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LEARNING FROM OUR MISTAKES: ERROR MANAGEMENT TRAINING FOR MATURE LEARNERS

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ABSTRACT: This research explored the effects of training goal (learning goal vs. performance goal) and training type (error management vs. error avoidance) on word processing skill acquisition with older workers. Sixty-seven participants were randomly assigned to one of four experimental conditions and attended two interactive tutorial training sessions. Results indicated that error management training lead to significantly higher performance test scores, learning quiz scores, and requests for assistance compared to error avoidant training. Additionally, learning goals generated significantly higher performance test scores and intrinsic motivation levels relative to performance goals. Other applications of error management training are discussed.

KEY WORDS: error management training; older workers; learning/performance goals.

As the new millennium unfolds, one of the greatest challenges facing organizations will be securing a workforce that is both technologically proficient and highly skilled (Cascio, 1995). One of the most prevalent technological changes in the workforce is the desktop computer. Comput-

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ers are becoming as common place in the office as desks and telephones (Office of Technological Assessment [OTA], 1985). In fact, the fastest growing job grouping in industry is computer and data processing services (Bureau of Labor Statistics, 1990; Cascio, 1995). The rapid and widespread introduction of this technology has left organizations with a growing need for skilled and proficient workers. Unfortunately, however, demographic projections indicate fewer qualified persons entering the workforce at the turn of the century (Goldstein & Gilliam, 1990). The shrinking labor market and the skill levels of potential employees suggests that organizations will increasingly turn towards training of both entry level and current employees to combat technical obsolescence (Cascio, 1995; Goldstein & Gilliam, 1990).

The challenges involved in developing effective computer training programs for the twenty-first century are likely to be compounded by demographic projections which indicate that the population most likely to be available for training will be over the age of 40 (Cascio, 1995; Noe, 1999; Sandell, 1987; Warr, 1994). Due to both the aging of the "baby boom" generation as well as the "baby bust" generation, it is expected that the number of older workers will steadily increase. In fact, it is anticipated that only 18% of the population will be between the ages of 20 and 29 by the year 2000 (Cascio, 1995; Sandell, 1987; Warr, 1994). Computer training programs will need to reflect these changing employee demographics. For example, research into the effects of aging on cognitive and performance changes shows that not all intellectual abilities decline with age (Horn & Hofer, 1992). While short-term memory and processing speed appear to decline with age, long-term memory and quantitative knowledge appear to increase throughout adulthood. Training programs will need to be geared to reflect research of this sort.

Certainly, in most cases, computer skills are not an option for older workers. Many older adults choose to remain on the job. Others are displaced and seek work where computer literacy is the norm (Sterns, Barrett, Czaja, & Barr, 1994; Timmerman, 1998). Given these trends, research on how to develop effective computer training programs for older adults would seem imperative. And yet surprisingly, computer training has not received the high priority the current market conditions suggests it should (Frese & Altmann, 1989). Historically, when new technology is introduced into the workplace, very little priority is given to training issues (Algera, Koopman & Vijlbrief, 1986; Cascio, 1995). When computer training is provided, common techniques such as interactive tutorials and videotape presentations are employed which tend to utilize formats that minimize error-occurrence. And yet, in order for computer training to be truly effective, it must acknowledge that errors will inevitably occur during training and on the job.

When one examines the training literature, it is clear that errors have been construed as having a negative effect on learning—producing strong emotional reactions such as stress and frustration. Trainees who experience these emotions may decrease computer activity, cease exploratory strategies and consequently depend on inefficient strategies. By integrating errors into the training process, these problems may be averted.

Frese and his colleagues have recognized the potentially positive function of errors and have developed an approach to training called "error management training" or EMT. EMT is predicated on the assumption that trainees should learn how to deal with errors rather than to avoid them (Frese, Albrecht, Altmann, Lang, Papstein, Peyerl, Prumper, Schulte-Gocking, Wankmuller, & Wendel, 1988; Frese & Altmann, 1989; Frese, Brodbeck, Heinbokel, Mooser, Schleiffenbaum, & Thiemann 1991). The goal of EMT is to help trainees redefine errors as learning opportunities for which emotional and cognitive coping strategies are available (Grief & Keller, 1990). To facilitate more effective behavioral and emotional coping strategies, EMT deliberately incorporates errors into the computer training program.

