2007

# Error training: an examination of metacognition, emotion control, intrinsic motivation, and knowledge as mediators of performance effects

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# ERROR TRAINING: AN EXAMINATION OF METACOGNITION, EMOTION CONTROL, INTRINSIC MOTIVATION, AND KNOWLEDGE AS MEDIATORS OF PERFORMANCE EFFECTS

A Dissertation

Submitted to the Graduate Faculty of the
Louisiana State University and
Agricultural and Mechanical College
in partial fulfillment of the
requirements for the degree of
Doctor of Philosophy

in

The Department of Psychology

by
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August 2007

ACKNOWLEDGEMENTS

I would like to give thanks to everyone who helped make this project a success.  I am especially grateful to my parents for their support and encouragement--this would not have been possible without you.  I would also like to thank my husband for his patience and support throughout this project.  I would like to especially thank Jim Diefendorff for advising this project from afar, without his input and encouragement it would not be the successful project that it is.  Thank you to my committee members: Tracey Rizzuto, Jason Hicks, Amy Copeland, and Bob Mathews for their ideas on ways to improve the project.  I would also like to thank Warren Liao, the dean's representative assigned to my committee, for his interest in the project.

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ABSTRACT

Error Management Training (EMT) is a method of training that encourages trainees to make errors during training and to view those errors as beneficial for learning. Previous research has shown support for the benefits of EMT on metacognition, emotion control, intrinsic motivation and transfer performance compared to traditional error avoidant training. Also, previous research has found support for the mediating effects of metacognition and emotion control on the training type (i.e., EMT vs. error avoidant) and transfer performance relationship. However, previous research has not determined whether the increased metacognition, emotion control, and intrinsic motivation of EMT individuals has its effects on transfer performance through only increased knowledge or whether the effects are partially independent of knowledge differences. Therefore, the purpose of the current study was to examine whether the increased metacognition, emotion control, and intrinsic motivation that result from EMT influence transfer performance holding constant any differences in knowledge acquisition. The proposed investigation manipulated the knowledge that individuals acquired from the training such that participants in the EMT group and an error-tailored avoidant group were exposed to the same information during training. These two groups were compared to participants in a control group who received error avoidant training. Consistent with the hypotheses, participants in the EMT group had higher levels of metacognition, emotion control and intrinsic motivation than participants in the error-tailored avoidant group. Results of the study suggested that participants in the EMT group had more task knowledge than participants in the error avoidant group, but did not differ from participants in the error-tailored avoidant group. Similar to previous studies, the current study showed that participants in the EMT condition demonstrated higher levels of transfer performance than the error avoidant or the error-tailored avoidant training conditions. A comparison of the EMT and the error avoidant training groups showed that the effect on transfer performance was partially mediated by task knowledge and a comparison of the EMT and the error-tailored avoidant groups indicated that the effect on transfer performance was mediated by emotion control. Implications, limitations, and areas for future research are discussed.

# INTRODUCTION

Technological advances have made jobs more cognitively complex and demanding (Goldstein & Ford, 2002). Advances in technology have also increased the pace of change making today's work environment less structured and more dynamic. Due to these changes, organizations must rely on workplace learning to gain a competitive advantage (Goldstein & Ford). There also has been a growing awareness that many traditional training tools and principles are not appropriate to meet these emerging challenges (Hesketh & Ivancic, 2002). Traditional training methods assume that the workplace is stable and predictable, that the necessary knowledge and skills are easily identified and remain constant over time, and that providing individuals with training on the needed knowledge and skills will result in improved job performance (Smith, Ford, & Kozlowski, 1997). However, the reality is that many work environments today are, for the most part, unpredictable and in a continuous state of change; the knowledge and skills needed to perform many jobs must be adapted and updated frequently; and routine expertise may not allow for the adaptability necessary for today's dynamic work environment (Hesketh, 1997; Hesketh & Ivancic, 2002).

Due to the limitations associated with several of the principles and methods used in traditional training, in recent years much attention has been devoted to developing new instructional techniques that are better suited to meet these emerging training challenges (Hesketh & Ivancic, 2002). Active learning is one method of training that may have considerable potential (Keith, 2005). Active learning is a general term that refers to a type of instructional strategy designed to involve trainees and encourage them to become active participants in the learning process (Hesketh & Ivancic, 2002). Active learning encourages mindful, effortful learning and systematically influences instructional, motivational, and emotional processes that are vital to the development of adaptable, generalizable skills (Keith, 2005). Interest in active learning strategies has increased as research has demonstrated that they frequently lead to increased performance and better transfer of skills (e.g., Frese, 1995; Ivancic & Hesketh 1995; Nordstrom, Wendland & Williams, 1998).

One popular active learning strategy that has received considerable attention is error management training (EMT). EMT is a method of training that promotes trainee learning by enabling them to make errors during the training process. This type of training can be contrasted with the more typical error avoidant training, which encourages trainees to follow step-by-step instructions and to not deviate from the correct way of working on a task. Research has shown strong support for the notion that making errors during the learning process may decrease performance during the training session, but increase performance in the transfer environment (Hesketh, 1997; Ivancic & Hesketh, 1995; Schmidt & Bjork, 1992). A number of reasons have been suggested as to why experiencing errors during training is beneficial (Frese, 1995; Sitkin, 1992). For example, Frese (1995) and Keith and Frese (2005) argued that errors lead to more exploration during training, increased metacognition, increased emotion control, and increased intrinsic motivation, each of which benefit transfer performance. The greater exploration is thought to lead to better task knowledge (Dorman & Frese, 1994). However, it has been implied in past research (e.g., Keith & Frese, 2005; Nordstrom et al., 1998) that the increased metacognition, emotion control, and intrinsic motivation that occur during EMT affect transfer performance directly. That is, thinking more about how one is doing, controlling one's emotions, increased task interest and persistence are thought to impact transfer performance through increased knowledge and also independent of the knowledge gained during training. However, the possible independent effects of these mediating processes on transfer performance has not been put to an adequate test as no past research has tried to measure or control for knowledge differences while still examining the effects of metacognition, emotion control, and intrinsic motivation. It is important that this issue is examined because if EMT simply leads to better knowledge than error avoidant training, it might be argued that the error-avoidant individuals simply need more instruction to attain the same performance as the EMT participants. However, if EMT yields benefits that are independent of the knowledge gained during training, then EMT can be said to have advantages that traditional error avoidant training cannot provide. Thus, the purpose of the proposed investigation is to examine whether the increased metacognition, emotion control, and intrinsic motivation that result from EMT influence transfer performance holding constant any differences in knowledge acquisition.

## Error Training

Errors are a natural part of work. Research has shown that experts make just as many errors as novices (Zapf, Brodbeck, Frese, Peters & Prumper, 1992). One study examined error occurrences in office workers using computers and found that approximately 10% of their time on the computer was spent handling errors (Brodbeck, Zapf, Prumper, & Frese, 1993). However, because of the level of experience of these employees, they were able to deal with 89% of the errors themselves. Because errors are going to occur in the workplace, it is beneficial for trainees to encounter error situations during training so that they may develop the knowledge and skills needed to handle errors once they are out of the training environment (Frese & Altmann, 1989).

EMT is a form of training which views the trainee as an active learner instead of a passive recipient of information. EMT provides trainees with opportunities to make errors and even encourages them to make errors. In EMT, trainees are given little direct instruction on performing the focal task, but they are taught to see errors positively and to use errors as an opportunity to learn.  This is in contrast to typical training, which tends to be error avoidant, moving trainees through the training material in such a way that they are not able to make any errors or explore new ways of working on the task (Frese, Brodbeck, Heinbokel, Mooser, Schleiffenbaum, & Thiemann, 1991).  Such training is consistent with conventional wisdom like "perfect practice makes perfect."

An early study conducted by Dorman and Frese (1994) is an example of research examining the benefits of EMT over error avoidant training.  In this study, the authors compared the effects of the two training methods on the transfer performance of individuals learning to use a statistical software package, SPSS. Although both groups performed the same training tasks, they went through these tasks in very different ways.  At the start of the training session, error avoidant trainees received written instructions describing each step and the commands to be used.  Error avoidant trainees were discouraged from making any errors or deviating from the instructions in any way.  If trainees did make errors, the experimenter corrected the errors for them.  On the other hand, the EMT group was not provided with any detailed instructions to guide them through the training.  At the beginning of their training they were encouraged to make errors as they went through the training tasks and they were provided with cognitive strategies to manage their errors, such as seeing errors as beneficial for learning.

Participants in Dorman and Frese (1994) then performed three transfer tasks, one easy, one of average difficulty, and one difficult task.  Participants received a performance score for each task.  Three criteria were used to evaluate performance: whether the problem in the transfer task was solved, the time it took to solve the problem, and how similar the solution was to the correct solution (i.e., did the solution follow the preferred way of solving the problem).

Consistent with expectations, results of the study showed that the participants in the EMT group did not differ significantly from the error avoidant trainees in their performance on the easy transfer task, but they did perform significantly better on both the average and difficult transfer tasks. These findings demonstrated that EMT is most beneficial for difficult transfer tasks.

Since this early study by Dorman and Frese (1994), there have been other studies demonstrating that making errors during training is beneficial. For example, Ivancic and Hesketh (2000) compared the effects of EMT and error avoidant training on training transfer using a driving simulator task. They found that participants in the EMT condition made fewer errors during the transfer task (driving test) than participants in the error avoidant condition. Another study by Wood, Kakebeeke, Debowski, and Frese (2000) found that EMT participants trained to perform a CD-ROM Database search performed better on the transfer task than participants receiving error avoidant training. More recently, Keith and Frese (2005) compared the effects of EMT on adaptive transfer and analogical transfer tasks. Adaptive transfer tasks require the application of knowledge gained during training to a novel task. Analogical transfer tasks ask participants to perform a task similar to the one worked on during training. It is believed that adaptive transfer is more beneficial to trainees than analogical transfer once they have returned to the workplace. Keith and Frese found that EMT was more effective for the adaptive transfer task than the analogical transfer task.

A recent meta-analysis examined the overall effectiveness of EMT (Keith, 2005). Twenty-three studies were included with a total of 1,981 participants. Overall, the findings indicated that EMT leads to better performance than other forms of training, with a mean effect size of 0.44 (Cohen's *d*). EMT was found to be equally effective for college students, employees, and older adults, suggesting that the benefits are not constrained to a particular population. The results of Keith did find that EMT is more effective when performance is evaluated using an adaptive transfer test (i.e., trainees apply knowledge gained during training to a novel task) compared to an analogical transfer test (i.e., test requiring trainees to use problem solutions that are the same as those used during training) and compared to using the final training task as a measure of performance. The findings from this meta-analysis provide convincing support for the positive effects of EMT on performance. However, what is not clear from this meta-analysis is how EMT improves performance. A variety of reasons have been suggested. These proposed mediating processes are discussed in the following section.

## Mediating Processes

Several variables have been suggested as mediators of the effects of EMT on performance. These variables include metacognition, emotion control, and motivation. While there is convincing evidence that these variables mediate the effects of training condition (e.g., EMT versus error avoidant training) on transfer performance, what is not clear is if these mediating variables lead to better transfer performance through increased task knowledge or whether they have direct effects on transfer performance. That is, it is unknown whether there is some independent effect of metacognition, emotion control, and motivation on transfer performance independent of increased task knowledge or whether the effects of these variables are completely mediated by task knowledge. Research on each of these mediating variables is reviewed below. Knowledge acquisition is discussed first, followed by metacognition, emotion control, and intrinsic motivation.

Knowledge. It is believed that encouraging trainees to learn from errors during training is beneficial because it leads to exploratory behavior and creative solutions (Frese & Altmann, 1989). This exploration of different solutions leads to more and better task knowledge. Sitkin

(1992) describes errors as signals that lead individuals to take risks, experiment, and try new routines. In contrast, the absence of errors sends a message that there is no need to seek out alternative strategies or to make adaptations (Sitkin, 1992). Sitkin noted that without failure, learners tend to become risk averse and have a decreased desire to experiment with alternative ways of working on the task. As a result, individuals who do not experience failure (i.e., errors) may learn less about the task.

