mail a set of questions covering the course work you studied. The test is designed to measure your retention of the material. It is vitally important that we have the results of the test. Without them, the work you are going to do today will not be usable in this research project. It's also of key importance that the time interval between studying and test taking be about the same for each participant. So we ask your cooperation in completing the

test within twenty-four hours after receiving it. It shouldn't take you more than a half-hour to do the work.

A stamped, self-addressed envelope will be provided for you to return the answer sheet. Promptly upon receiving it, we'll mail your \$20.00 participant's fee.

Thanks again for your cooperation!

PLEASE ANSWER THE QUESTIONS BELOW TO HELP US  
ROUTE THE TEST DOCUMENTS AND PROCESS YOUR PAYMENT

Name:

Social Security Number (if you have one):

Address to which we should send test and payment:

Phone number at location where we are to send test and payment:

Would you like to receive a summary of the results of this study?

**APPENDIX G**

COMPLETE STATISTICAL SUMMARY OF RESPONSES TO  
 QUESTIONS 11-40 -- ATTITUDE EVALUATION POST TEST

| Question | $\bar{X}$ | $\bar{Y}$ | S <sub>X</sub> | S <sub>Y</sub> | t     |
|----------|-----------|-----------|----------------|----------------|-------|
| 11       | 3.47      | 3.73      | 1.20           | .77            | -.68  |
| 12       | 1.67      | 1.93      | .60            | .44            | -1.31 |
| 13       | 2.40      | 2.60      | 1.02           | 1.08           | -.50  |
| 14       | 2.80      | 3.07      | 1.17           | 1.00           | -.66  |
| 15       | 2.87      | 2.67      | .96            | 1.01           | .54   |
| 16       | 3.87      | 3.87      | .81            | .72            | 0.00  |
| 17       | 1.87      | 1.93      | .88            | .68            | -.20  |
| 18       | 4.27      | 4.40      | 1.00           | .49            | -.44  |
| 19       | 1.73      | 1.87      | .77            | .72            | -.50  |
| 20       | 3.47      | 3.60      | 1.09           | 1.02           | -.33  |
| 21       | 3.73      | 3.53      | .93            | .76            | .62   |
| 22       | 1.07      | 1.33      | .25            | .47            | -1.83 |
| 23       | 1.00      | 1.13      | 0.00           | .34            | -1.43 |
| 24       | 1.80      | 2.27      | .54            | .85            | -1.74 |
| 25       | 3.33      | 3.00      | 1.01           | .81            | 0.91  |
| 26       | 1.60      | 1.80      | 1.08           | .54            | -.62  |
| 27       | 2.33      | 2.60      | 1.40           | 1.14           | -.56  |
| 28       | 1.07      | 1.20      | .25            | .40            | -1.03 |
| 29       | 1.33      | 1.27      | .87            | .44            | .23   |
| 30       | 1.00      | 1.20      | 0.00           | .54            | -1.38 |

(continued on next page)



APPROVAL SHEET

The thesis submitted by Marc F. Ellis has been read and approved by the following committee:

Dr. Todd J. Hoover, Director  
Associate Professor of Curriculum and Instruction, Loyola

Dr. Barney M. Berlin  
Associate Professor of Curriculum and Instruction, Loyola

The final copies have been examined by the director of the thesis and the signature which appears below verifies the fact that any necessary changes have been incorporated and that the thesis is now given final approval by the Committee with reference to content and form.

The thesis is therefore accepted in partial fulfillment of the requirements for the degree of Master of Arts.

April 3, 1986  
Date

Todd Hoover  
Director's Signature