EMT is consistent with cognitive and action theories which argue that errors can increase knowledge of a system by enhancing the mental model (Koslowski & Salas, 1996; Neisser, 1976). By having the learner attend to errors and explore strategies to manage them, EMT training leads to a deeper and more enduring understanding of a system (Fischer & Lipson, 1986). EMT training allows for the exploration of the content through hypothesis-testing and problem-solving strategies. Such activities generally lead to the development of more efficient knowledge structures. The learner develops mental models that not only include optimal strategies, but also knowledge of strategies that are not optimal (Ivancic & Hesketh, 1996).

To encourage exploration, EMT uses a set of heuristics to help computer trainees re-frame errors into a more positive experience (Frese et al., 1991). Trainees are encouraged to view errors as a natural part of any training experience. The heuristics also reassure trainees that they can overcome the error situation. Additionally, trainees are encouraged to watch the computer screen and attend to changes as they occur. This re-framing tends to reduce the stress or frustration evoked by the error situation. Not consumed with negative feelings, trainees are better equipped to focus on developing effective strategies to extricate themselves from the error situation. In this way, trainees remain open to the environment and thereby maximize their learning (Morgan, 1997).

One of the clear strengths of EMT is that it explicitly acknowledges that while errors may be avoided during training, they are inevitable on the job site. Workers will invariably commit errors for a variety of reasons. First, not all computer system features can be taught during training, exposing workers to novel error situations. Second, software is frequently updated and new versions released which tend to be susceptible to "bugs." Finally, it is not uncommon for system malfunctions to occur placing employees into error situations.

Research by Frese and his colleagues has tested EMT against more traditional error-avoidant computer training formats. Using rather small German samples, Frese's research has yielded promising results. Error management trainees demonstrated significantly higher recall of computer commands, evidenced more competence in dealing with difficult tasks, and scored higher on overall performance rating compared to trainees in error-avoidant conditions. Additionally, EMT not only impacted skill acquisition, it also influenced trainees' moods. Results of mood and frustration scales indicated that those in EMT were less frustrated and evidenced a higher mood state than the error avoidant group by the end of the training.

Recent research by Nordstrom, Wendland, and Williams (1998) also has yielded positive EMT results. This study replicated Frese's research using a much larger sample of American citizens. Results indicated that computer trainees assigned to the error management group scored higher on a performance test, reported less frustration, and reported higher intrinsic motivation levels compared to the traditional error avoidant group.

Nordstrom et al. (1998) also investigated the impact that participants' goals for training had on their performance and emotional states. Nordstrom et al., suggested that EMT was very consistent with the "learning goal" construct described by Elliot and Dweck (1988). According to Elliot and Dweck (1988), learners often enter the learning situation with very different goals. Some possess "learning goals" while others possess "performance goals." Individuals with learning goals enter training with the goal to increase their ability and master new tasks. Errors are viewed by these individuals as opportunities to increase knowledge and develop their skill repertoire. Thus, errors are perceived as a natural and instructive part of training (Dweck & Leggett, 1988; Elliot & Dweck, 1988; Wood & Bandura, 1989). When confronted with errors, those with a learning goal orientation are more likely to request assistance in order to maximize learning. They are likely to view ability in terms of their own improvement and are less likely to use comparisons with others as a benchmark (Elliot & Dweck, 1988).

Those with a performance goal orientation to learning situations, on the other hand, show a distinctly different pattern. These individuals tend to seek affirmation of their competence and avoid negative judgments from others. Additionally, they seek to validate and document their ability as proof of their competence. Individuals who possess performance goal orientations prefer tasks that minimize errors and provide opportunities for intellectual proficiency. Errors, therefore, are viewed as deficits in performance and are evaluated as negative self-judgments (Dweck & Leggett, 1988; Elliot & Dweck, 1988). Due to the manner in which errors are construed, individuals with a performance goal orientation tend to be less likely to ask for assistance. Additionally, those with this orientation may actually avoid learning situations rather than risking errors (Wood & Bandura, 1989).