An inherent quality of EMT is that trainees make errors, which lead them to explore the system. Exploration results in being exposed to more aspects of the task, which allows trainees to become more knowledgeable about the system on which they are being trained and to develop their own strategies for working on the task. Frese (1995) notes that by exploring the system, trainees are exposed to information that may not be necessary to complete the training task, but that can be useful for the transfer task. The key point here is that individuals in the EMT condition explore more and therefore have more task knowledge than error avoidant individuals, and this knowledge may prove beneficial when faced with novel work conditions.

Dorman and Frese (1994) examined whether differences in task exploration might explain the effects of training condition (EMT vs. error avoidance) on transfer performance. The role of exploration was examined for both the error avoidant group and the EMT group because it was found that some error avoidant individuals engaged in exploration, even though they were instructed not to. The researchers hypothesized that participants in the error avoidant group who did not follow the instructions and explored the task would demonstrate better performance on the transfer task. Essentially, the unauthorized exploration would lead these individuals to experience some errors during training and make them perform more like the EMT group. In the EMT group, exploratory behavior was considered to be anything beyond the set of commands that they were given. Participants in the error avoidant group who ignored the instructions and explored during training demonstrated better transfer performance than error avoidant trainees who did not explore. A positive relationship was also found between exploration and transfer performance for participants in the EMT group. Although participants in the EMT group who explored more demonstrated better performance, the participants in the error avoidant group who explored more demonstrated performance levels similar to the participants in the EMT group who explored little. Results of this study showed that although exploration reduced differences in transfer performance between the EMT and error avoidant training groups, some performance differences remained. This finding suggests that another mechanism besides exploration may be contributing to the increased performance seen with EMT.

Metacognition. Metacognition involves the maintenance and control over one's thoughts through processes which include planning, monitoring, and evaluating one's progress (Brown, Bransford, Ferrara, & Campione, 1983; Flavell, 1979). Kluwe (1982) identified two characteristics of metacognitive activity. First, the person possesses some knowledge with regard to his/her own thinking and that of others around him or herself. Second, an individual may monitor and regulate the path of his or her own thinking. This second attribute, which Kluwe referred to as executive processes, consists of an individual monitoring and regulating other thought processes. Executive monitoring processes involve a person's decisions, which aid in identifying the task on which he or she is currently involved, evaluating the progress of his or her work, and making predictions regarding the outcome of that progress. Executive regulation processes involve a person's decisions to allocate resources to the task at hand, to determine the sequence of steps to be taken in order to finish the task, and to set the intensity or the pace at which he or she will work.

It has been suggested that errors in training may help to increase metacognitive activity, which then leads to improved transfer performance (Keith & Frese, 2005). The initiation of metacognitive activity is expected when an individual adopts a difficult goal and believes that he or she possesses the skills and abilities needed to achieve the goal (Kanfer & Ackerman, 1989). EMT may help to improve metacognition because it creates an environment that allows individuals to set goals, and their errors may serve as feedback indicating a discrepancy between their goal and their current state. Metacognition may also be very important for this type of training because EMT is unstructured and offers little external guidance (Schmidt & Ford, 2003).

Keith and Frese (2005) examined the role of metacognitive activity as a mediator in the relationship between EMT and transfer performance. Participants were trained to create PowerPoint slides and their performance was measured by how closely the slide they created matched an example slide. The authors found support for EMT increasing metacognitive activity, and the increase in metacognitive activity led to better adaptive transfer performance (i.e., applying knowledge gained during training to a novel task). This study demonstrated that metacognition is another process through which EMT leads to better transfer of training outcomes. However, what is not clear is whether these changes in metacognitive activity during learning simply led to better knowledge, which led to better performance, or whether they have some effect on transfer performance that is independent of knowledge. For instance, it may be the case that increased planning and monitoring, as well as evaluation of progress during task completion helped individuals perform the transfer task.

<u>Emotion Control.</u> It has been argued that it is not the error itself that is problematic, but rather, the trainee's reaction to the error that can be detrimental (Frese, 1995). Therefore, one argument against making errors during learning is that errors may lead to feelings of anxiety and

frustration and that these feelings can inhibit performance (Frese et al., 1991). Kanfer & Ackerman (1996b) argued that these negative emotions compete for cognitive resources, leaving individuals fewer resources to use in working on the primary task – in this case learning something during training.

Frese et al. (1991) examined whether EMT leads to increased negative emotions compared to error avoidant training. Frese et al.'s results indicated that trainees who were encouraged to make errors during training did not demonstrate increased frustration during training. However, participants in the error avoidant group experienced an increase in frustration during the training session. The authors argued that this effect may have occurred because the EMT participants were taught to view errors as a positive thing and learned how to deal with them from the start of the training program. On the other hand, participants in the error avoidant group were given a manual at the start of the program and were taught only to perform certain tasks. Then, later during the training program the manual was removed and they had to remember the previously learned information. Therefore, it was argued that the participants in the error avoidant group experienced frustration because they were unable to recall the passively learned information and did not have error handling strategies. Thus, Frese (1995) suggested that teaching trainees strategies to manage their frustration when errors occur can be beneficial for them even after they have left the training environment.

Heimbeck, Frese, Sonnentag, and Keith (2003) examined the effects of EMT in combination with error management strategies in teaching people to use Excel software. The error management instructions informed trainees that errors are a natural part of the learning process and that errors should be seen as an opportunity to learn something new and explore the task (Dorman & Frese, 1994; Gully, Payne, Koles, & Whiteman, 2002; Heimbeck et al., 2003).

Providing these additional instructions at the start of the training session was seen as a way to reduce some of the negative effects of errors (e.g., worry, stress, rumination, or negative self-appraisals; Heimbeck et al., 2003; Reason, 1990). This study found that trainees receiving EMT and error management instructions performed better on the post-test and the transfer task than trainees who received error avoidant training or EMT without error management instructions. Therefore, it seems that telling trainees that it is okay to make errors helps to reduce the negative consequences associated with making errors.

Recently, a study by Keith and Frese (2005) examined the effects of training type on emotion control. Emotion control involves attempts to minimize performance anxiety and frustration that can accompany errors in skill acquisition (Kanfer & Heggestad, 1999) and was assessed with a self-report measure after completion of the transfer performance task. Participants in this study were trained to create PowerPoint slides with either EMT or error avoidant training. Training performance was evaluated based on how closely a trainee's slide matched an example slide. Results demonstrated that participants in the EMT condition had more emotion control, performed better on the performance task, and had a relationship between the type of training and transfer performance fully mediated by emotion control. This finding indicates that emotion control is another process through which EMT leads to improved transfer performance. However, what is not known from this study is whether emotion control simply led to better knowledge (which led to better performance) or if it had some effect on transfer performance that is independent of knowledge (e.g., people perform better on the transfer task because they have more cognitive resources available).

<u>Intrinsic Motivation.</u> It has been proposed that motivation is one process through which EMT may affect transfer performance (Frese, 1995). That is, individuals in the EMT group

experience greater motivation than individuals in the error avoidant group, and this difference in motivation affects transfer performance. Kanfer and Ackerman (1989) define motivation as the direction of attention (i.e., choice of tasks), the amount of effort directed to a task, and the extent to which effort is maintained over time (p. 661). Research in EMT has focused specifically on intrinsic motivation, which refers to performing an activity simply because it is interesting or enjoyable (Ryan & Deci, 2000a). Cognitive evaluation theory has focused on specifying factors that will enhance intrinsic motivation (Ryan & Deci, 2000b). This theory argues that social-contextual events such as feedback and rewards will lead to feelings of competence while performing a task, and this greater sense of competence will enhance intrinsic motivation for that task. Cognitive evaluation theory also holds that feelings of competence alone are not enough to promote intrinsic motivation; competence must be accompanied by a sense of autonomy, the feeling that one's behavior is self-determined. Research has shown that environmental factors such as choice and opportunities for self-direction enhance feelings of autonomy and intrinsic motivation (Ryan & Deci, 2000b).

The design of EMT may foster intrinsic motivation because making errors provides the trainee with feedback on how to work on the task and allows them to choose the way that they work on the task (a key aspect of autonomy). On the other hand, error avoidant training does not provide trainees with corrective feedback or give them much autonomy in exploring the task. As a result, their intrinsic motivation is likely to be quite low. Frese et al. (1991) made some qualitative observations suggesting that EMT led to increased intrinsic motivation in their study. In particular, Frese et al. noted that trainees in the error encouragement group wanted to continue working after the session was complete, whereas the participants in the error avoidant group did not linger around after the session. They also noted that participants in the error encouragement group bombarded them with questions and in general, demonstrated more interest. The authors interpreted these differences as an indication of the EMT group exhibiting more intrinsic motivation than the error avoidant group.

Debowski, Wood, and Bandura (2001) looked at the role of motivation by examining whether participants in the EMT group experienced greater intrinsic motivation than participants in the error avoidant group. Results did not show any difference in intrinsic motivation between the two groups. However, similar to Frese et al. (1991), informal observations by the experimenters suggested that the EMT group appeared more involved in the task by asking themselves questions such as “Let’s see what else I can do?” and “How did I do that?” (Debowski et al., 2001).

Wood et al. (2000) also examined whether EMT led to increased intrinsic motivation. In their study, participants were trained to perform a CD-ROM Database search. Intrinsic motivation was measured at three separate times: before the start of the training tasks, after the completion of the training tasks, and following the transfer performance test. The EMT group did not differ from the error avoidant group prior to the start of training, but after the training tasks and after the transfer performance test the EMT group had higher levels of intrinsic motivation. Although EMT trainees performed better on the transfer performance test, intrinsic motivation was not related to performance, and it was negatively related to the quality of search strategies used during the transfer performance test. Additional analyses showed that regardless of the type of training received, participants with high levels of intrinsic motivation continued to use exploratory strategies during the transfer performance test. Because their strategies were not well organized, their level of performance may have been reduced. The authors suggested that regardless of the type of training, the negative relationship between intrinsic motivation and quality of search strategies may have been due to the short training session (less than 2 hours).

Nordstrom et al. (1998) considered the effects of EMT on intrinsic motivation. Participants were trained to use word processing software with either error avoidant training or EMT. Participants who received EMT had higher levels of intrinsic motivation and performed better on the transfer task. However, this study did not examine whether the higher levels of intrinsic motivation were related to the better performance on the transfer task. In sum, research has shown that error training leads to intrinsic motivation, but research has not yet clearly demonstrated that improved intrinsic motivation leads to better transfer performance. Further, as with metacognition and emotion control, it is not known whether intrinsic motivation impacts performance through better knowledge or independent of knowledge. That is, increased intrinsic motivation may lead individuals to work harder on the task during the learning phase, which leads to better task knowledge. In addition, this increased intrinsic motivation may lead individuals to put forth more effort and utilize more cognitive resources to perform better on the transfer task, regardless of their levels of task knowledge.

Summary. There have been great strides in the area of EMT research in recent years (Keith, 2005). Researchers have sought to understand the benefits of EMT and why it works. Several studies (e.g., Frese et al., 1991; Dorman & Frese, 1994) have demonstrated that EMT yielded superior performance when compared to traditional, error-avoidant training. Further, several mechanisms have been proposed to explain why EMT leads to better performance, including metacognition (Keith & Frese, 2005), emotion control (Frese et al., 1991; Keith & Frese, 2005), and intrinsic motivation (Debowski et al., 2001; Wood et al., 2000). However, it is unclear whether metacognition, emotion control, and intrinsic motivation simply lead to more task knowledge or whether these mediating variables help transfer performance independent of the knowledge acquired in training. A study that manipulates the exploration and experience of errors, while controlling for knowledge differences between groups will reveal whether these "mediating" mechanisms contribute uniquely to transfer performance beyond knowledge acquisition.

## The Proposed Investigation

Previous work has shown that EMT leads to better metacognition, emotion control, and intrinsic motivation than error avoidant training (Keith & Frese, 2005; Wood et al., 2000). However, what is unclear is whether these mechanisms enable individuals to learn more during training, which leads to better transfer performance, or whether these mechanisms have effects on transfer performance beyond the effects of improved knowledge. The proposed investigation will attempt first to replicate past work by showing that EMT leads to better metacognition, emotion control, and intrinsic motivation than does error avoidant training. It then will test whether the increased metacognition, emotion control, and intrinsic motivation have any effects on transfer performance, controlling for the level of knowledge acquired from the task.

