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Training Novice Users in Developing Strategies for Responding to Errors When Browsing the Web

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Novice users frequently make errors when learning a new computer task and spend a large portion of their time trying to recover from errors. Three methods for helping novice users respond to errors have been presented in the literature: error management training, exploratory training, and conceptual models. In error management training, errors are presented as opportunities for learning, and users are instructed in strategies for coping with errors. In exploration, users are given an overview of their environment and are taught how to navigate through their task environment. Conceptual models are graphical or mathematical representations of a system that correspond closely to the real-world system. This experiment tested the effectiveness of these different approaches on training novice users to use the Internet. In this experiment, users received 3 hr of training on the World Wide Web and then were asked to perform a set of information retrieval tasks. Performance was measured in two ways: task performance and performance time. Participants who received exploratory training had significantly higher task performance. Participants who received exploration and conceptual models, both individually and together, were able to complete the tasks in less time. Error management had no significant effect on the performance of participants. In the task application of Web browsing, exploration seems to be the most appropriate training method for novice users.

1. INTRODUCTION

As users learn to use a new application of computer technology, they frequently make errors (Greif & Keller, 1990; Lazonder & Meij, 1995; Norman, 1983). Systems and interfaces should be designed to minimize the chance of making an error. When errors are made, the system should maximize the user's understanding of the error and make it easy for users to recover from the error (Booth, 1991; Lewis & Norman,

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1986; Norman, 1991; Senders & Moray, 1991; Shneiderman, 1998). Even if a system is designed to follow these principles, it is virtually impossible for users, especially novice users, to avoid making errors, because novice users are especially prone to committing errors (Arnold & Roe, 1987; Carroll, 1990; Greif & Keller, 1990; Lazonder & Meij, 1995). When novice users make an error, they frequently become frustrated (Arnold & Roe, 1987; Carroll & Mack, 1984). Novice users spend a large portion of their time trying to recover from errors (Carroll & Carrithers, 1984). These errors are stressful to users (Frese, Brodbeck, Zapf, & Prumper, 1990), who tend to blame themselves for errors (Carroll & Mack, 1984; Lewis & Norman, 1986). When novice users learn tasks in a networked environment, such as the Internet, the probability for making errors increases (Lazar & Norcio, 1990b, 2000). There is an increased level of complexity, with all of the protocols and unpredictable network connections, and consequently there are many new opportunities for errors to occur.

Because of all of these factors, it is important to train novice users in how to respond to errors. However, traditional training methods for novice users do not address errors. Traditional training methods, also called "procedural training," typically involve giving users a step-by-step list to follow to learn a task (Carroll, 1984; Wendel & Frese, 1987). Traditional methodologies for teaching novice users how to use computer applications focus on avoiding errors (Frese & Altmann, 1989). The assumption of these training methodologies is that users never make errors when performing tasks (Carroll, 1990). However, this is unrealistic, because it is virtually impossible to avoid errors when learning new tasks (Arnold & Roe, 1987; Carroll, 1990; Greif & Keller, 1990; Lazonder & Meij, 1995). Typically, novice users make insignificant errors but are not instructed on how to recover from these errors (Carroll, 1984, 1990; Carroll & Mack, 1984; Lazonder & Meij, 1995). A few of these insignificant errors combine to form more significant errors, which frustrate users, who are not able to recover from the error sequence (Carroll & Carrithers, 1984; Carroll & Mack, 1984).

Three methodologies for helping novice users respond to errors have been presented in the literature: error management training, exploratory training, and conceptual models. In error management training, errors are presented as opportunities for learning (Dormann & Frese, 1994; Frese & Altmann, 1989; Frese et al., 1991; Nordstrom, Wendland, & Williams, 1998), and users are instructed in strategies for coping with errors. In exploration, users are given an overview of their environment (Greif & Keller, 1990; Wendel & Frese, 1987). Instead of being given step-by-step directions, users are taught how to navigate through their task environment. Conceptual models are graphical or mathematical representations of a system that correspond closely to the real-world system (Santhanam & Sein, 1994). Conceptual models assist users in understanding systems and predicting the actions of systems.

