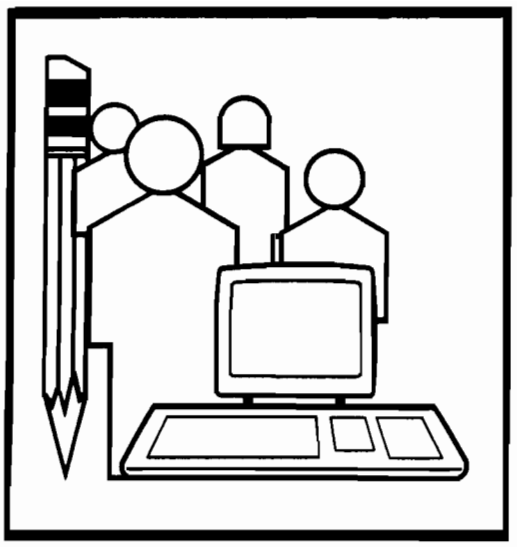

TECHNICAL REPORT

EFFECT OF INTEGRATED CBI PRACTICE ON TASK PERFORMANCE AND ATTITUDE

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ABSTRACT

This study investigated the effects of integrated CBI practice on criterion task performance and attitudes of learners. Twenty two subjects participated in the study, 11 in a treatment group and 11 in a control group. All subjects took a CBI lesson that taught them to use a communications software package to transfer files between a personal computer and a VAX. The lesson taken by subjects in the treatment group included an additional section that allowed them to practice the task without initial instructional prompts. Each subject then used the software package to do the file transfer task. Subjects who took an additional practice section completed the file transfer in, on average, half as long as the subjects who did not have the practice section ($p < .001$). They also made fewer errors ($p < .01$). There was only a slight difference between control and treatment groups on total attitude score. However, subjects in the control group were much more likely to indicate a desire for additional review than subjects in the treatment group.

PURPOSE OF THE STUDY

Computer-based instruction (CBI) courses are often designed to teach the computer user how to perform a series of steps that result in the performance of a target task, such as transferring of a file between two computers, or creating and editing a letter. Common sense, informed by precepts of instructional design (Briggs, 1977; Dick and Carey, 1974; Gagne and Briggs, 1979) and instructional effectiveness research findings (Hull, 1952; Bugeshi, 1964; Mowrer, 1960), would dictate that a course which allows the user to practice the entire sequence of steps that comprise a task, chained together, would be more effective in teaching the target task than a course which merely allows users to practice each step in isolation. Research findings (Tobias, 1973; Bloom, 1974; Berliner, 1979; Rosenshine, 1979) further suggest that, generally, any instructional method or procedure which results in students spending more time actively engaged in the learning of a task results in higher achievement.

However, many courses simply present concepts and tell the learner about the steps they will perform to accomplish a specific task or tasks. At best, the course may allow the learner to practice each step in isolation. This type of course design probably has not evolved from any firmly held convictions about its instructional effectiveness. Rather, it is more likely the result of real cost and time constraints that inevitably impact CBI course design. At some point decisions are made, perhaps by default, that the additional time required to include practice exercises that more closely approximate the tasks learners must ultimately perform outweigh the possible benefits that might accrue from such practice.

Costs associated with the development of a CBI lessons with integrated practice include the time necessary to plan and implement the practice exercise. Balanced against these costs are the possible benefits which might result from users performing the target tasks more quickly and with fewer errors as a result of the additional practice. If users do, in fact, use the target software with more ease and precision they may feel more less frustrated and more confident about their newly acquired skills.

It was the purpose of this study to assess the benefits associated with CBI course designs that include practice sessions that realistically simulate the task to be learned as well as the presentation of concepts and practice of individual steps. It is not possible, within the confines of this study, to determine whether the costs outweigh the benefits, or vice versa. It was merely our purpose to conduct a comparative study of CBI instruction that did and did not include integrated practice and to present our findings. These findings represent one source of data that instructional designers may consult to inform their decisions about course content and structure.

DESIGN OF THE STUDY

Subjects

In this study, 22 subjects were randomly assigned to either a treatment or a control group. Subject included 16 Boston College undergraduate and graduate students, all of whom had taken at least one computer course, and 6 professional instructional designers of computer-based instruction.