To do this, the proposed investigation will provide one group of participants with the standard EMT. The only difference from past research is that every step that EMT participants take will be recorded with keystroke software. Thus, an exact record of each EMT participant's path through the training will be obtained. This information will then be transcribed into written protocols that will be given to a second group of matched participants, the error-tailored avoidant group. Participants in the error-tailored avoidant group will receive error avoidant instructions and be told to follow the exact steps provided in the written protocols. Thus, participants in the error-tailored avoidant condition will go through the task in the exact same fashion as the EMT group, but will not be allowed to explore the task in the same way. Thus, the knowledge acquired through training for these two groups will be identical, but the level of metacognitive activity, practice in controlling one's emotions when errors occur, and the intrinsic motivation should differ. Such a methodology will isolate the effects of knowledge from metacognition, emotion control, and intrinsic motivation, enabling a powerful test of whether these "mediating" mechanisms identified in the literature contribute to transfer performance beyond the simple acquisition of knowledge. Finally, there will be a third group of trainees who will receive traditional error avoidant training. This condition will allow a comparison of the more traditional error avoidant group to the error-tailored avoidant group. These groups should be equivalent on metacognition, emotion control, and intrinsic motivation, but should differ in their level of knowledge. Thus, a comparison of these two groups will determine whether knowledge has effects on transfer performance that are independent of metacognition, emotion control, and intrinsic motivation.

Determining the mechanism through which EMT improves transfer performance is important for both theoretical and practical reasons. Theoretically, answering these questions will enable the development of a more specific model of the EMT process, clarifying the pathways through which EMT impacts performance. A more specific model can lead to more precise questions that can be examined in future research. From an applied perspective, it would be useful to know whether individuals receiving EMT perform better because of greater knowledge than error avoidant trainees or because of better emotion control, intrinsic motivation, or metacognitive skills than error avoidant individuals. If it is the latter, then individuals in traditional training programs may benefit from additional training on the regulation of thoughts, emotions, and motivation. If it is the former, that EMT participants simply acquire more knowledge, then individuals in traditional training programs are simply not getting enough information in training, suggesting that the training content could be improved.

Metacognition. Previous research has shown that one way that EMT leads to better transfer performance is by inducing greater metacognitive activity (Keith & Frese, 2005). Much of the research concerning metacognition has been conducted in educational settings. In general, these studies have demonstrated that when students are provided with metacognitive training they score higher on post-tests than students who were taught using traditional methods (Hohn & Frey, 2002; Mevarech & Kramarski, 2003; Teong, 2003).

Training research has also examined the role that metacognitive activity plays in training outcomes. For example, students taught to use process-oriented verbalizations (metacognitive training group) to solve problems performed better on a performance task and a transfer task than did students told to think aloud (control group) (Berardi-Coletta, Buyer, Dominowski, & Rellinger, 1995). Ford, Smith, Weissbein, Gully, and Salas (1998) trained participants using the TANDEM decision-making task. Results of this study indicated that metacognitive activity was significantly related to knowledge acquisition, training performance, and self-efficacy, which were all related to transfer performance. A similar study by Schmidt and Ford (2003) provided high learner control in an online training that taught participants to create web pages. Their results indicated the participants with higher levels of metacognitive activity gained more knowledge, performed better on a skill-based measure of performance, and had higher levels of self-efficacy. Thus, there seems to be evidence that increasing metacognitive activity during training leads to positive outcomes for knowledge acquisition and training performance.

The design of EMT provides trainees with a chance to develop metacognitive skills. When a trainee makes an error, he or she has the opportunity to pause and consider the cause of the error, and the trainee then has a chance to develop a strategy to handle the problem (Ivancic & Hesketh, 2000). Next, the strategy must be implemented and the trainee must monitor and evaluate his or her progress (Ivancic & Hesketh). Another benefit of this way of learning is that it helps the trainee develop a skill for problem solving that can be applied to different types of errors. Research has demonstrated that when a strategy is shown to be ineffective for solving one type of problem, it may be retrieved and tried again on an analogous problem during transfer (Gick & McGarry, 1992). Therefore, it is hypothesized that participants who receive EMT will have increased levels of metacognitive activity. However, there should be no difference in metacognitive activity between the error-tailored avoidant group and the error avoidant group.

Hypothesis 1: Participants in the EMT condition will demonstrate higher levels of metacognition than participants in the error-tailored avoidant group or the error avoidant training group.

Emotion Control. Emotion control is a self-regulatory skill used to keep negative emotional reactions such as performance anxiety and worry under control while the individual is engaged in a task (Kanfer & Ackerman, 1996a; 1996b; Kanfer & Heggestad, 1999). Kanfer and Ackerman's research has suggested that emotion control is most critical during the early stages of learning when a person's cognitive resources may be limited and when failures in emotion control can take attention away from the task at hand. If there is a lack of emotion control when an error occurs, the trainee is more likely to focus on him or herself and attention is diverted away from the task. This can prove detrimental to the learner.

Not all forms of emotion control are beneficial. One study showed that when participants had to suppress emotions while watching a distressing video they were not able to perform a handgrip task, which requires strength and endurance, as well as individuals who did not have to suppress their emotions (Muraven, Tice, & Baumeister, 1998). Research has also shown that emotion control that requires individuals to suppress their emotions uses cognitive resources that could be used for learning (Baumeister, Bratslavsky, Muraven, & Tice, 1998; Muraven & Baumeister, 2000). In contrast, the emotion control of reappraisal (i.e., reinterpreting a situation so as to change its emotional impact) does not reduce individuals' attentional resources (Richards & Gross, 2000). In fact, Richards and Gross demonstrated that participants who were taught to reappraise their emotions while they viewed an emotional stimulus, such as a film clip, performed better on a test of their memory for other aspects of the film clip than participants taught to suppress their emotions.

EMT is believed to induce emotion control because the error management instructions provided prior to training encourage trainees to reappraise an error as a positive. Specifically, errors are framed as opportunities to learn, rather than mistakes to be avoided (or that reflect incompetence). By encouraging trainees to reappraise errors, their attention is focused on the task at hand, rather than on negative emotions that result from a mistake. In contrast, an error avoidant learner who experiences errors may perceive them in a much more negative light and experience negative emotions, which may use up valuable cognitive resources. Therefore, when trainees in EMT are taught to reappraise the error situation, it is expected to benefit learning and lead to better transfer performance. Although there should be differences in emotion control between the EMT and other conditions, there should not be a difference in emotion control between error-tailored avoidant and error avoidant groups

Hypothesis 2: Participants in the EMT condition will have higher levels of emotion control than participants in the error-tailored avoidant group or the error avoidant training group.

Intrinsic Motivation. Behaviors that are intrinsically motivated are caused by an individual's underlying need for skill and self-determination (Deci & Ryan, 1980). Two factors that have been shown to enhance intrinsic motivation are competence and autonomy. Providing feedback, allowing for choice, and opportunities for self-directed action can promote feelings of competence and autonomy, which have been found to enhance intrinsic motivation (Ryan & Deci, 2000b). The design of EMT allows participants to experience both competence and autonomy during training.

Several EMT studies have observed either qualitatively or quantitatively that EMT does in fact lead to increased intrinsic motivation (Frese et al., 1991; Debowski et al., 2001; Nordstrom et al., 1998; Wood et al., 2000). Frese et al. and Debowski et al. observed that participants in the EMT group demonstrated more interest and were more persistent during training. Nordstrom et al. and Wood et al. demonstrated empirically that EMT leads to increased intrinsic motivation. However, EMT research has not clearly demonstrated the relationship between intrinsic motivation and better transfer performance.

Various studies have confirmed that in addition to greater persistence and creativity, intrinsic motivation is associated with better learning and performance (Benware & Deci, 1984; Deci, Schwartz, Sheinman, & Ryan, 1981; Grolnick & Ryan, 1987; Valas & Sovik, 1993). For example, Benware and Deci (1984) found that participants who learned information for the purpose of teaching a class, as opposed to learning the information for a test, were more intrinsically motivated and had higher conceptual learning scores. Grolnick and Ryan (1987) found that students who learned in a less controlling environment and were allowed more autonomy had higher intrinsic motivation and demonstrated better learning. In a longitudinal study, intrinsic motivation toward accomplishment was positively related to college students' course grades over a three-year period (Baker, 2003). Therefore, there is evidence that increased intrinsic motivation can have positive outcomes on learning and performance. Thus, the proposed investigation expects that due to the greater autonomy provided in EMT, participants will have higher intrinsic motivation than participants in the error avoidant group or the error-tailored avoidant group.

> Hypothesis 3: Participants in the EMT group will have higher levels of intrinsic motivation than participants in the error avoidant training or error-tailored avoidant training groups.

Knowledge Acquisition. Anderson (1982) describes a model of skill acquisition in which declarative knowledge is integrated into procedural knowledge over the course of three phases of learning. The first phase is declarative knowledge, which involves gaining an understanding about facts and things related to the new skill. During this phase of learning the trainee is believed to encode and store rules about the new task and to develop strategies for the new task; therefore, attentional demands are at their greatest and performance may be error prone (Kanfer & Ackerman, 1989). Once the learner has reached an adequate level of knowledge about the task, he or she may proceed to the knowledge compilation phase. This phase of learning is one of transition; declarative knowledge is being converted into a procedural form (Anderson). During this phase the learner is able to implement and practice strategies that help to make performance of the task faster and more accurate (Kanfer & Ackerman, 1989). Because this second phase of learning integrates declarative knowledge into a procedural form, the cognitive demands on the learner are reduced and the learner may now be able to attend to additional aspects of the task (Kanfer & Ackerman, 1989). The final phase of learning is procedural knowledge. During this phase the learner continues to practice the task in its procedural form until the task can be performed quickly and the learner is able to perform the task even when attention is diverted to a second task (Anderson).

Schmidt and Bjork (1992) reviewed a variety of studies suggesting that knowledge acquired from training could be enhanced by having individuals practice tasks in a variety of different ways, rather than by having them use the same task strategy in a repetitive fashion. Schmidt and Bjork argued that having individuals use different information processing activities during learning will expose them to more knowledge, which can be beneficial for transfer performance. Consistent with the ideas of Schmidt and Bjork, the process of learning by exploring the system and making errors serves to vary the training session such that individuals are guiding themselves through training. Experiencing errors during training requires trainees to try new information processing strategies, which may result in greater exposure to knowledge that they may later apply during the transfer test.

Although most error training research has focused on transfer performance as the primary dependent variable, some research has focused on knowledge acquisition as the dependent variable (Bell, 2002; Frese et al., 1991; Nordstrom et al., 1998). For example, Frese et al. asked participants to recall all the word processing commands learned during training and their uses. Their results indicated that participants receiving error training demonstrated better recall. More recently, Bell (2002) found an effect for training type on knowledge, such that trainees receiving EMT demonstrated greater knowledge on a learning test given after the training session. Thus, there is some evidence for the benefits of error training leading to increased knowledge.

Therefore, it is expected that participants in the EMT group will explore the system and be exposed to more information. Participants in the error-tailored avoidant group will not be able to explore, but they will be provided with training materials that expose them to the information that their EMT counterparts saw. As a result, the EMT group is expected to have more task knowledge than the error-tailored group, whereas both of these groups should have better knowledge than the error avoidant group.

Hypothesis 4: Participants in the EMT group will have more task knowledge than participants in the error-tailored avoidant group, and participants in the error-tailored avoidant group will have more task knowledge than participants in the error avoidant training group.

There is a good theoretical rationale to expect that metacognition, emotion control, and intrinsic motivation will have direct effects on the level of knowledge that individuals acquire during training (Benware & Deci, 1984; Grolnick & Ryan, 1987; Ivancic & Hesketh, 2000; Kanfer & Ackerman, 1989; Kanfer & Heggestad, 1999). In particular, individuals who monitor their learning will assess what they have learned and identify gaps in their knowledge that can be filled during training (Ivancic & Hesketh, 2000). Individuals with better emotion control will focus cognitive resources on the task at hand instead of thinking about their mistakes, which will leave more cognitive resources available for learning during the training (Kanfer & Heggestad, 1999). Finally, individuals with more intrinsic motivation will want to continue to learn about the task and seek out as much knowledge as they can acquire (Benware & Deci, 1984).