2. LITERATURE REVIEW

2.1. Error Training

A new methodology for training, called *error training,* has been presented in the literature (Dormann & Frese, 1994; Frese et al., 1991; Nordstrom et al., 1998). Error training consists of two related techniques: error management and exploration. The goal of error training is to change how users view errors. In error training, errors are presented as positive opportunities for learning, not as a bad thing. In error training, users are taught tasks by using exploratory techniques instead of procedural techniques. Error training was first introduced into the literature by Frese and Altmann (1989). There are three published studies of experimental findings on error training (Dorman & Frese, 1994; Frese et al. 1991; Nordstrom et al., 1998). In all three studies, the participants who had received error training had higher levels of performance than those who had received the traditional training. However, the studies focused on the limited task domains of word processing and statistical software. The following sections review the error management and exploration literature.

Error management. The cornerstone of error management is to train users that errors are not bad. Users are taught that errors are good, because errors are opportunities for learning (Frese & Altmann, 1989). There are other positive aspects of making errors. Errors might keep incorrect sequences from becoming automated (Frese & Altmann, 1989). By making errors, users should be able to correct their actions before a procedure becomes habitual. Also, in the real-world work environment, errors occur frequently (Frese et al., 1991). In the work environment, there is not always someone (a trainer) there to assist the user. Users should be prepared to handle errors when they occur on the job.

Error management strategies assist users in viewing errors as a learning experience and becoming less frustrated by errors (Frese & Altmann, 1989). Greif and Keller agreed with this assessment, saying that "it is important to redefine errors as learning situations for which emotional and cognitive coping strategies have to be developed" (Greif & Keller, 1990, p. 242).

Exploration. Exploration has been defined as encountering objects and situations with a certain degree of uncertainty (Greif & Keller, 1990). Exploration can be used as an alternative to the traditional (also called "procedural") methodologies for training novice users in computer tasks. Exploratory learning also has been described as an inductive approach to learning tasks (Davis & Bostrom, 1993). Carroll believes that exploration is an appropriate methodology for training novice users, because they are not overloaded with too much information (Carroll, 1984). Greif and Keller stated that when interacting with a computer, users usually do not plan their actions in advance. Instead, users follow something akin to trial and error (Greif & Keller, 1990). Therefore, Wendel and Frese (1987) suggested modeling training on users' behavior and encouraging users to explore.

Some suggestions for designing exploratory training come from research on user manuals designed in an exploratory manner, instead of the traditional procedural manner. These studies suggest that training should be designed around task orientation. That means that the training should be related to real-world tasks; training should not be a set of exercises that occur rarely in the task environment (Carroll, 1984, 1998; Wendel & Frese, 1987). Carroll and Rosson stated (1987) that users become frustrated when training introduces them to functions but does not provide the opportunity to perform a real-world task. Exploratory training should put users in an active role (Carroll, 1984, 1998). Users should be required to learn some things on their own.

2.2. Conceptual Models

Another method that has been presented in the literature for delivering exploratory training to novice users is conceptual models (Santhanam & Sein, 1994). A conceptual model is an "accurate, consistent and complete representation of the target system" (Staggers & Norcio, 1993, p. 588). These models are useful when teaching human users about computer systems (Norman, 1987; Staggers & Norcio, 1993). The human users, when given a conceptual model, compare it with what is happening in their world (Staggers & Norcio, 1993). Norman (1988) stated that it is easier for users to learn to use a system when the users have a good conceptual model. A conceptual model should assist users in predicting the actions of the system.

There are two types of conceptual models: analog and abstract models (Santhanam & Sein, 1994). An analog conceptual model compares the target system (the system that the user is learning about) to another type of system (Santhanam & Sein, 1994). For instance, a computer network could be compared with a system made of two cans and a string. An abstract conceptual model describes a system using graphics, charts, diagrams, and mathematical expressions (Santhanam & Sein, 1994). It has been suggested that abstract conceptual models were more effective than analog conceptual models in training novice users (Sein, Bostrom, & Olfman, 1987). Santhanam and Sein (1994) noted that conceptual models might be helpful in explaining errors to users.

2.3. Research Framework

To assist in developing the research methodology, a research framework (Table 1) has been developed to examine the current published literature related to errors, exploration, and conceptual models in training (Lazar & Norcio, 1999a).