Although some research suggests that one's goal orientation toward learning may develop from a very early age (Diener & Dweck, 1978; Elliot & Dweck, 1988), there is some research which suggests that goal orientation may be amenable to manipulation in training contexts (Czaja, Hammond, Blascovich, & Swede, 1989; Wood & Bandura, 1989). Nordstrom et al., (1998) investigated manipulating trainees' goal orientations through the use of different training instructions. In addition to the positive EMT findings described above, Nordstrom et al., found that trainees who were encouraged to develop learning goals reported higher intrinsic motivation and were more likely to seek assistance during training than those in the performance goal conditions.

Nordstrom et al., findings indicate that EMT, in combination with learning goals, might provide an effective mechanism to help organizations meet their computer training needs. But as beneficial as EMT and learning goals appear to be, their utility for more mature trainees has yet to be established. On the face of it, there are many components of EMT which would seem conducive to the training needs of older workers. For example, the self-paced training associated with EMT may be beneficial to older workers in order to process new material more effectively (Belbin & Belbin, 1972). Older workers may need additional time to combat the interference of previously acquired skills. Additionally, the system exploration which is encouraged by EMT also would seem to advantage older workers. By allowing older workers the opportunity to explore a task in greater depth, workers are able to block old associations and build new schema (Czaja et al., 1989; Warr, 1994). Finally, by re-framing errors as a positive learning tool, older workers might be expected to benefit from the same reduction in stress and frustration that the previously researched populations experienced (Frese et al., 1991; Nordstrom et al., 1998).

In summary, while Nordstrom et al.'s, 1998 research utilizing EMT in combination with a learning goal orientation is promising, the age of participants was 17–20 years. Given the projected population distribution, this research needs to be expanded to determine if trainees over the age of 40 would similarly benefit from this training method. Thus, this research addressed the following question: How does type of training (error management vs. error avoidant) and type of training goal (learning vs. performance) affect training outcomes for workers over the age of 40? The following hypotheses were tested:

Hypothesis 1: Participants who receive EMT will perform better on a performance test than those receiving error avoidant training.

Hypothesis 2: Participants who receive EMT will perform better on a learning quiz than those receiving error avoidant training.

Hypothesis 3: Participants in the error management groups will evidence high frustration levels at the time 1 measurement and low levels of frustration at time 2 measurement as they gradually acquire acceptance and error coping skills. The error avoidant groups will evidence the opposite pattern of frustration levels.

Hypothesis 4: Participants who receive EMT or are assigned to a learning goal condition will report higher intrinsic motivation levels than those in error avoidant or performance goal conditions (i.e., a main effect of training and type of goal is posited).

Hypothesis 5: Participants assigned learning goals will ask for help more frequently than participants with performance goals.

METHOD

Participants

Sixty-seven participants took part in the study. Participants were recruited via an advertisement in a local community paper. The advertisement offered two free Microsoft Word software training sessions for those 40 years or above. This age group was selected because 40 years of age is the youngest age protected under the Age Discrimination in Employment Act (amended ADEA, 1978). Additionally, this age range has been estimated to be the largest employed group in the year 2000 (Warr, 1994). Participants' ages ranged from 40 to 80, with a mean age of 55.1. Participants predominantly came from the community at large with only one participant being a non-traditional student, in a large midwestern university. Seventy-two percent of the participants were female and 28% were male.

Participants were requested to apply for training only if they had little or no previous computer experience. The majority of participants (58%) had access to a computer and used it daily or more than once per day. Fifty-seven percent of the sample indicated that they had "never used" a word processing program or had used a word processing program "very little." Twenty-four percent had used a word processing program "some" and 18% indicated "considerable usage."

In terms of specific experience with Microsoft Word, 48% of the participants had "never used" any version of Microsoft Word, 28% of the participants responded using Microsoft Word "very little." Eighteen percent had "some" Microsoft Word experience while only 6% rated themselves as having "considerable usage."

Free word processing lessons were the only incentives offered participants. All participation was voluntary and all participants were treated in accordance with the American Psychological Association's guidelines (1994).

Procedure

All participants took part in two training sessions. A maximum of twenty participants attended each session and each group attended two separate sessions. Each session was scheduled for approximately two hours. All training sessions were conducted according to a self-paced format. The same instructor was present for all sessions, and was not informed of the research hypotheses until after all data had been collected.