Due to the matched design of the study, participants in the error-tailored group will be exposed to the same information as participants in the EMT group, but they will have levels of metacognition, emotion control, and intrinsic motivation similar to the participants in the error avoidant group. Therefore, it is expected that participants in the EMT group will have more knowledge than participants in the error-tailored avoidant group and the error avoidant group. Thus, the following hypothesis is presented.

Hypothesis 5*:* The effects of training type on task knowledge will be partially mediated by (a) metacognition, (b) emotion control, and (c) intrinsic motivation. In particular, differences in task knowledge between the EMT group and the error avoidant training group and the error-tailored avoidant training group will be fully explained by differences in metacognition, emotion control, and intrinsic motivation.

It is expected that increased task knowledge will lead to better transfer performance. This idea is based on the notion that participants who are more knowledgeable about the task will know more and be able to apply that knowledge when they encounter new aspects of the task during transfer and as a result perform better. This idea is supported by a variety of past research (Dorman & Frese, 1994; Frese, 1995; Schmidt & Bjork, 1992).

What is not clear from past research is whether metacognition, emotion control, and intrinsic motivation will have effects on transfer performance independent of knowledge. Keith and Frese (2005) provide arguments that these variables will have a direct effect on transfer performance. For metacognition, it may be the case that increased planning and monitoring, as well as evaluation of progress during task completion will help individuals perform the transfer task. Similarly, for emotion control, it may be the case that learning to reappraise errors during training will teach individuals to use the same reappraisal strategies for emotion control when experiencing errors during the performance of the transfer task. This argument is consistent with Heimbeck et al. (2003) who found that participants receiving emotion management instructions performed better than participants who did not receive them, regardless of receiving error encouragement or error avoidant training. Intrinsic motivation may benefit transfer performance independent of knowledge acquisition because, as research has demonstrated, individuals high in intrinsic motivation may be more interested and persist longer when working on the transfer task

(Ryan & Deci, 2000a). This is consistent with Baker (2003) which demonstrated that intrinsic motivation toward achievement was positively related to college students' course grades over a three year period.

Thus, consistent with the vast majority of the past research on EMT, it is expected that the EMT group will have better transfer performance than the error avoidant group (Chillarege et al., 2003; Dorman & Frese, 1994; Heimbeck et al., 2003; Ivancic & Hesketh, 2000; Nordstrom et al., 1998; Wood et al., 2000). This effect should be attributable to differences in knowledge, metacognition, emotion control, and intrinsic motivation between the EMT and error avoidant individuals. It is also expected that the EMT group will have better transfer performance than the error-tailored group. This effect should be attributable to differences in metacognition, emotion control, and intrinsic motivation and not to differences in task knowledge. Finally, it is expected that the error-tailored group will have better transfer performance than the error avoidant group. This effect should be attributable to differences in task knowledge and not differences in metacognition, emotion control, and intrinsic motivation. These ideas lead to the following hypotheses.

Hypothesis 6: Training type is expected to effect transfer performance such that participants in the EMT condition will have higher transfer performance than participants in the error-tailored avoidant group or the error avoidant training group, and individuals in the error-tailored avoidant group will have higher transfer performance than individuals in the error avoidant training group.

Hypothesis 7*:* The effects of training type on transfer will be partially mediated by (a) knowledge, (b) metacognition, (c) emotion control, (d) and intrinsic motivation.

A schematic overview of the proposed model is presented in Figure 1.

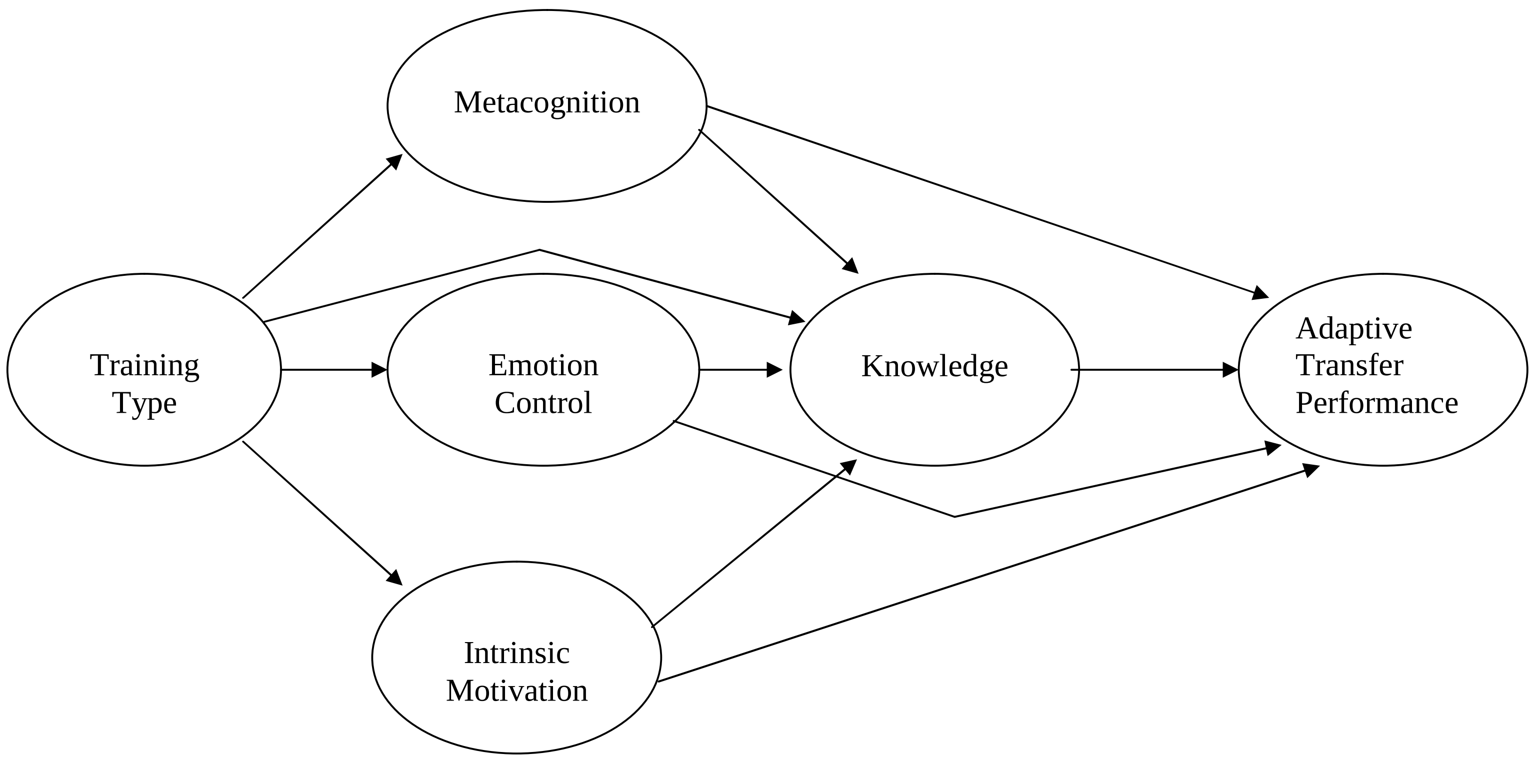


Figure 1. Metacognition, emotion control, intrinsic motivation, and knowledge as mediating effects of training condition on transfer performance.

# METHOD

## Participants

The participants in this study were 191 undergraduate students enrolled in psychology classes at a large southern university. Four participants were missing data for measures of the dependent variables and four participants left during the experiment session; therefore, they were not included in the analyses, resulting in a final sample size of 183. In exchange for their participation in the study, participants received credit to be used for the research learning requirement for their class or for extra credit in the class. Participants in this study were from a wide range of majors including: psychology, kinesiology, nursing, biology, business, and engineering. The sample was composed of 121 women (66%) and the mean age was 20.8 years (*SD* = 3.71). The majority of participants reported using a computer daily (96%) and 98% of the participants reported that they had never created a document using Corel® Presentations™, the software being learned. Participants were randomly assigned to one of three training groups, EMT, error avoidant training (control), or error-tailored avoidant training. There were sixty-one participants in each training group.

## Procedure

Participants were trained to create overhead slides using Corel® Presentations™ software in one of three conditions. As Figure 2 depicts, each training session was comprised of: (1) an introduction to the experimental session and administration of pre-training measures, (2) an introductory training phase, (3) a training phase in which the experimental manipulation took place (this was different for each of the three experimental groups), (4) a measurement phase, (5) a test phase, and (6) a debriefing phase.

Outline of the Experiment

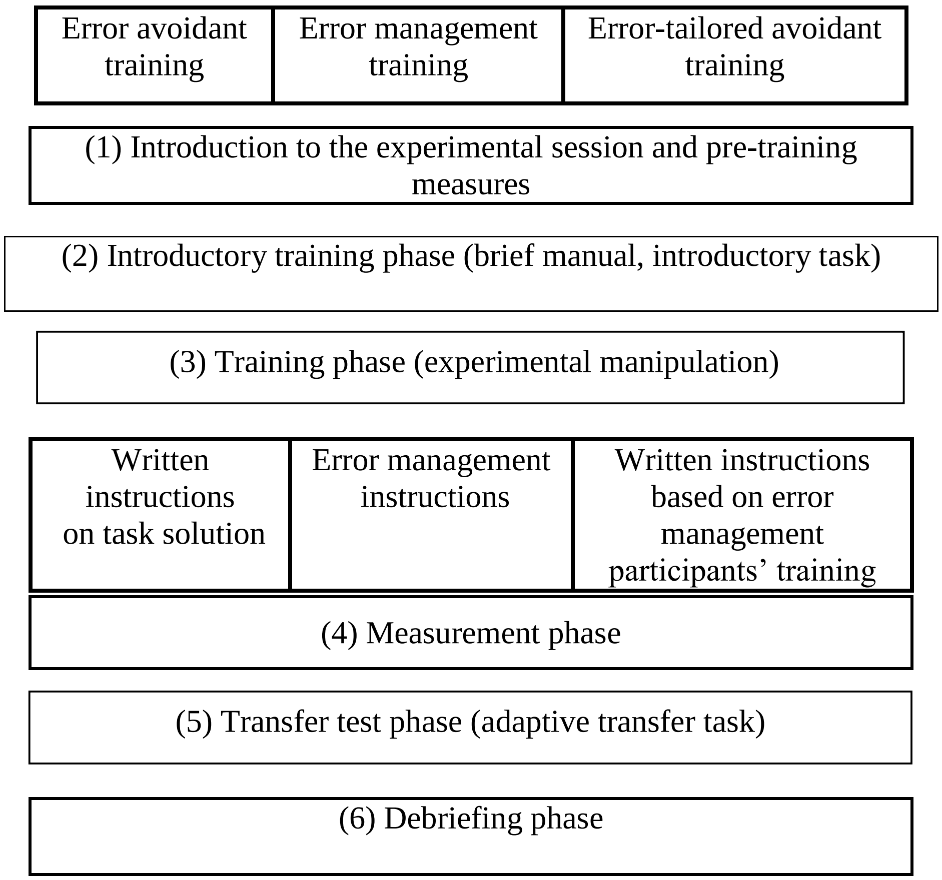


Figure 2. Outline of the experiment.

<u>Introduction to the Experimental Session</u>. At the start of the session participants were informed about the experiment and were asked to provide their written consent to participate. Then, participants completed a measure of computer experience and a measure of cognitive ability.

<u>Introductory Training Phase</u>. After the pre-training measures were completed all participants received a manual that contains general information about the program. The manual is presented in Appendix A. The manual provides brief descriptions of the menu and toolbars, how specific functions can be activated to create objects (e.g., a circle), and how existing objects

can be modified (e.g., enlarging a circle). The manual also informed participants about the delete key and undo function of the program. Regardless of training condition, participants received the same manual so as to hold this basic level of task knowledge constant across all conditions. Participants were allowed to refer to the manual during the training session, but not during the test phase.

Prior to the start of the actual training session, participants first worked on one simple slide. This allowed them to become accustomed to handling the mouse to create objects. This introductory slide required participants to create shapes and modify them while following written instructions. These instructions are in Appendix B and the introductory slide is in Appendix C.

Training Phase. After the introductory phase, the actual training began. It is in this phase that the experimental manipulation occurred. All participants were given color copies of slides printed on paper. The task was to reproduce these slides as closely as possible. The first slide required creating and modifying shapes and textboxes and inserting clipart. The next slide required creating and modifying an organization chart by altering box fields and box properties. The final slide required participants to format a text box and format several objects to create a complex shape. The training slides are in Appendix D.