The research framework shows that many areas of training have yet to be explored. For instance, error management has been combined with exploratory training, as "error training." However, the effects of error management, by itself, have yet to be tested in the literature. Conceptual models have not been combined with either error management or exploration in the literature. The combination of error management, exploratory training, and conceptual models used together in training has not been tested in the literature. Several other examples of "gaps" in the literature exist. These gaps are approaches to training that have not been tested in the literature, although the theoretical foundations exist in the literature (Lazar & Norcio, 1999a). Furthermore, the software application used in the majority of the published studies is word processing. Most training studies do not examine network-based applications, such as e-mail or the World Wide Web.

Table 1: Research Framework for Training Methods

Main Effects				
Conceptual Model	*Error Management*	*Exploratory Training*	*Named Training Method*	*Published Studies*
Yes	Yes	Yes		
Yes	Yes	No		
Yes	No	Yes		
Yes	No	No	Conceptual training	Sein, Bostrom, & Olfman (1987) Santhanam & Sein (1994)
No	Yes	Yes	Error training	Frese et. al. (1991) Dormann & Frese (1994) Nordstrom, Wendland, & Williams (1998)
No	Yes	No		
No	No	Yes	Exploratory training	Frese & Altmann (1989) Carroll & Mazur (1986) Carroll & Mack (1984)
No	No	No	Traditional training	Many studies

3. METHOD

3.1. Participants

In an experimental study such as this, one of the most important considerations is the participants. It is important to find participants who are representative of the population that you want to study. Because this experiment is concerned with training methods for novice users, it was important to first define who is considered a novice user. After a review of the published literature (Dormann & Frese, 1994; Nordstrom et al., 1998), it was decided that a novice user would be someone who has (a) not previously taken a class in using the Internet and (b) does not use the Internet as a regular part of his or her job. Furthermore, university students were specifically not used as participants, because most university students either are required to take courses in using the Internet or have learned to use the Internet on their own. Therefore, university students would not be representative of the population of novice users. The participants came from a wide range of occupations, such as managers, administrators, teachers, and clergy. The average age was 50.38 ($SD = 9.90$), with the oldest participant being 76 and the youngest participant being 23. A total of 263 participants took part in the experiment.

3.2. Apparatus

The training sessions took place in a computer classroom that could accommodate a total of 36 users. Each participant had a personal computer, with Internet access, that was running Netscape Navigator.

3.3. Tasks

The participants were given a list of 10 information-gathering tasks to perform on the Web. These tasks were developed because they required specific information where there was only one correct answer. As part of the pilot study, the task list was tested for clarity with 16 participants, and minor wording changes on the task list were made. Task performance was measured on a binary basis. For each task, there was only one right answer; therefore, the participants were scored based on the number of correct tasks, out of a possible 10. This form of measurement was used to ensure objectivity. To show that they had completed a task, the participants were required to fill out information that could only be known by completing the task. The task list is in Appendix A.

3.4. Training Sessions

A series of 16 training sessions were arranged. All training sessions took place in the same computer lab, with the same instructor. The participants were divided into eight treatment groups. These treatment groups were based on the research framework presented earlier in this article and are displayed in Table 2.

To ensure that all participants who received error management, for example, received the same training, training modules were developed. The training modules were developed by using the guidelines in the research literature that focus on nonnetworked applications (Carroll & Mack, 1984; Carroll & Mazur, 1986; Dormann & Frese, 1994; Frese & Altmann, 1989; Frese et al., 1991; Nordstrom et al., 1998; Santhanam & Sein, 1994; Sein et al., 1987). However, because experiments on these types of training methods for Web browsing have not been previously performed, it was necessary to develop new training scripts. To assist in working out any problems in the training methodologies, a pilot study with 16 participants took place before the main experiment. The pilot study tested the feasibility of the training modules as well as the specific wording in the training modules and the measurement tools. This was important, because

Table 2: Treatment Groups

Treatment Group	*Conceptual Model*	*Error Management*	*Exploratory Training*	*Training Methodology Name*
A	Yes	Yes	Yes	Networked error training[a]
B	Yes	Yes	No	Conceptual error training[a]
C	Yes	No	Yes	Conceptual exploratory training[a]
D	Yes	No	No	Conceptual training
E	No	Yes	Yes	Error training
F	No	Yes	No	Error management training
G	No	No	Yes	Exploratory training
H	No	No	No	Traditional training

[a]Indicates that this name is being introduced to the literature.

many aspects of the training, although having been tested on word processing applications, have not been tested on network-based applications such as a Web browser. There were two pilot participants for each treatment group, for a total of 16 pilot participants. Overall, participants found that the training methods worked well. There were a number of suggestions on wording changes in the training scripts. Key passages from the finalized training modules are included in Appendix B.