The experiment utilized a double blind, 2×2 factorial ANOVA design. The two factors were goal type (learning vs. performance) and training type (error management vs. error avoidant). The four conditions were: learning goal/error management, learning goal/error avoidant, and performance goal/error management and performance goal/error avoidant.

Prior to the first session, participants were randomly assigned to one of the four experimental conditions. All participants in the same session were involved in the identical experimental condition. Before session one commenced, participants were asked to sign the informed consent form and were asked to complete a demographic questionnaire.

Experimental Manipulations

Manipulation of the training goal (learning or performance) was accomplished by providing participants with different training instructions. Instructions for the error management and error avoidant conditions were replicated from the Nordstrom et al. (1998) study, which were based on those used by Frese et al. (1991) and Wood and Bandura (1989). Participants randomly assigned to each condition both heard (the instructor read the instructions prior to each class) and read (each participant received a written copy of the instructions) a different set of instructions.

EMT/Learning Goal instructions emphasized that the trainee's goal was computer mastery and individual improvement. Moreover, the instructions stressed the benefits of making errors and presented trainees with four heuristics (see Figure 1) to help them cope with errors.

EMT/Performance Goal instructions stressed that the trainee's goal was to demonstrate high performance relative to other trainees and also mentioned that computer performance was diagnostic of intellectual ability. The instructions further informed trainees of the benefits of making errors and presented the four heuristics.

Error Avoidant/Learning Goal instructions again emphasized skill mastery and individual improvement but stressed that errors inhibit learning and were to be avoided during training.

Error Avoidant/Performance Goal instructions again stressed maximum performance relative to other trainees. The instructions noted that acquiring computer knowledge is diagnostic of intellectual ability. Additionally, trainees were told that errors inhibit learning and are best avoided.

In addition to written instructions, trainees in the EMT conditions were exposed the four heuristics presented on an overhead during training.

Sessions

During the first session, participants were read the instructions and were provided time to become familiar with the keyboard. The keys that were of special note are: ESC, ARROW KEYS, ENTER, BACKSPACE, and SPACE BAR. Additionally, participants were familiarized with function keys, the mouse, and the mousepad. Participants were then asked to begin training by following the written instructions provided in a training manual.

If questions arose during training, participants were asked to raise place a sheet of colored paper in a container next to their computer and the instructor would come to them. Research assistants kept a record of

Figure 1
Error Management Training Heuristics

1. I have made an error. Great!
2. There is a way to leave the error situation.
3. Look at the screen.
4. I watch what is on the screen and what is changing.

each participant's requests for help. Participants then began the computer training.

After the first session was completed, participants were asked to return all materials to the instructor. They were told that they may keep the instruction manual following the completion of the second session. Participants were then thanked for their attendance and reminded of their next session.

The second session took place one week later and commenced in the same manner as the first. Participants were again given the instructions appropriate for their condition and were provided time to re-familiarize themselves with the keyboard. If the session was an error management session, the four heuristics were again displayed on an overhead projector. Lastly, participants were asked to follow the written instruction in their manual until they completed the computer training begun in the first session.

At the end of the second session, a "forced error session" was introduced. During this period, participants were confronted with an error situation. The participants were asked to perform corrections to text based on the skills they had acquired during training. The error-avoidant group was provided with step-by-step solutions to these corrections. The error management group received no written solutions. The error management group therefore had to find the solution to the error situation by themselves.

After the completion of the error session, two measures were administered. Participants were asked to complete an emotional response questionnaire and a manipulation check. Participants also completed a performance quiz. The performance quiz required participants to once again edit text similar to the error session however, in this case, no group was provided with solutions. Following completion of the performance quiz, participants completed the Mayo Intrinsic Motivation Questionnaire and a second administration of the emotional response questionnaire. Finally, participants were debriefed and thanked for their participation.