Participants completed the training tasks in one of three training conditions: error avoidant training, EMT, or error-tailored avoidant training. Participants in the error avoidant training received detailed written instructions (similar to those in the introductory practice phase) explaining the task solution using step-by-step directions. These instructions are in Appendix E. This training condition was similar to a commercially available software tutorial. Participants were encouraged to follow these instructions carefully. They were told that these instructions would help them to learn the key functions of the software in the shortest amount of time.

Participants in the error management training condition were not provided with any information on the task solution. They received error management instructions that encouraged them to make errors and learn from them. The error management instructions are presented in Appendix F.

Participants in the error-tailored avoidant training condition were provided with detailed written information explaining the task solution using step-by-step instructions. However, these instructions were created based on the training experience of an EMT participant. Therefore, each EMT participant was paired with one error-tailored avoidant participant. The training session of each EMT participant was recorded using the screen recording software, Camtasia Studio 2. This software allowed the researcher to create step-by-step instructions using the recording and editing functions. Thus, the researcher watched a video showing shots of the EMT participants' monitor during training and transcribed their actions so as to create the step-by-step instructions for each error-tailored avoidant participant. The recording software ran simultaneously with the presentation software and was virtually undetectable by the participant. Similar to the error avoidant training, participants in the error-tailored avoidant training were encouraged to follow these step-by-step instructions carefully. They were told that these instructions were created by a novice as they learned to use this computer software, and that at times it may seem that the instructions were not leading them directly to the solution, but that it was important that they follow the instructions as they were written.

Once the training session had begun no further help was provided during training. The experimenter only intervened if a participant was unable to correct the situation on his or her own and was not able to move forward in the training. An example of such a situation was if the software was not responding and needed to be restarted.

Each participant's training session was recorded with the Camtasia Studio 2 software and all participants were aware of the recording software so as to avoid any confounds between conditions.

Measurement Phase. Directly following the training phase, all participants completed measures of metacognition, emotion control, intrinsic motivation, and knowledge.

Transfer Test Phase. Following completion of the dependent measures, participants received a ten minute break before beginning the transfer test phase. Tasks and instructions in the test phase were identical for all participants. Participants were given printed copies of three slides. Similar to the training phase, the task was to reproduce these slides as closely as possible. The test slides were more difficult than the training slides and creating them required participants to apply elements learned during the training session in novel ways.

Debriefing Phase. Following the transfer test phase[1], all participants were debriefed as to the purpose of the experiment and given an opportunity to ask questions about the training.

## Measures

Metacognitive Activity. Metacognitive activity was measured using a fourteen-item scale used by Schmidt and Ford (2003) and Ford et al. (1998). Studies have used this measure to assess the metacognitive activity of participants during training. A sample item from this scale is, "During this training program, I asked myself questions to make sure I understood the things I had been trying to learn". Participants responded to these items using a 5-point scale ranging from 1 = *strongly agree* to 5 = *strongly disagree*. These items are in Appendix G. Coefficient alpha for the scale was .88.

Emotion Control. Emotion control was measured using an eight-item scale developed by Keith and Frese (2005). These items were written to measure emotion control based on

Kanfer and colleagues' (Kanfer & Ackerman, 1989; Kanfer & Ackerman, 1996a; 1996b) definition of the construct. A sample item from this scale is, "When difficulties arose, I purposely continued to focus myself on the task." Participants responded to these items using a 5-point scale ranging from 1 = *strongly disagree* to 5 = *strongly agree*. These items are in Appendix H. Coefficient alpha for the scale was .91.

Intrinsic Motivation. Intrinsic motivation was measured using the Intrinsic Motivation Inventory (IMI) developed by Deci and Ryan (n. d.). The IMI measures intrinsic motivation and self-regulation. It has been used in numerous experiments related to intrinsic motivation (e.g., Deci, Eghari, Patrick, & Leone, 1994; McAuley, Duncan, & Tammen, 1989; Ryan, 1982). The IMI contains six subscales. The present investigation used the 7-item interest/enjoyment subscale, as it is the subscale that seemed most appropriate for the current investigation and is the subscale considered by Deci and Ryan to be a self-report measure of intrinsic motivation. Participants responded to each item using a 7-point scale ranging from 1 = *not at all true* to 7 = *very true*. These items are in Appendix I. Coefficient alpha for the scale was .94.

Knowledge. Twenty-six multiple choice questions were used to assess trainees' knowledge of a wide range of commonly used functions in the software. The Corel® Presentations™ tutorial and a guide to using Presentations™ (Neibauer, 2001) were used to write these items. These items are in Appendix J. The content validity of this measure was established by having three individuals familiar with presentation software review the training materials and knowledge measure to determine that the items in the knowledge measure were representative of the content domain. The reliability of the knowledge measure was examined using the Kuder-Richardson (KR-20) method. The reliability for this measure was .53

Transfer Performance Task. The transfer performance task required a trainee to apply knowledge gained during training to a new task. Trainees were asked to create slides that required skills similar to those learned during training, but not exactly the same skills. These slides are presented in Appendix K. Performance on the task was determined by multiple ratings of how closely each slide matched the example slide. Each of the slides was broken down into components necessary to create that slide. For example, in the first transfer performance slide, components of the slide were inserting the title text box, formatting the text, inserting the slide text, formatting the bullets, inserting one of the rectangles, inserting all three rectangles, inserting one arrow, inserting all three arrows, and formatting the text in each box. The number of slide components that were present comprised the score for that slide. These slide scores were summed to provide a rating of transfer performance that was used for the analyses. Two undergraduate students who were trained to use the coding system and were blind to the experimental conditions served as raters. Cases where the ratings of both raters differed by more than one point were resolved through discussion. Rater agreement on transfer performance was assessed using the average measure interclass correlation coefficient (ICC) and the average deviation index ($AD_{M(J)}$). ICCs provide an estimate of the average reliability of the raters making the ratings (Gatewood & Field, 2001). The ICC for ratings of transfer performance on the three slides is .89. The $AD_{M(J)}$ is a measure of rater agreement, which looks at whether each rater gave the same raw score to the participant being rated. (Burke, Finkelstein, & Dusig, 1999). Calculating the $AD_{M(J)}$ involves determining how much each individual rating differs from the mean rating, summing the absolute value of these deviations, and dividing by the total number of deviations. One of the benefits of the $AD_{M(J)}$ is that it does not require modeling the null response range of interrater agreement, which is required with other measures of rater agreement such as $r_{wg}$ (Burke et al., 1999). Rather, the $AD_{M(J)}$ requires that ranges for acceptable levels of random error are set ahead of time. Burke and Dunlap (2002) recommend that for measurement scales using proportions, such as in the current study, the upper limit for acceptable agreement is .2. The $AD_{M(J)}$ for ratings of transfer performance on the three slides is .11. The rater agreement for the transfer slides is less than the upper limit of .2, so it is in the acceptable range.

Computer and Software Experience. Participants were asked to indicate their previous experience with computers and software by responding to several items included in a survey of background information. This measure was used as a covariate in the analyses to control for any prior knowledge that was relevant for the training. The items asked participants to indicate the number of years experience they have with various software packages and also the frequency with which they use these. Items also asked participants to rate their level of experience using certain functions of the software, such as creating a table. These items are in Appendix L.

Cognitive Ability. Participants completed the Wonderlic Personnel Test™ (WPT), a test used to assess cognitive ability in employees. Participants' scores on the WPT were used in the analyses to control for any effects that cognitive ability may have on participants' learning during training. The WPT is a 12-minute paper and pencil test that consists of 50 items. The items are arranged in order of increasing difficulty and items considered to be of average difficulty are those at which approximately 60 percent of test takers would answer the item correctly (Gatewood & Field, 2001). Parallel forms reliability for the test has been found to range from .82 to .94 (Gatewood & Field, 2001). Sample items from this measure are in Appendix M.

End Note

[1]Following the transfer test phase, participants were given the measures of metacognition, emotion control, and intrinsic motivation a second time. Paired samples t-tests did not show any significant differences between the scores at time one and the scores at time two. The tests of hypotheses pertaining to these variables were also conducted using the time two scores and the pattern of findings was the same.

# RESULTS

Prior to beginning the analyses the data was examined to determine that the variables met the assumptions of normality, linearity, and homoscedasticity. It was determined that two variables, metacognition (skewness = -4.85; kurtosis = 2.33) and emotion control (skewness = -5.99; kurtosis = 5.23), did not meet the criteria for normality as both variables were outside the acceptable range of ± 2 for skewness and kurtosis. Following recommendations found in Tabachnick and Fidell (2001), logarithmic transformations were performed. The transformation of these variables did not change any of the results. So for ease of interpretation, analyses using the untransformed data are reported.

Table 1 presents descriptive statistics and intercorrelations for the study variables. Three dummy coded variables were created to examine the correlations between each of the three training conditions and the other variables in the study. EMT displayed a significant positive relationship with emotion control ($r = .24$, $p < .01$) and intrinsic motivation ($r = .27$, $p < .01$). Error avoidant training demonstrated a significant positive relationship with intrinsic motivation ($r = .15$, $p < .05$) and error-tailored avoidant training was significantly negatively related to metacognition ($r = -.16$, $p < .05$), emotion control ($r = -.35$, $p < .01$), and intrinsic motivation ($r = -.42$, $p < .05$). The pattern of these relationships suggests that participants in the error-tailored avoidant condition had less metacognition, emotion control and intrinsic motivation than participants in the EMT and error avoidant training conditions. Because transfer performance was a focus of this research, the reader might be interested to see that transfer performance was significantly positively correlated with task knowledge ($r = .39$, $p < .01$) and emotion control ($r = .35$, $p < .01$). This finding suggests that participants with more task knowledge and

Table 1
Descriptive Statistics and Correlations Among Variables of Interest.

| Variable | *M* | *SD* | 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. | 10. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. EMT | .33 | .47 | -- | | | | | | | | | |
| 2. Error avoidant training | .33 | .47 | -.50** | -- | | | | | | | | |
| 3. Error-tailored avoidant training | .33 | .47 | -.50** | -.50** | -- | | | | | | | |
| 4. Computer experience | 48.68 | 8.60 | .14 | -.07 | -.07 | -- | | | | | | |
| 5. Wonderlic | 23.38 | 4.19 | -.05 | -.06 | .11 | .04 | -- | | | | | |
| 6. Metacognition | 3.05 | .67 | .09 | .07 | -.16* | -.25** | -.10 | (.88) | | | | |
| 7. Emotion control | 3.89 | .74 | .24** | .11 | -.35** | .16* | .20** | .17* | (.91) | | | |
| 8. Intrinsic motivation | 3.69 | 1.38 | .27** | .15* | -.42** | -.16* | -.004 | .41** | .28** | (.94) | | |
| 9. Task knowledge | 14.45 | 3.05 | .17* | -.14 | -.03 | .20** | .26** | -.02 | .16* | .07 | (.53) | |
| 10. Transfer performance | 63.25 | 11.52 | .23** | -.17* | -.06 | .28** | .24** | -.14 | .35** | -.01 | .39** | (.89) |

Note: Scale reliabilities are in parentheses on the diagonal. EMT is a dummy coded variable (EMT = 1, Error Avoidant Training = 0, Error-Tailored Avoidant Training = 0). Error Avoidant Training is a dummy coded variable (EMT = 0, Error Avoidant Training = 1, Error-Tailored Avoidant Training = 0). Error-Tailored Avoidant Training is a dummy coded variable (EMT = 0, Error Avoidant Training = 0, Error-Tailored Avoidant Training = 1).

* $p<0.05$.

** $p<0.01$.

emotion control had better transfer performance. It was somewhat surprising to see that neither metacognition nor intrinsic motivation was significantly related to task knowledge or transfer performance.

Given the matched nature of the EMT and error-tailored avoidant conditions, I examined the correlations between these two conditions. These analyses revealed no significant relationship between the two conditions on the knowledge test ($r$ = -.02, n.s.) or the transfer performance measure ($r$ = .01, n.s.), suggesting that the matching of the conditions did not create dependence across the experimental conditions. As such, all hypotheses were tested using independent groups statistical analyses. Table 2 presents the means and standard deviations of the measured variables by training condition.