Procedure

A research assistant explained to each subject that the purpose of the study was to help assess the effectiveness of different types of course design. Then the assistant briefly explained the personal computer and the communications software package that was the subject of the CBI course used as a treatment in the study.

Each subject took two CBI lessons that were taken from a larger course. The first lesson was an introductory lesson designed to teach computer communications concepts. This first lesson did not vary for treatment and control groups. The second lesson taught how to transfer a file using the communications software. The format and content of this second lesson was varied to reflect the major question addressed by this study.

For the control group, this lesson included an introduction to file transfer, an explanation of each step of the file transfer process accompanied by the opportunity for the learner to practice each step, and a summary. The lesson taken by the treatment group included an additional section that was inserted before the summary. This section was designed to enable learners to practice doing all of the steps being taught in the task sequence without interruption and without prompting. This section of the lesson was designed to reflect what a user would do when working with the communications software, i.e., enter a series of commands to perform a given task with no explicit prompting from the system. Subjects in the treatment group were given prompts only when they answered incorrectly after two tries. After an incorrect first entry, subjects were asked to try again. After the second try, they were given an informational hint. Finally, after the third incorrect response, they were given the correct response.

Due to the additional instruction taken by subjects in the treatment group, it took them longer, on the average, to complete the CBI instruction. The average time required for control group subjects to complete the two CBI lessons was 17 minutes while the average time for subjects in the treatment group was 21 minutes.

Subjects in both groups were permitted to take notes, if they wished, and were told in advance that after the lessons they would use the software about which they were learning. Both groups were also told that they could repeat any part of the lesson they wished.

When each subject had finished taking the CBI, s/he was assisted by a second research assistant who did not know whether the subject had been assigned to the treatment or control group. The research assistant, reading from a prepared text, explained the task that the subject was to perform. The task involved actually performing a file transfer using a personal computer connected by a modem to a VAX computer.

The second research assistant observed subjects performing the task. Subjects' comments and actions, as well as correct and incorrect responses were recorded on an observation protocol. A task performance score was computed for each subject based on responses. The total number of minutes required to perform the task, rounded to the nearest minute, was also recorded. After the task was completed, an attitude questionnaire was administered to each subject. The questionnaire was designed to assess each subject's opinion of how adequately they felt the instruction had prepared them to do the file transfer task. Students rated themselves on a scale from strongly agree (4) to strongly disagree (1) on each item.

RESULTS

Task Performance

Subjects in the treatment group, on average, performed better on the criterion task than did subjects in the control group (see Table 1). Out of a total possible of 27 points that could be

Table 1

MEAN TASK PERFORMANCE SCORES

Treatment N = 11	Control N = 11	t-test
24.91 sd = 2.21	20.36 sd = 4.23	p < .01

derived from the task performance scoring procedure, the average score for the treatment (practice) group was 24.91 with a standard deviation of 2.21. High and low scores were 27 and 21, respectively. The average score for the control group was 20.36 with a standard deviation of 4.23. The highest score for the control group was 25 and the lowest was 13. As these data indicate, there was much less variability among the scores of subjects in the treatment group as compared to the scores of subjects in the control group. The results of statistical analysis using a one-tailed t-test to assess the significance of the difference between mean scores of the two groups yielded a probability level of .01.

The most impressive difference between treatment and control groups was observed when average times to complete the criterion task were compared. It took subjects in the control group nearly twice as long, on average, to complete the target task as it took subjects in the treatment group. As can be seen in Table 2, the mean for the treatment (practice) group was 4.82 minutes while the mean for the control group was 8.91 minutes. A one-tailed t-test indicated a significance level of .001. As can be discerned from the standard deviations reported in Table 2, there was again more variability among subjects in the control group than among subjects in the treatment group. The fastest subject in the control group completed the task in 3 minutes and the slowest subject in that group took 8 minutes. In contrast, the fastest person in the control group completed the task in 5 minutes, while the slowest required 14 minutes.

Attitudes of Subjects

Responses to the attitude measure for each item were analyzed for the control group and treatment group. Items were categorized as High Agreement if the majority of students rated themselves as 3 (agree) or 4 (strongly agree), and Low Agreement if most students rated themselves as 2 (disagree) or 1 (strongly disagree).