Measures

The mean, standard deviation and reliabilities for each scale used in the study, as well as the intercorrelations for the sample, can be found in Table 1. The following dependent measures were administered to participants:

Demographic Questionnaire. Participants were asked to complete a brief demographic questionnaire. This questionnaire was based on a similar questionnaire used by Nordstrom et al. (1998). Information was solicited

Table 1
Intercorrelations for Entire Sample

Scale	1	2	3	4	5	6	7	8	9	10	11	12	13
1 age	—												
2 gender	–.31*	—											
3 access	–.22	.02	—										
4 wpexp	–.07	.06	.46**	—									
5 wdexp	–.16	.09	.35**	.48**	—								
6 quest	.24	.29*	–.40**	–.16	–.15	—							
7 perf	–.52**	.14	.35**	.45**	.20	–.30*	(.90)						
8 quiz	–.49**	.13	.32**	.30*	.12	–.19	.50**	(.56)					
9 Mayo	–.06	.01	.10	.08	.08	–.36**	.07	.07	(.94)				
10 ER1	.04	.07	–.25*	–.47**	–.34**	.25*	–.20	–.25*	–.34**	(.78)			
11 ER2	.16	.01	–.29*	–.46**	–.24	.33**	–.26	–.38**	–.50**	.71**	(.78)		
12 TG	–.23	.14	.14	.20	.26*	–.33**	.33**	.17	.33**	–.25*	–.38**	(.36)	
13 TT	–.22	.15	.09	.28*	.03	.21	.45**	.36**	–.10	–.15	–.21	.22	(.89)

Note. age = participants' age, gender = participants' gender, access = whether participants had access to a computer, wpexp = degree of word processing experience, wdexp = degree of Microsoft Word experience, quest = number of questions posed during training, perf = total points on the computer performance test, quiz = total points on the learning quiz, mayo = Mayo Intrinsic Motivation Questionnaire score, ER1 = emotional response questionnaire score (first administration), ER2 = emotional response questionnaire score (second administration), TG = total score on the Training Goal manipulation check items, TT = total score on the Training Type manipulation check items.

Coefficient alphas are reported on the matrix diagonal.

$^{*}p < .05$, $^{**}p < .01$.

regarding gender, age, access to computers, and previous computer experience.

Emotional Response Questionnaire. This five-item scale was used in the Nordstrom et al. (1998) study and was based on a similar questionnaire used by Frese et al. (1991). It was designed to measure the emotional responses of participants to error situations. The questionnaire was administered twice: a) immediately following the forced error session and b) following the performance quiz. Scores could range from 6–42. Low scores were indicative of low levels of frustration.

Goal/Training Manipulation Checks. A thirteen-item questionnaire developed by Nordstrom et al. (1998) was used to confirm the effectiveness of the experimental manipulations. Six items examined whether those assigned to the learning goal conditions believed it was their aim to develop mastery of the task. The score range for this component is 6–42 with higher scores associated with learning goal orientations and low scores associated with performance goal orientations. Seven items were used to examine whether error management training and error avoidant training participants viewed errors differently. Scores on this measure could range from 7–49 with low scores indicating an error avoidant view of errors and high scores indicating an error management view of errors. The measure used a 7-point Likert response scale with "strongly disagree" and "strongly agree" as anchors.

Mayo Intrinsic Motivation Questionnaire. This questionnaire consisted of 23 questions and used a 7-point Likert response scale format. The maximum score of 161 indicates the highest intrinsic motivation level possible. In previous research the scale has demonstrated acceptable properties reporting an internal consistency of $r = .93$ (Mayo, 1977), and split-half reliability of $r = .96$ (Fisher, 1978). Construct validity had been supported by results in a direction consistent with predicted cognitive evaluation theory (Fisher, 1978; Mayo, 1976). These results indicate the Mayo questionnaire was both a reliable and valid measure of intrinsic motivation.

Learning Quiz. The Learning quiz consisted of 10 items that sampled knowledge of key combinations used in word processing functions. The format was multiple choice . For each item, participants' responses were judged as correct (1) or incorrect (0). Scores on the quiz ranged from 0–10.

Performance Test. The performance test was developed to measure post-training word processing knowledge. It consisted of fourteen different questions that required students to perform a variety of tasks and functions on the computer screen to an assigned text (e.g., spell check the document). Trainees received one point for each question they completed correctly. Students were not provided assistance during the performance quiz. Scores ranged from 0–14 with higher scores indicative of higher performance levels.

Material

Instruction Manual. A twenty-page manual was issued to each participant. The manual covered: creating a document, typing text, reviewing the status and command bars, naming a document, saving, moving through a document, editing text, bold and italic functions, inserting text, retrieving files, copying and moving text, the undo function, and spell check.