Table 2

Means and Standard Deviations of Measured Variables by Type of Training.

| | EMT | | Error Avoidant Training | | Error-Tailored Avoidant Training | |
|---|---|---|---|---|---|---|
| Variable | *M* | *SD* | *M* | *SD* | *M* | *SD* |
| Computer experience | 50.39 | 7.30 | 47.80 | 9.38 | 47.84 | 8.86 |
| Wonderlic | 23.08 | 4.16 | 23.05 | 4.39 | 24.02 | 4.02 |
| Metacognition | 3.13 | .61 | 3.12 | .68 | 2.91 | .71 |
| Emotion control | 4.14 | .48 | 4.01 | .53 | 3.53 | .97 |
| Intrinsic motivation | 4.16 | 1.26 | 3.94 | 1.07 | 2.83 | 1.84 |
| Task knowledge | 15.18 | 2.93 | 13.85 | 3.12 | 14.33 | 2.99 |
| Transfer Performance | 67.02 | 7.65 | 60.48 | 13.23 | 62.26 | 12.08 |

## Tests of Hypotheses

Hypotheses 1 through 4 proposed that type of training would have a significant effect on metacognition, emotion control, intrinsic motivation, and task knowledge. As a starting point in testing these hypotheses, a multivariate analysis of covariance (MANCOVA) was conducted in which type of training was the independent variable, metacognition, emotion control, intrinsic motivation, and task knowledge were the dependent variables, and computer experience and the Wonderlic were covariates. Results of the MANCOVA were significant, Wilk's $\Lambda = .72$, $F(8, 350) = 7.85$, $p < .05$, partial $\eta^2 = .15$. The results of the MANCOVA are presented in Table 3. Thus, I proceeded to test each of these hypotheses separately using analysis of covariance (ANCOVA) and planned comparisons.

Table 3

Multivariate Analysis of Covariance for Main Effect of Type of Training on Metacognition, Emotion Control, Intrinsic Motivation, and Task Knowledge.

| Source | Wilks' Λ | Hypothesis df | Error df | Multivariate F | Partial $\eta^2$ |
|---|---|---|---|---|---|
| Computer Experience [a] | .86 | 4 | 175 | 7.00* | .14 |
| Wonderlic [a] | .86 | 4 | 175 | 7.18* | .14 |
| Type of Training | .72 | 8 | 350 | 7.85* | .15 |

Note: [a] Computer Experience and Wonderlic are Covariates.

* p < .05
** p < .01

Hypothesis 1 stated that participants in the EMT condition would have higher levels of metacognition than participants in the error-tailored avoidant or the error avoidant training conditions. ANCOVA was conducted where type of training was the independent variable, metacognition was the dependent variable, and computer experience and the Wonderlic served as covariates. Results of the ANCOVA indicate that there was no significant main effect for type of training on metacognition, $F(2, 178) = 2.87$, n.s., partial $\eta^2 = .03$. However, the key tests of this hypothesis were conducted using the LSD (Least Significant Difference) planned comparison tests. Results for the first planned comparison between the EMT condition (adjusted $M = 3.17$, $SD = .65$) and the error-tailored avoidant condition (adjusted $M = 2.89$, $SD = .65$) revealed significant differences in metacognition, $LSD\ (1, 178) = 2.20$, $p < .05$, partial $\eta^2 = .04$. Results for the second planned comparison between the EMT condition (adjusted $M = 3.17$, $SD = .65$) and the error avoidant condition (adjusted $M = 3.10$, $SD = .65$) were nonsignificant, $LSD\ (1, 178) = .73$, n.s., partial $\eta^2 = .002$. Results of the ANCOVA and planned comparison tests are presented in Table 4. These findings indicate that participants in the EMT group did report significantly more metacognition than participants in the error-tailored avoidant training group, but did not report significantly more metacognition than participants in the error avoidant training group. Therefore, hypothesis 1 was partially supported.

Hypothesis 2 stated that participants in the EMT condition would have higher levels of emotion control than participants in the error-tailored avoidant group and the error avoidant training group. Similar to hypothesis one, this hypothesis was tested by first conducting a one-way ANCOVA followed by LSD planned comparison tests. Results of the ANCOVA show that there was a significant main effect for type of training on emotion control, $F(2, 178) = 14.79$, $p < .01$, partial $\eta^2 = .14$. Results for the first planned comparison between the EMT condition

Table 4

Analysis of Covariance Examining the Effect of Type of Training on Metacognition Followed by Least Significant Difference Planned Comparison Tests.

| Source | Sum of squares | df | Mean squared | *F* | *p* | Partial $\eta^2$ |
|---|---|---|---|---|---|---|
| Computer experience[a] | 1116.01 | 1 | 5.69 | 13.62 | .001 | .07 |
| Wonderlic[a] | 71.24 | 1 | .36 | .87 | .35 | .01 |
| Type of Training | 469.97 | 2 | 1.20 | 2.87 | .06 | .03 |
| Within sources | 14580.51 | 178 | .42 | | | |

LSD Planned Comparison Tests

| Type of Training | Type of Training | df | *t* | *p* | Partial $\eta^2$ |
|---|---|---|---|---|---|
| EMT | Error-tailored avoidant training | 178 | 2.20 | .02 | .04 |
| | Error avoidant training | 178 | .73 | .56 | .002 |

Note: [a] Computer experience and Wonderlic are Covariates.

(adjusted *M* = 4.13, *SD* = .67) and the error-tailored avoidant condition (adjusted *M* = 3.51, *SD* = .67) revealed significant differences in emotion control, *LSD* (1, 178) = 4.62, $p < .01$, partial $\eta^2$ =.15. Results of the second planned comparison indicate that participants in the EMT group (adjusted *M* = 4.13, *SD* = .67) did not differ significantly from participants in the error avoidant training group (adjusted *M* = 4.03, *SD* = .67), *LSD* (1, 178) = 1.31, n.s., partial $\eta^2$ = .01. The results of the ANCOVA and planned comparison tests are presented in Table 5. These findings suggest that participants in the EMT condition had significantly higher levels of emotion control compared to participants in the error-tailored avoidant training condition, but did not have significantly higher levels of emotion control than participants in the error avoidant training condition. Therefore, hypothesis 2 was partially supported.

Table 5

Analysis of Covariance Examining the Effect of Type of Training on Emotion Control Followed by Least Significant Difference Planned Comparison Tests.

| Source | Sum of squares | df | Mean squared | *F* | *p* | Partial $\eta^2$ |
|---|---|---|---|---|---|---|
| Computer experience[a] | 82.66 | 1 | 1.29 | 2.88 | .09 | .02 |
| Wonderlic[a] | 332.51 | 1 | 5.20 | 11.58 | .001 | .06 |
| Type of Training | 849.46 | 2 | 6.64 | 14.79 | .001 | .14 |
| Within sources | 5110.15 | 178 | .45 | | | |

LSD Planned Comparison Tests

| Type of Training | Type of Training | df | *t* | *p* | Partial $\eta^2$ |
|---|---|---|---|---|---|
| EMT | Error-tailored avoidant training | 178 | 4.62 | .001 | .15 |
| | Error avoidant training | 178 | 1.31 | .40 | .01 |

Note: [a] Computer experience and Wonderlic are Covariates.

Next, hypothesis 3 stated that participants in the EMT group would have higher levels of intrinsic motivation than participants in the error avoidant training or error-tailored avoidant training groups. Results of the ANCOVA indicate that there was a significant main effect of type of training on intrinsic motivation, $F(2, 178) = 22.39$, $p < .01$, partial $\eta^2 = .20$. The results of the first planned comparison show that participants in the EMT (adjusted $M = 4.22$, $SD = 1.24$) differed significantly from participants in the error-tailored avoidant training (adjusted $M =$

2.79, *SD* = 1.24), *LSD* (1, 178) = 5.98, $p < .01$, partial $\eta^2 = .23$. Results of the second comparison demonstrate that participants in the EMT (adjusted *M* = 4.22, *SD* = 1.24) and the error avoidant training (adjusted *M* = 3.92, *SD* = 1.24) did not differ significantly in their levels of intrinsic motivation, *LSD* (1, 178) = 1.44, n.s., partial $\eta^2 = .02$. Results of the ANCOVA and planned comparison tests can be found in Table 6. This pattern of findings suggests that participants in the EMT group had significantly more intrinsic motivation than participants in the error-tailored avoidant group, but participants in the EMT group did not have significantly more intrinsic motivation than participants in the error avoidant training group. Therefore, hypothesis 3 was partially supported.

Hypothesis 4 proposed that participants in the EMT group would have more task knowledge than participants in the error-tailored avoidant group and participants in both of these groups would have more task knowledge than participants in the error avoidant training group. Results of the ANCOVA suggest that there was not a significant main effect for type of training on task knowledge, $F(2, 178) = 2.67$, n.s., partial $\eta^2 = .03$. The first planned comparison indicates that participants in the EMT (adjusted *M* = 15.14, *SD* = 2.90) did not differ from participants in the error-tailored avoidant training (adjusted *M* = 14.26, *SD* = 2.90) on task knowledge, *LSD* (1, 178) = 1.55, n.s., partial $\eta^2 = .02$. The second comparison showed that participants in the EMT (adjusted *M* = 15.14, *SD* = 2.90) differed significantly from participants in the error avoidant training (adjusted *M* = 13.97, *SD* = 1.07) on task knowledge, *LSD* (1, 178) = 2.09, $p < .05$, partial $\eta^2 = .04$. Results of the third planned comparison showed that participants

Table 6

Analysis of Covariance Examining the Effect of Type of Training on Intrinsic Motivation Followed by Least Significant Difference Planned Comparison Tests.

| Source | Sum of squares | df | Mean squared | *F* | *p* | Partial $\eta^2$ |
|---|---|---|---|---|---|---|
| Computer experience[a] | 654.38 | 1 | 13.36 | 8.81 | .003 | .05 |
| Wonderlic[a] | 42.85 | 1 | .87 | .58 | .45 | .003 |
| Type of Training | 3324.64 | 2 | 33.93 | 22.39 | .001 | .20 |
| Within sources | 13218.31 | 178 | 1.52 | | | |

LSD Planned Comparison Tests

| Type of Training | Type of Training | df | *t* | *p* | Partial $\eta^2$ |
|---|---|---|---|---|---|
| EMT | Error-tailored avoidant training | 178 | 5.98 | .001 | .23 |
| | Error avoidant training | 178 | 1.44 | .18 | .02 |

Note: [a] Computer experience and Wonderlic are Covariates.

in the error-tailored avoidant training (adjusted *M* = 14.26, *SD* = 2.90) did not differ from participants in the error avoidant training (adjusted *M* = 13.97, *SD* = 1.07) on task knowledge, *LSD* (1, 178) = .49, n.s., partial $\eta^2$ = .001. The results of the ANCOVA and planned comparison tests are presented in Table 7. This pattern of findings suggests that participants in the EMT had significantly more task knowledge than participants in the error avoidant training, but did not differ from participants in the error-tailored avoidant training; and participants in the error-tailored avoidant training did not have significantly more task knowledge than participants in the error avoidant training. Therefore, hypothesis 4 was partially supported.

Table 7

Analysis of Covariance Examining the Effect of Type of Training on Task Knowledge Followed by Least Significant Difference Planned Comparison Tests.

| Source | Sum of squares | df | Mean squared | *F* | *p* | Partial $\eta^2$ |
|---|---|---|---|---|---|---|
| Computer experience[a] | 43.57 | 1 | 43.57 | 5.26 | .02 | .03 |
| Wonderlic[a] | 110.01 | 1 | 110.01 | 13.29 | .001 | .07 |
| Type of Training | 44.55 | 2 | 22.27 | 2.67 | .07 | .03 |
| Within sources | 1473.67 | 178 | 8.23 | | | |

LSD Planned Comparison Tests

| Type of Training | Type of Training | df | *t* | *p* | Partial $\eta^2$ |
|---|---|---|---|---|---|
| EMT | Error-tailored avoidant training | 178 | 1.55 | .10 | .02 |
| EMT | Error avoidant training | 178 | 2.09 | .03 | .04 |
| Error-tailored avoidant training | Error avoidant training | 178 | .49 | .58 | .001 |

Note: [a] Computer experience and Wonderlic are Covariates.