Treatment groups A, B, C, and D received conceptual models of local networks and how they connected to the Internet. The two conceptual models used were at different levels of abstraction. One conceptual model provided a very general model of how a network works (Krol, 1994, p. 25). The second conceptual model was a specific example of a network connection between two sites on the Internet (Tennant, Ober, & Lipow, 1993, p. 109).

Treatment groups A, B, E, and F all received error management training. This means that the instructor told them that errors are an opportunity for learning. A section of the wording for the error management training came from Nordstrom et al. (1998). Each participant who received error management training also received a sheet listing error heuristics, from Frese et al. (1991) and Greif and Keller (1990). Those treatment groups that did not receive error management training received information on errors telling them that errors are a bad thing (also called error avoidance training; Nordstrom et al., 1998). These instructions are usually a part of traditional training (Carroll, 1990; Frese & Altmann, 1989). The error avoidance instructions used here were from Nordstrom et al. (1998).

Treatment groups A, C, E, and G all received exploratory training. This means that participants received information on how to navigate through their task environment; however, they did not receive step-by-step instructions on what to do. This exploratory training in this experiment was based on research that used the exploratory approach (Carroll & Mack, 1984; Frese & Altmann, 1989), modified for network-based tasks.

3.5. Procedure

A specific procedure was used in each session:

1. Participants filled out human subjects forms, describing their rights in the experiment, as required by university policy and federal law.
2. Participants received a 3-hr training session. The training presented to them depended on which treatment group the training session belonged to.
3. Participants were given a list of information-gathering tasks on the World Wide Web. The task list is in Appendix A.
4. Participants were given 1 hr in which to complete these tasks. During the hour, participants were not allowed to talk to anyone else in the training session. The training instructor could not assist the participants. The only assistance that the instructor could provide is that if the participant's computer terminal crashed, the instructor would move the participant to a new computer terminal.

5. As soon as the participants had completed the tasks, they turned in their task list to the instructor, who then recorded the time.

3.6. Experimental Design

A 2 × 2 × 2 factorial design was used in this experiment. The three independent variables were error management, exploratory method, and conceptual models. Participants were randomly categorized with and without each of those three independent variables. The two dependent variables measured for each participant were task performance and task completion time. Subsequent to this study, the U.S. National Institute of Standards and Technology confirmed the appropriateness of these measurement techniques (National Institute of Standards and Technology, 1999). The list of tasks is in Appendix A. Task completion time was measured from the time that the participant began the tasks until the participant indicated that he or she was done. While participants were completing the tasks, they did not receive any assistance (Nordstrom et al., 1998). Participants each received the tasks listed in a different order. By randomizing the order of the task list, it was possible to eliminate any effects due to the order of the tasks.

The number of errors made by participants was not measured. This is due to two factors. First, in the error training methodology, errors are not considered to be a bad thing, so the measurement of errors is inconsequential to performance. Second, and more importantly, there is no taxonomy for user errors in networked environments, as there is for user errors in nonnetworked environments (Lazar & Norcio, 1999b; Norman, 1983). What constitutes a user error in a networked environment is not well defined (Lazar & Norcio, 1999a). For instance, if a user completes all tasks in the appropriate manner, it is possible that the user still could not reach his or her task goal. This could be for a number of reasons; for instance, the Web server could not respond, or the user's local Internet service provider could be having problems. An error in a networked environment is not a binary yes or no, based on the user performing the correct actions, but rather an error is based on the user's perceptions of error. The user may have performed the tasks in a totally correct manner (which wouldn't be measured as an error) but still might not reach the task goal. In addition, the download time could be so long that the user perceived that an error had occurred. The only way to determine when a user perceives that an error has occurred is to ask the user to stop and either tell the instructor or write a note. However, such an action increases the task completion time with an action that is not inherent to the task itself. In addition, asking the user to stop the tasks might distract the user and require additional time for the user to get back on track.