Equipment

Participants completed their training at a workstation connected via a local area network. Each station was equipped with an IBM computer and a color monitor, and the seating was arranged so that the participants viewed the screen from a distance of approximately 20 inches. The software used during the training was Microsoft Word, (version 6.0).

RESULTS

Manipulation Checks

As expected, EMT trainees reported more positive feelings regarding making errors ($M = 42.48$; $SD = 6.14$) compared to error trainees ($M = 26.78$; $SD = 9.72$) (t ($df = 4$)) = –7.75; $p < .001$) (see Table 1 for correlations). Additionally, participants in the learning goal conditions were more likely to report that their goal in training was to master the material and improve their individual performance ($M = 33.54$; $SD = 5.68$) relative to participants in the performance goal conditions ($M = 29.63$; $SD = 5.60$) (t ($df = 4$) = –2.84; $p < .01$.)

Hypothesis 1

As predicted, an ANOVA revealed that EMT participants successfully completed more task assignments on the performance test ($M = 10.98$; $SD = .65$) than those under error avoidant conditions ($M = 6.05$; $SD = .60$) (F (1, 63) = 30.70; $p < .001$; eta^2 = .33). Though not predicted, there was a main effect for goal type (F(1, 63) = 5.13; $p < .05$; eta^2 = .08). Participants assigned to learning goal conditions successfully completed more task assignments ($M = 9.52$; $SD = .61$) than those under performance goal conditions ($M = 7.50$; $SD = .64$). The interaction between goal type and training type was not significant ($F(1, 63) = .05$; $p > .05$).

Hypothesis 2

As hypothesized, an ANOVA revealed a significant main effect for training type ($F(1, 63) = 9.01$; $p < .01$; $eta^2 = .13$) for participants' learning quiz scores. EMT participants scored significantly higher on the learning quiz ($M = 7.96$; $SD = .35$) than participants in the error avoidant conditions ($M = 6.55$; $SD = .32$). Goal type was not a significant main effect ($F(1, 63) = .38$; $p > .05$). Additionally, the interaction term failed to reach significance ($F(1, 63) = .04$; $p > .05$).

Hypothesis 3

Contrary to what was hypothesized, results from a repeated ANOVA did not find a significant Training Type × Time interaction ($F(1, 63) = .02$; $p > .05$) for participants' frustration scores across time. Additionally, none of the between subject effects nor the within subject effects achieved statistical significance.

Hypothesis 4

Contrary to the hypothesis, training type did not emerge as a significant main effect ($F(1, 63) = 2.44$; $p > .05$) for participants' intrinsic motivation scores. However, consistent with predictions, goal type was a significant main effect ($F(1, 63) = 3.84$; $p < .05$; $eta^2 = .06$). Those assigned to the learning goal conditions reported significantly higher levels of intrinsic motivation ($M = 135.56$; $SD = 3.18$) compared to those in the performance goal conditions ($M = 126.55$; $SD = 3.33$). The interaction term between training type and goal type did not reach statistical significance ($F(1, 63) = 3.26$; $p > .05$).

Hypothesis 5

Contrary to the hypothesis, there was no main effect for goal type ($F(1, 63) = 1.87$; $p > .05$) on the number of requests for assistance participants made. However, there was a main effect for training type ($F(1, 63) = 6.03$; $p < .05$; $eta^2 = .09$). EMT participants ($M = 8.77$; $SD = .71$) requested help more frequently than did participants under error avoidant conditions ($M = 6.41$; $SD = .66$).

DISCUSSION

Our results indicate that EMT had beneficial effects on the performance test scores, learning quiz scores and requests for assistance of mature learners. Furthermore, learning goals promoted high computer performance levels and fostered intrinsic motivation in our sample. It also is worth noting that the significant effects found in this study explained a non-trivial amount of variance in the dependent measures. The effect sizes across dependent measures ranged from 6–33%.

Although EMT and learning goals showed positive effects on the majority of dependent measures, participants' frustration levels failed to show any experimental effects. The failure to find effects may be due to environmental factors. While this study was conducted in an environment similar to traditional training settings, it was still a controlled environment. For instance, participants were allowed to complete training without the interruptions that might occur in work settings. Furthermore, participants were aware that they were part of a research study and not in a job training session. Participants' frustration levels might be elevated in a job-training environment where training success (or failure) has real organizational consequences.