To test hypothesis 5, which stated that metacognition, emotion control, and intrinsic motivation would partially mediate the relationship between type of training and knowledge, it was necessary to establish the conditions of mediation (Baron & Kenny, 1986). The conditions that needed to be met for mediation were (a) the type of training is related to knowledge (b) type of training is related to metacognition, emotion control, and intrinsic motivation, (c) metacognition, emotion control, and intrinsic motivation are related to knowledge after accounting for the effects of type of training, and (d) type of training has a nonsignificant effect on knowledge after accounting for the effects of metacognition, emotion control, and intrinsic motivation.

Because the hypotheses for differences in task knowledge involved comparisons between two groups at a time (EMT > error avoidant training; EMT > error-tailored avoidant training), the mediation hypotheses were tested separately for each of these comparisons in regression through the use of dummy coding to reflect the training condition (coded EMT = 1, error avoidant training = 0 in one set of analyses and EMT = 1 and error-tailored avoidant training = 0 in the other set of analyses). In these analyses, the covariates were entered at Step one and a dummy code distinguishing the training conditions was entered at Step two, depending upon which two groups were being compared. I first examine mediation for the comparison of EMT and error avoidant training and then turn to the tests of mediation for the comparison of EMT and error-tailored avoidant training.

As indicated in the previous analyses, the first condition of mediation was met as the dummy code comparing EMT and error avoidant training was significant ($\beta = .19$, $p < .05$), indicating that there were differences in knowledge between these two groups. The second condition of mediation was that the dummy code comparing EMT and error avoidant training would predict metacognition, emotion control, and intrinsic motivation. The regression analyses showed that participants in the EMT and the error avoidant training did not differ significantly on the measure of metacognition ($\beta = .06$, $p = .48$), emotion control ($\beta = .12$, $p = .20$), or intrinsic motivation ($\beta = .13$, $p = .19$). Thus, the second condition to establish mediation was not met, and as a result, Hypothesis 5 was not supported for this comparison. Results of these regression analyses are presented in Table 8.

Turning to the comparison of EMT and error-tailored avoidant training, the first condition of mediation was not met ($\beta$ = .14, $p$ = .14). The results of this regression are presented in Table 9.

Table 8

Hierarchical Regression Analyses Examining the Mediating Effects of Metacognition, Emotion Control, and Intrinsic Motivation on the Relationship Between the Comparison of EMT and Error Avoidant Training and Task Knowledge.

| | Dependent Variables | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Task knowledge | | Metacognition | | Emotion control | | Intrinsic motivation | |
| Predictor | $\beta$ | $t$ | $\beta$ | $t$ | $\beta$ | $t$ | $\beta$ | $t$ |
| Computer experience | .14 | 1.63 | -.33** | -3.81 | .07 | .75 | -.23** | -2.56 |
| Wonderlic | .26** | 3.00 | -.14 | -1.58 | .26** | 2.94 | .02 | .21 |
| EMT > Error avoidant training | .19* | 2.23 | .06 | .73 | .12 | 1.31 | .13 | 1.44 |

* p < .05
** p < .01

This finding suggests that there was no significant difference in knowledge for participants in EMT and participants in error-tailored avoidant training. Therefore, hypothesis 5 was not supported for this comparison.

Hypothesis 6 stated that there would be a significant effect of type of training on transfer performance such that participants in the EMT condition would have higher transfer performance than participants in the error-tailored avoidant group or the error avoidant training group, and individuals in the error-tailored avoidant group would have higher transfer performance than individuals in the error avoidant training group. Similar to tests of the first four hypotheses, this hypothesis was tested by first conducting a one-way ANCOVA followed by LSD planned

Table 9

Hierarchical Regression Analyses Examining the Mediating Effects of Metacognition, Emotion Control, and Intrinsic Motivation on the Relationship Between the Comparison of EMT and Error-Tailored Avoidant Training and Task Knowledge.

| | Dependent Variable | |
|---|---|---|
| | Task knowledge | |
| Predictor | *β* | *t* |
| Computer experience | .19* | 2.16 |
| Wonderlic | .21* | 2.43 |
| EMT > Error-tailored avoidant training | .14 | 1.56 |

* p < .05
** p < .01

comparisons. Results of the ANCOVA indicate that there was a significant main effect of type of training on transfer performance, $F(2, 178) = 4.80$, $p < .01$, partial $\eta^2 = .05$. The first planned comparison showed a significant difference between participants in the EMT (adjusted $M$ = 66.65, $SD$ = 10.70) and error-tailored avoidant training (adjusted $M$ = 62.13, $SD$ = 10.62), $LSD$ (1, 178) = 2.25, $p < .05$, partial $\eta^2 = .04$. The second planned comparison showed a significant difference between participants in the EMT (adjusted $M$ = 66.65, $SD$ = 10.70) and participants in the error avoidant training (adjusted $M$ = 60.98, $SD$ = 10.62), $LSD$ (1, 178) = 3.06, p < .01, partial $\eta^2 = .07$. The third comparison examined differences between participants in the error avoidant training (adjusted *M* = 60.98, *SD* = 10.62) and the error-tailored avoidant training (adjusted *M* = 62.13, *SD* = 10.62), and demonstrated that they did not differ significantly *LSD* (178) = .41, n.s., partial $\eta^2$ = .001. The results of the ANCOVA and the planned comparison tests are presented in Table 10. These results indicate that participants in the EMT condition had significantly higher transfer performance than participants in the error avoidant condition and the error-tailored avoidant condition; however, participants in the error-tailored avoidant condition did not have significantly higher transfer performance than participants in the error avoidant condition. Hypothesis 6 was partially supported.

Hypothesis 7 proposed that the effects of training type on transfer would be mediated by knowledge, metacognition, emotion control, and intrinsic motivation. Similar to hypothesis five, the mediation analyses were run separately in regression comparing EMT with error avoidant training (dummy coded as EMT = 1 and error avoidant training = 0), EMT with error-tailored avoidant training (dummy coded as EMT = 1 and error-tailored avoidant training = 0), and error avoidant training with error-tailored avoidant training (dummy coded as error avoidant training = 1 and error-tailored avoidant training = 0). The set of analyses comparing EMT and error avoidant training will be discussed first. In order to meet the first condition for mediation the dummy coded variable comparing EMT and error avoidant training must be significantly related to transfer performance. There was a significant difference between EMT and error avoidant training on transfer performance ($\beta = .26$, $p < .01$). As indicated in previous analyses, the dummy coded variable comparing EMT and error avoidant training did not significantly predict metacognition ($\beta = .06$, $p = .48$), emotion control ($\beta = .12$, $p = .20$), or intrinsic motivation ($\beta = .13$, $p = .11$). However, there was a significant relationship for task knowledge, ($\beta = .19$, $p < .05$). The results of the regression analyses to establish the first two conditions for mediation are presented in Table 11. Therefore, the third step to establish mediation included only task knowledge as a potential mediator.

Table 10

Analysis of Covariance Examining the Effect of Type of Training on Transfer Performance Followed by Least Significant Difference Planned Comparison Tests.

| Source | Sum of squares | df | Mean squared | *F* | *p* | Partial $\eta^2$ |
|---|---|---|---|---|---|---|
| Computer experience[a] | 1410.61 | 1 | 1410.61 | 12.60 | .001 | .07 |
| Wonderlic[a] | 1303.70 | 1 | 1303.70 | 11.65 | .001 | .06 |
| Type of Training | 1073.73 | 2 | 536.87 | 4.80 | .01 | .05 |
| Within sources | 19926.82 | 178 | 111.95 | | | |

LSD Planned Comparison Tests

| Type of Training | Type of Training | *t* | *p* | Partial $\eta^2$ |
|---|---|---|---|---|
| EMT | Error-tailored avoidant training | 2.25 | .02 | .04 |
| EMT | Error avoidant training | 3.06 | .004 | .07 |
| Error avoidant training | Error-tailored avoidant training | .41 | .55 | .001 |

Note: [a] Computer experience and Wonderlic are Covariates.

The third step in testing for mediation was met. Task knowledge significantly predicted transfer performance while controlling for the effect of the dummy variable comparing EMT and error avoidant training, ($\beta$ = .27, $p < .01$). The relationship between the dummy coded variable and transfer performance while controlling for the effects of task knowledge was significant, ($\beta$ = .21, $p < .05$). Thus, the proportion of variance in transfer performance accounted for by training condition decreased from adjusted $R^2$ = .065 to $R^2$ = .04, when task knowledge was included in the model, which is a 38.5% reduction in the effect of training condition on transfer performance. knowledge as a potential mediator. The third step in testing for mediation was met. Task knowledge significantly predicted transfer performance while controlling for the effect of the dummy variable comparing EMT and error avoidant training, ($\beta = .27$, $p < .01$). The relationship between the dummy coded variable and transfer performance while controlling for the effects of task knowledge was significant, ($\beta = .21$, $p < .05$). Thus, the proportion of variance in transfer performance accounted for by training condition decreased from adjusted $R^2 = .065$ to $R^2 = .04$, when task knowledge was included in the model, which is a 38.5% reduction in the effect of training condition on transfer performance. This reduction in the effect of training condition when controlling for task knowledge suggests that knowledge partially mediated the effect. The results of these analyses to establish the third and fourth conditions of mediation are presented in Table 12.

Looking next at the comparison of EMT and error-tailored avoidant training, the first condition of mediation was met, ($\beta = .20$, $p < .01$). This finding suggests that there is a significant difference in transfer performance for participants in the EMT and the error-tailored avoidant training. The comparison of EMT and error-tailored avoidant training significantly predicted metacognition, ($\beta = .20$, $p < .05$), emotion control, ($\beta = .38$, $p < .01$), and intrinsic motivation, ($\beta = .49$, $p < .01$). However, there was not a significant relationship with task knowledge, ($\beta = .14$, $p = .14$). The results of the analyses demonstrating the first and second conditions for mediation are presented in Table 13. Metacognition, ($\beta = -.09$, $p = .34$) and intrinsic motivation, ($\beta = -.08$, $p = .37$) were not significantly related to transfer performance; however, there was a significant relationship between emotion control and transfer performance,

Table 11

Hierarchical Regression Analyses Examining the First and Second Condition to Establish the Mediating Effects of Metacognition, Emotion Control, Intrinsic Motivation, and Task Knowledge on the Relationship Between the Comparison of EMT and Error Avoidant Training and Transfer Performance.

| | Dependent Variables | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Transfer performance | | Metacognition | | Emotion control | | Intrinsic motivation | | Task knowledge | |
| Predictor | *β* | *t* | *β* | *t* | *β* | *t* | *β* | *t* | *β* | *t* |
| Computer experience | .21** | 2.56 | -.33** | -3.81 | .07 | .75 | -.23* | -2.56 | .14 | 1.63 |
| Wonderlic | .28** | 3.41 | -.14 | -1.58 | .26** | 2.94 | .02 | .21 | .26** | 3.00 |
| EMT > Error avoidant training | .26** | 3.12 | .06 | .73 | .12 | 1.31 | .13 | 1.44 | .19* | 2.23 |

* $p < .05$
** $p < .01$

Table 12

Hierarchical Regression Analyses Examining the Third and Fourth Condition to Establish the Mediating Effects of Metacognition, Emotion Control, Intrinsic Motivation, and Task Knowledge on the Relationship Between the Comparison of EMT and Error Avoidant Training and Transfer Performance.

| | Third condition | | | Fourth condition | |
|---|---|---|---|---|---|
| | Transfer performance (controlling for predictor) | | | Transfer performance (controlling for task knowledge) | |
| Predictor | *β* | *t* | Predictor | *β* | *t* |
| Computer experience | .17* | 2.15 | Computer experience | .17* | 2.15 |
| Wonderlic | .21* | 2.57 | Wonderlic | .21* | 2.57 |
| EMT > Error avoidant training | .21* | 2.54 | Task knowledge | .27** | 3.16 |
| Task knowledge | .27** | 3.16 | EMT > Error avoidant training | .21* | 2.54 |

* $p < .05$
** $p < .01$

($\beta = .42$, $p < .01$). Because emotion control was the only variable to significantly predict transfer performance, the final step to test for mediation examined the relationship between the comparison of EMT and error-tailored avoidant training and transfer performance while controlling for the effects of emotion control. The relationship became non-significant, ($\beta = .06$, $p = .53$), suggesting that emotion control fully mediated the relationship between the comparison of EMT and error-tailored avoidant training and transfer performance. This finding offers support for Hypothesis 7. The results of these regression analyses can be found in Table 14.