4. RESULTS

Table 3 presents the means of task and time performance of participants (the dependent variables), based on the training method that they received (independent variables). A 2 (exploration vs. nonexploration) × 2 (conceptual models vs. none) × 2

Table 3: Task and Time Performance byTraining Method

Subject Group	Conceptual Model	Error Management	Exploratory Training	Number of Subjects	Task Performance (Out of 10 Tasks)		Time Performance (min)	
					M	*SD*	*M*	*SD*
A	Yes	Yes	Yes	37	6.3784	3.1829	46.6216	13.2463
B	Yes	Yes	No	23	6.1739	2.4982	54.0870	9.6527
C	Yes	No	Yes	23	6.2174	3.1472	51.4783	9.7088
D	Yes	No	No	48	5.5000	3.1352	56.5417	7.8224
E	No	Yes	Yes	41	6.0976	2.5671	57.5854	5.3384
F	No	Yes	No	24	5.0000	2.7346	54.6667	9.6983
G	No	No	Yes	35	6.9714	2.0362	53.5714	9.2173
H	No	No	No	32	6.0313	2.9998	55.8438	9.0984
Overall				263	6.0532	2.8400	54.0000	9.8069

(error management vs. error avoidance) multivariate analysis of variance (MANOVA) was performed to determine if there were any statistically significant differences. There were three statistically significant findings in the MANOVA results. Conceptual models were significant (Wilks's $\lambda = .967$, multivariate $F = 4.290$, $df = 2, p < .05$). Exploration was significant (Wilks's $\lambda = .971$, multivariate $F = 3.747, df = 2, p < .05$). The two-way interaction of conceptual models and exploration was also significant (Wilks's $\lambda = .955$ multivariate $F = 6.010$, $df = 2$, $p < .05$). In addition, univariate tests were performed on the dependent variables of task performance and time performance and are reported in the following paragraphs.

Conceptual model was not significant with the dependent variable of task performance (univariate $F = .014$, $p = .907$). Conceptual model was significant with the dependent variable of time performance (univariate $F = 7.418$, $p = .007$).

Exploration was significant with the dependent variable of task performance (univariate $F = 3.205$, $p = .041$). Exploration was also significant with the dependent variable of time performance (univariate $F = 6.256$, $p = .013$).

The two-way interaction of conceptual models and exploration was not significant with the dependent variable of task performance (univariate $F = 0.598$, $p = .440$). However, the two-way interaction of conceptual models and exploration was significant with the dependent variable of time performance (univariate $F = 7.692$, $p = .006$).

4. ANALYSIS OF RESULTS

4.1. Analysis on Task Performance

In the experiment, participants were given 10 tasks to complete. Based on the previously published literature (Carroll & Mack, 1984; Carroll & Mazur, 1986; Dormann & Frese, 1994; Frese & Altmann, 1989; Frese et al., 1991; Nordstrom et al., 1998; Santhanam & Sein, 1994; Sein et al., 1987), it might be expected that all training methods (involving conceptual models, exploration, or error management) would be superior to traditional training in task performance. However, in this experiment, all methods were not significantly higher than traditional training. The only independent variable that was shown to make a significant difference in task performance was exploration.

4.2. Analysis on Performance Time

In the experiment, participants were given up to 60 min to complete the tasks and were encouraged to turn in their task sheets as soon as they were done. Three approaches had statistically significant differences relating to performance time: conceptual models, exploration, and the combination of exploration and conceptual models. It is therefore concluded that conceptual models and exploratory training are helpful, both individually and together, in improving performance time.

5. CONCLUSIONS

5.1. Exploration

It is possible that the success of exploratory training is due to the nature of tasks on the Internet. In the task environment of the Internet, the user usually must search through many Web sites on the network to find the specific information that he or she is looking for. Sometimes users know the address (the Uniform Resource Locator, or URL) of the Web site that they want to access, but sometimes they do not and must use a search engine or explore many different Web sites. Although transparent to the user, many different networks, connections, and protocols are involved in actually completing a task on the Web (Johnson, 1998). In addition, the many different Web sites have different interfaces and different approaches to site navigation with which the user may not be familiar (Lazar, 2001). Because of all of these factors, the user cannot always predict exactly what might happen in executing the task (Johnson, 1998; Lazar, 2001).

Exploratory training does not train users to follow exact steps; rather, the exploratory approach trains users to navigate through the training environment and deal with some level of ambiguity (Carroll & Mack, 1984; Carroll & Mazur, 1986; Frese & Altmann, 1989). This is exactly what users must do on the Internet: navigate through their environment and deal with certain levels of ambiguity.