Table 2

MEAN TIME TO COMPLETE TASK

Treatment N = 11	Control N = 11	t-test
4.82 min. sd = 1.66	8.91 min. sd = 2.66	p < .001

The results are presented in Table 3. The ratings for the groups differ only for Item 3. The majority of control group subjects agreed whereas a majority of the treatment group subjects disagreed with the statement that they wished they could have reviewed the lesson again. Only a slight difference was observed between the control and treatment groups overall on the attitude measure.

DISCUSSION

The results of this study support the premise that learners are more likely to successfully accomplish a target task that is comprised of many individual steps when they have had a chance to practice the steps in sequence. This outcome, while not surprising, has interesting implications for the design of computer-based instruction.

Social psychologists have long argued that people strive for competence, that sense of efficacy that comes with the perception that's one's environment is understandable and manageable (Smith, 1968). More simply put, people like to succeed. When success means entering a series of commands that may have no contextual

Table 3

SUMMARY OF RESULTS OF ATTITUDE SELF RATINGS

	ITEM	AGREEMENT Treatment	Control
1.	I felt I had the information I needed to be able to use the software to transfer a file.	HI	HI
2.	I felt very frustrated.	LOW	LOW
3.	I wish I had had a chance to review the lesson again.	LOW	HI
4.	I felt I understood how to use the software to transfer a file.	HI	HI
5.	I just didn't know what to do.	LOW	LOW

meaning to a novice computer user, as one instructional designer put it, "people need all the help they can get."

The subjects in the treatment group had the opportunity to practice what they had just been taught in the CBI lesson before demonstrating their mastery of the lesson by performing a file transfer task. The additional help provided by the practice exercise in the experimental treatment was well received by subjects. They indicated that the practice "made them feel more comfortable" with the software. One subject noted that while she enjoyed taking the CBI, it wasn't until the practice session that she felt very confident to perform the task. Said another Boston College subject, "It's just like teaching ... it helps if you review and (practice) the lesson."

It is this self-directed practice that is often missing from computer-based instruction. It is interesting that while subjects in the treatments were told they could review the CBI and the practice session as many times as they wished, no one reviewed the CBI lessons. Four of the eight Boston College students who took the practice session reviewed the session before beginning the target task. It is not surprising that all four of these students attained a perfect task performance score of 27. Their average task completion time was 3.6 minutes. When given the opportunity to practice until they achieved mastery, these subjects did so.

Some users of computer-based instruction have indicated that it is a big shock to go from the supportive environment of a CBI course to the actual software the course teaches about. The applications software may provide understandable error messages when the user makes a syntax error. However if the user simply forgets the correct sequence of commands and enters an inappropriate command, such help is not available.

It is possible that a practice session like the one included in this study could help bridge the gap between supportive instructional courseware and the hard realities of the applications software. The practice session included no direct instruction and only offered hints after two unsuccessful tries. Thus the users had a chance to try to do the task on their own, but they were not permitted to fail. Practice is, after all, what most of us do after we have been taught something that involves the memorization of a sequential task. We practice until we get it right. It is probably much more satisfying for the learner to practice in an instructional setting than in the work environment where lack of success may have more serious consequences.

SUMMARY

The purpose of this study was to assess the extent to which a CBI lesson that includes a practice session is more effective than a CBI lesson that does not include such a practice session. Subjects in a control group took a CBI lesson designed to teach the user to transfer a file between a personal computer and a VAX computer using a communications software package. The control group lesson included a section explaining the file transfer and a simulation of the file transfer process during which the user practiced each step of the process as it was presented. The subjects in the treatment group took the same lesson, with an added practice section which allowed them to practice the file transfer proces with no instruction or prompts. If the subject made an error, feedback was provided.

At the end of the treatment, each subject performed a file transfer using the communications software package. Subjects were observed and each correct and incorrect response was recorded. A task performance score was computed, and the time required to do the task was measured for each subject. An attitude survey was administered to each subject to assess how the subject felt about the instruction and their ability to perform the file transfer process.

There were statistically significant differences between control and treatment groups both on task performance and task time. The treatment group made fewer mistakes performing the file transfer task than the control group, and were able to accomplish file transfer in, on average, half the time that the control group required. Despite these differences, there was only a slight difference between the attitude survey averages of the control and treatment groups.

Although the findings of this study are based on a small sample (22) subjects, the finding that the treatment group performed the file transfer in about half the time that the control group required is notable. This study suggests that the inclusion of well designed practice sessions results in substantial gains in user performance of the objectives the course is designed to teach.

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