While the results from this study paint a positive picture for integrating error management and learning goals into computer training situations, results must be considered in light of experimental design limitations. First, the motivation and educational levels of the group may have differed relative to another sample of older adults. In terms of motivation, the participants in this study answered an advertisement in the local community paper and were required to attend two, two-hour evening courses. Taking the initiative to answer the advertisement and to attend the classes may have resulted in a highly motivated sample. Indeed, this sample evidenced high motivation scores across all conditions. Regarding education, this research was conducted on a large mid-western university campus in a community where the population distribution may have been skewed towards possessing higher levels of education. Unfortunately, educational experience was not requested on the demographic questionnaire and, therefore, it was not possible to determine if this sample was representative of the population at large.

Second, the experimental effects may be more pronounced for certain age ranges. In support of this, analysis of the data revealed negative correlations between age and performance test scores as well as age and learning quiz scores. Certainly, the age span of this sample was quite large with a minimum age of 40, a maximum age of 80, and a mean age of 55.1. Thus, the effects of training type and training goals may be more concentrated or diffused across certain age ranges. However, the sample size precluded the analysis of results for certain age ranges. Future research might examine the effect of EMT and learning goals in samples more homogeneous in age.

Finally, based on this study, managers may be inclined to adopt an error management/learning goal approach to training. If so, they may want to consider some practical issues. First, organizations may have to invest additional training time. EMT elongates up-front training time because trainees are encouraged to work through encountered errors independently. Additionally, results of this study indicate that those in EMT conditions asked more questions than did error avoidant trainees, which also might add to time spent in training. However, the amount of additional training time need not be substantial. During this study, both error avoidant and error management participants completed the training within the two-hour time limit with very little variance in completion times. Moreover, computer performance tests and learning quiz results suggest that organizations might actually show an overall saving of time as potentially costly and time consuming "on-the-job" errors are decreased. A second practical issue has to do with organizational climate. In order for the positive effects of EMT and learning goals to be fully realized, the behaviors and cognitive strategies learned during training need to be nourished back on the job. In other words, the positive framing of errors and the encouragement of system exploration cannot be restricted to training settings.

Although this study focused on computer skill acquisition in mature learners, EMT may prove useful in the training of other skills and with other worker populations. For example, EMT seems particularly applicable for the training of important interpersonal skills (i.e., employee discipline situations). Management trainees may benefit from actually making interpersonal blunders, exploring these problematic communications and then developing more effective strategies for dealing with discipline problems. Using this approach, managers may have a better understanding of what strategies work and which do not in employee relation situations. EMT also may extend to other worker populations. One underrepresented group, for instance, that may benefit from EMT is the developmentally disabled (Denton, Feaver, & Spencer, 1986). Just like older adults, this group is expected to comprise an increasingly large segment of the US workforce by the year 2010 (Sandell, 1987). And just like older adults, this group may benefit from training programs which allow more time per session, anticipate frequent requests for assistance, and are "user friendly" (Nurius, 1990). Future research might explore the generalizability of EMT to other workplace skills and populations.

In conclusion, as we begin the new millennium, the rapid influx of computers into organizations shows no signs of slowing. If organizations are to stay abreast of these changes, they must obtain a workforce versed in computer skills (Bureau of Labor Statistics, 1990; Cascio, 1995). The forecasted labor shortages, due to the baby bust generation, will force organizations to turn less towards selection and more towards training (and retraining) if they are to meet their technological needs (Cascio, 1995; Goldstein & Gilliam, 1990). Couple this trend with the trend toward greater adult longevity and vitality (Quinnones & Ehrenstein, 1996) and it soon becomes apparent that organizations will require research to help them design effective computer training programs for lifelong learners (Baldi, 1997; Charness, Schumann, & Boritz, 1992). EMT and the inclusion of learning goals into training programs may be steps in the right direction. Our results combined with this those of Frese and his colleagues (1988, 1991) and Nordstrom et al. (1998) indicate that human beings not only to learn from being allowed to make mistakes, they seem to learn best when *encouraged* to make mistakes.

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