Users might not know the exact URL of a Web site. Instead, they may guess at the URL, using their knowledge of how a URL is set up. This could be why participants who received exploratory training had higher levels of performance. Participants who received exploratory training might have had higher levels of performance because the exploratory training gives them an explanation of how the Internet works. With this level of understanding on how the Internet works, the participants might have been better able to deal with errors when they occurred.

This is not to say that exploratory training is only appropriate for training users to work in the networked environment. Other studies have found exploratory training to be successful in nonnetworked environment applications, such as word processing (Carroll & Mack, 1984; Carroll & Mazur, 1986). Rather, exploratory training might specifically be well suited to the design of the task environment of the Internet. In the task environment of the Internet, users must deal with certain levels of uncertainty and unpredictability. Exploratory training addresses these types of situations and prepares users to handle these types of situations.

5.2. Error Management

In this study, there was no effect on task or time performance due to error management. In error management, users are told that errors are not bad, and they are instructed in methods for responding to errors when they occur (Dormann & Frese, 1994; Frese et al., 1991; Nordstrom et al., 1998). It is possible that users do not respond to error management because it is the opposite of how they have been trained in the past. Traditionally, from the time that people are young, they are told that errors are bad and should be avoided. Users often feel responsible for errors and believe that if they had done everything correctly, there would be no errors. This could be an ingrained habit, and it might not be possible to change human perception of errors in a single training session. Receiving error management training actually lowered the performance of users in some circumstances. Not only did error management training not improve the performance of users, but in some cases, it might have actually hurt the level of performance. It is possible that error management is actually confusing to users. It might go against everything that they have learned in the past regarding making errors.

It is a very interesting finding that error management has no effect on task or time performance in this experiment. Before this experiment, error management training, by itself, had not been tested in the literature. In the literature, error management training has only been tested in combination with exploratory training, called "error training" (Dormann & Frese, 1994; Frese et al., 1991; Nordstrom et al., 1998). Error training is found to be helpful in training novice users in using word processing and statistical applications. Exploratory training by itself has been tested in the literature and found to be helpful in training novice users (Carroll & Mack, 1984; Carroll & Mazur, 1986). Based on the results of this experiment, it seems that the part of error training that has the greatest effect on performance is exploration.

5.3. Conceptual Models

Based on the results of this study, conceptual models do not seem to improve task performance, but they may improve performance time. Perhaps the conceptual models help participants to respond to errors but not to perform their tasks. For those users who received conceptual models, the understanding of the structure of the Internet (given to them by the conceptual model) may have helped them to respond to errors and not get caught in an error sequence. However, once the participants recovered from the error, it is possible that the conceptual model did not help them to perform the tasks. This could explain why conceptual models improved performance time but not task performance.

5.4. Summary

The results of this experiment relate specifically to the task application of the World Wide Web. There is currently a paucity of research literature available about training methods for task applications in networked environments. Other task applications in networked environments include e-mail (e.g. Microsoft Outlook), groupware, intranets, and distance learning (e.g. Blackboard). Until more research is done with training methods for these specific task applications, the results of this study cannot be generalized to all task applications in networked environments.

The results of this study provide interesting starting points for research on how to improve task performance and performance time in networked environments. For instance, it appears that conceptual models improve performance time but not task performance for applications in networked environments. Error management does not seem to affect task performance or performance time. Exploration seems to be the most effective approach to improving both task performance and performance time. Other sections of this article provide a more detailed discussion of the particular characteristics of networked environments. Based on the characteristics of networked environments and the results of this study, it appears that networked environments are a very different task environment for users, and until more research is done, no assumptions on generalizability should be made.

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APPENDIX A

Task List

ID No. ____Time began:______Time completed:______

Please find the following information on the Internet:

1. The Omicron Delta Kappa Honor Society was first founded in what year?

____

2. Locate the fall 1998 class schedule at the University of Maryland Baltimore County and find out how many classes are given on the language Wolof. _______

3. Locate the Web site for Lands' End (a clothing/luggage company) and find out how much the "Square Rigger Deluxe Attache" luggage costs. $______________

4. What colors does the "Square Rigger Deluxe Attache" come in?

____

5. How many restaurants are at the Marriott Copley Place Hotel in Boston, MA?

____

6. How much does the textbook *Human–Computer Interaction*, by Dr. Jenny Preece, cost at Barnes and Noble? $______________

7. In what year did the Minute Man National Historical Park (in Massachusetts) first become part of the National Park Service? ________

8. In what American city will the stage show "Riverdance" be in on January 13, 1999? City: _____________

9. In what American town is a children's camp named "Crane Lake Camp"?

____

10. The furnishings in the Red Room of the White House are of what style?

____

APPENDIX B

Key Passages From Training Modules

(from script for participants who received error management)

Many times, errors occur, and they are not your fault. On the Internet, many computers and network connections are involved, and sometimes one of these components fails. You may have done everything correctly, but you still may not be able to reach your goal. Don't worry about it. It's not your fault. It may be the computer's fault.

Here are some examples of errors on the Internet. On requesting a Web page, you may get a message saying, "The server is busy, please try again later." Or you may get a message saying, "Server does not have DNS entry" or a message saying, "Access denied." Another possibility is that your computer will continuously attempt to access a Web page but is not able to access anything. All of these are errors, but you did not cause them.

The best thing to do is first double-check that you typed in the URL correctly. With longer URLs, there is an increased chance for spelling errors. A spelling error when typing in a URL is similar to when you dial a phone number, and you dial one number incorrectly. You then get either the wrong party or no answer at all. If you make a spelling error when you type in the URL, you may get the wrong Web site, or you may get a message indicating that the URL that you requested doesn't exist at all. If you have typed the URL in correctly but the Web browser could not access the Web site, try pressing the "reload" button on your Web browser. If that doesn't work, try accessing the Web page at a later time.

"During training, one should expect to make errors. Errors are a positive part of any learning experience. As a result of making errors, you can learn from your mistakes....Remember, errors are an essential part of any learning experience. It is expected that when learning a new computer application one will make errors. If you make an error—that's great!! Remember that there is always a way to leave the error situation. Always pay attention to the screen and observe what is happening." (Nordstrom et al., 1998, p. 276)

(from script for participants who received conceptual models)

I am now passing out models of how the Internet is set up. First, take a look at the image that has the title "The Internet" at the top. Notice how the computer on the left side sends a request to the computer on the right side. The request goes through many different networks and routers. A router helps route a request to the right network location. Through all of these networks and connections, an error may occur. You may not be able to access the Web page that you want, but this may not be your fault.

Now, take a look at the other model. Notice that this model is more detailed. This model shows a request being sent from Berkeley to Dartmouth, across the country. Look at all of the different networks and routers that the request travels across. Not only does this request travel through campus networks at Berkeley and Dartmouth, but it also travels through regional networks as well as the main Internet backbone. There could be failures on any one of these networks. And because of this, you might not be able to reach your task goal, but this wouldn't be your fault!

(from script for participants who received exploratory training)

Note that Netscape Navigator keeps track of what Web sites you have visited. So, if you want, you can go back a few Web sites by clicking the "back" button. Try that right now (pause). Then, click the "forward" button (pause). Another button that you might be interested in is the "stop" button. If you try accessing a Web site, and it takes a really long time to load, you can always stop the page load by clicking on the "stop" button. This may be useful if your Web browser is having problems accessing a specific Web site.

Feel free to spend a few minutes looking through Web pages. Note that, sometimes, you can guess the address for a Web page. For instance, the National Football League Web page is located at www.nfl.com. Many times, Web addresses are just the organizational name or an acronym of the organizational name. For instance, the Smithsonian Institution is www.si.edu. The Disney Company is www.disney.com.

(a later excerpt from script for participants who received exploratory training)

Some of the search engines available on the Web include Excite, Yahoo, Lycos, and Hotbot. Please enter the URL www.hotbot.com right now.

When you type in the Web address, you should see the Hotbot screen come up. Remember, when you use a search engine, you are using a database. You type in some words, and the search engine looks for matches in its database. You can type in anything—a name, a word, a complete phrase—in the box below the phrase "Search the Web."

Usually, the more information that you can provide, the better the results of the search. After you type in the words that you want to find in the search engine, look at the box below it. It may start out saying "all of the words." Look for the little arrow in the right-hand side of that box, and click once on that arrow. Note that it will bring up a list of choices for you. In this box, you specify what type of information you have put in the search box. The choices that you will use most often are "all the words, " "any of the words," "exact phrase, " and "the person."