The analyses comparing error avoidant training with error-tailored avoidant training did not demonstrate significant differences on transfer performance ($\beta = -.04$, $p = .68$). Therefore, the first condition for mediation was not met. The results of this regression analysis can be seen in Table 15.

Summary. The results of the study indicate that participants in the EMT condition had significantly more metacognition, emotion control and intrinsic motivation than participants in the error-tailored avoidant training condition. Participants in EMT also had more task knowledge than participants in error avoidant training. Participants receiving EMT demonstrated higher levels of transfer performance than participants receiving error avoidant training or error-tailored avoidant training. The relationship between the comparison of EMT and error avoidant training and transfer performance was partially mediated by task knowledge. Results of the study also showed that emotion control mediated the relationship between a variable comparing EMT and error-tailored avoidant training and transfer performance. These findings, their implications and areas for future research are discussed in the next section.

Table 13

Hierarchical Regression Analyses Examining the First and Second Condition to Establish the Mediating Effects of Metacognition, Emotion Control, Intrinsic Motivation, and Task Knowledge on the Relationship Between the Comparison of EMT and Error-Tailored Avoidant Training and Transfer Performance.

| | Dependent Variables | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Transfer performance | | Metacognition | | Emotion control | | Intrinsic motivation | | Task knowledge | |
| Predictor | *β* | *t* | *β* | *t* | *β* | *t* | *β* | *t* | *β* | *t* |
| Computer experience | .26** | 2.99 | -.20* | -2.22 | .12 | 1.50 | -.20 | -2.40 | .19* | 2.16 |
| Wonderlic | .10 | 1.18 | -.03 | -.39 | .25** | 3.09 | .08 | .96 | .21 | 2.43 |
| EMT > Error-tailored avoidant training | .20* | 2.30 | .20* | 2.20 | .38** | 4.62 | .49** | 5.98 | .14 | 1.56 |

* p < .05 ** p < .01

Table 14

Hierarchical Regression Analyses Examining the Third and Fourth Condition to Establish the Mediating Effects of Metacognition, Emotion Control, Intrinsic Motivation, and Task Knowledge on the Relationship Between the Comparison of EMT and Error-Tailored Avoidant Training and Transfer Performance.

| | Third condition Transfer performance (controlling for predictor) | | | Fourth condition Transfer performance (controlling for emotion control) | |
|---|---|---|---|---|---|
| Predictor | *β* | *t* | Predictor | *β* | *t* |
| Computer experience | .18* | 2.04 | Computer experience | .21** | 2.59 |
| Wonderlic | -.001 | -.01 | Wonderlic | .01 | .08 |
| EMT > Error avoidant training | .10 | 1.01 | Emotion control | .38** | 4.12 |
| Metacognition | -.09 | -1.02 | EMT > Error-tailored avoidant training | .06 | .64 |
| Emotion control | .42** | 4.41 | | | |
| Intrinsic motivation | -.08 | -.76 | | | |

* p < .05
** p < .01

Table 15

Hierarchical Regression Analysis Examining the Mediating Effects of Metacognition, Emotion Control, Intrinsic Motivation, and Task Knowledge on the Relationship Between the Comparison of Error Avoidant Training and Error-Tailored Avoidant Training and Transfer Performance.

| | Dependent Variable | |
|---|---|---|
| | Knowledge | |
| Predictor | *β* | *t* |
| Computer experience | .26** | 3.10 |
| Wonderlic | .31** | 3.73 |
| Error avoidant training > Error-tailored avoidant training | -.04 | -.41 |

* p < .05
** p < .01

# DISCUSSION

A growing body of research supports the idea that EMT (i.e., training that allows trainees to experience errors and encourages them to view errors as helpful for learning) is beneficial for learning and transfer performance (Chillarege, et al., 2003; Dorman & Frese, 1994; Frese et al., 1991; Heimbeck et al., 2003; Keith & Frese, 2005; Nordstrom et al., 1993; Wood et al., 2000). However, the mechanisms by which EMT has its beneficial effects are not well understood. The present study examined mechanisms that have been proposed in prior research (Debowski et al., 2001; Frese et al., 1991; Heimbeck et al., 2003; Keith & Frese, 2005; Nordstrom et al., 1998; Wood et al., 2000), including metacognition, emotion control, intrinsic motivation, and task knowledge. Prior theory suggests that individuals receiving EMT should have higher levels of each of the variables than individuals receiving traditional, error avoidant training because they are able to autonomously explore the system, have learned to cope with and manage mistakes, have become more involved in thinking about the task, and ultimately developed more knowledge about the task (Frese, 1995; Heimbeck et al., 2003; Keith & Frese, 2005).

To examine these potential mediating mechanisms, I developed an EMT condition, where individuals could explore the system and make errors along the way, and an error avoidant condition, where individuals were guided through the system and encouraged to learn it the way they were taught. These conditions were modeled after conditions in much of the past error training research. In addition, this study introduced a third condition labeled error-tailored avoidant, in which participants went through the training in exactly the same fashion as individuals in the EMT condition, but were not allowed to freely explore during the training. Thus, this new condition was designed so that individuals would be exposed to the same content during training as the EMT individuals, but they would not experience errors in an autonomous way. It was anticipated that their subjective experience would be similar to the error avoidant training condition, though their knowledge would be similar to the EMT condition. Such a design was intended to enable me to more precisely determine whether the benefits of EMT were due to increased metacognition, emotion control, intrinsic motivation, or due to increased knowledge (or perhaps a combination of these things).

The following sections first discuss the findings of the study and their implications for theory and research on EMT. This is followed by a discussion of the study limitations and suggested directions for future research.

## Tests of Hypotheses

It was proposed that participants in the EMT condition would have higher levels of metacognition, emotion control, and intrinsic motivation than participants in the error-tailored avoidant condition or the error avoidant condition because of the opportunity to freely explore the task and naturally experience errors. Results revealed that participants in the EMT condition had significantly higher levels of metacognition, emotion control, and intrinsic motivation than participants in the error-tailored avoidant condition. These results suggest that, even though the two groups encountered the same task features, the group which was allowed to freely explore the task had higher levels of metacognition, emotion control, and intrinsic motivation. However, counter to expectations, the EMT participants did not differ significantly from participants in the error avoidant condition in metacognition, emotion control, or intrinsic motivation (though the pattern of means was in the expected direction). These findings are inconsistent with past research showing that individuals receiving EMT have higher levels of metacognition (Keith & Frese, 2005), emotion control (Frese et al., 1991; Keith & Frese, 2005), and intrinsic motivation (Nordstrom et al., 1998; Wood et al., 2000) than individuals receiving error avoidant training (though Debowski et al. (2001) also found no effect for intrinsic motivation). Thus, on the one hand, the results comparing the EMT condition to the new, error-tailored avoidant condition were supportive of the idea that EMT enhances these mediating factors; however, the tests aimed at replicating past work comparing the EMT condition to the error avoidant condition did not support the idea that errors during learning enhance these mediating factors. I return to possible reasons for this difference later.

Based on the idea that individuals in the EMT and error-tailored avoidant conditions would encounter more task information than individuals in the error avoidant condition, it was anticipated that individuals in these two conditions would have more task knowledge than individuals in the error avoidant condition. Consistent with the hypothesis, participants in the EMT condition had significantly higher levels of task knowledge than participants in the error avoidant training condition; however, inconsistent with the hypothesis, the error-tailored avoidant condition did not differ from the error avoidant condition in task knowledge. The results also demonstrated that the EMT condition did not differ in task knowledge from the error-tailored avoidant condition. This lack of a difference is consistent with the fact that the error-tailored avoidant training participants went through the training phase using instructions that were created based on the training experiences of the EMT participants. As such, both groups of participants were exposed to the same aspects of the software and their knowledge of the task did not differ significantly.

A key purpose of the current study was to examine whether metacognition, emotion control, and intrinsic motivation mediated the effects of training type on task knowledge. That is, I sought to understand whether individuals who experience errors during learning acquire more task knowledge because of higher levels of metacognition, emotion control and intrinsic motivation. Specifically, it was hypothesized that differences in task knowledge between participants in the EMT condition and the error-tailored avoidant training condition and differences between participants in the EMT condition and the error avoidant training condition would be fully explained by differences in metacognition, emotion control and intrinsic motivation. However, because the EMT condition did not differ from the error-tailored avoidant training condition in task knowledge, no mediating effect could exist for this comparison. However, it is instructive to also consider the fact that these two groups differed greatly in their levels of metacognition, emotion control and intrinsic motivation. Thus, at least for the comparison of these two groups, it may be concluded that differences in these cognitive, emotional, and motivational processes did not translate into knowledge differences. Rather, it seems that experiencing the same task information may have been primarily responsible for the knowledge acquired by individuals in these two conditions.

Although participants in the EMT condition and the error avoidant training condition demonstrated significant differences in task knowledge, the relationship was not mediated by metacognition, emotion control, or intrinsic motivation as these two groups did not differ significantly in their levels of these mediating mechanisms. This set of findings suggests that rather than EMT leading to increased levels of knowledge through the effects of metacognition, emotion control, or intrinsic motivation, the differences in task knowledge may have primarily been due to differences in task exposure and exploration. Of course, it is also possible that some other unmeasured mechanism is responsible for the differences in knowledge between these conditions as well. Other potential mediators are discussed later. Together, these results point to task exposure as the primary driving factor behind task knowledge across the training conditions, and that metacognition, emotion control, and intrinsic motivation did not explain the task knowledge individuals acquired.

Next, it was hypothesized that type of training would affect transfer performance, whereby participants in the EMT condition would have higher levels of transfer performance than participants in the error-tailored avoidant training condition and the error avoidant training condition. This hypothesis was supported as participants in the EMT condition had significantly higher levels of transfer performance than participants in both the error-tailored avoidant and error avoidant training conditions. This finding is consistent with previous EMT studies, which have shown that participants who receive EMT outperform participants receiving error avoidant training on transfer performance (Chillarege, et al., 2003; Dorman & Frese, 1994; Frese et al., 1991; Heimbeck et al., 2003; Keith & Frese, 2005; Nordstrom et al., 1993; Wood et al., 2000). Contrary to the non-significant results for knowledge acquisition, the participants in the error-tailored avoidant training condition, who were exposed to the exact same task features as the participants in the EMT condition, performed worse on the transfer task than the participants in the EMT condition. Further, no difference in transfer performance was observed between the error-tailored avoidant and error avoidant conditions. This result suggests that mere exposure to different task features did not result in differences in the ability to perform well on a transfer task that required tackling a new problem. Thus, there was no transfer advantage for individuals who were exposed to the same task attributes as the EMT, but were not allowed to freely explore the task and experience errors.

The last purpose of this study was to establish whether metacognition, emotion control, intrinsic motivation, and task knowledge could explain differences in transfer performance between training conditions. As indicated above, the EMT condition differed significantly from the error avoidant and error-tailored avoidant conditions in transfer performance. Results revealed that task knowledge partially explained the differences in transfer performance between the EMT and error avoidant training conditions, accounting for over 1/3 of the effect of training differences on transfer performance. Metacognition, emotion control and intrinsic motivation did not account for any of the differences in transfer performance between these conditions. These results run counter to recent theorizing on this topic by Keith and Frese (2005) and suggest that the relatively simple explanation of task knowledge was partially driving the difference between these experimental conditions. Including the present investigation, there are now two studies examining metacognition and emotion control as explanatory mechanisms for the effects of metacognition and these studies came to different conclusions. Additional research is needed on this issue.

In trying to understand the difference in transfer performance between the EMT and error-tailored avoidant conditions, I found strong support for emotion control explaining this effect, whereas metacognition, intrinsic motivation and task knowledge did not contribute to the difference. This finding is consistent with the results of Keith and Frese (2005) who found that when comparing participants in EMT with participants in error avoidant training, metacognition and emotion control mediated the relationship with transfer performance. The finding from the present study can be interpreted to mean that participants who learned to cope with errors during training did better when faced with a new task requiring the transfer of learned skills, not because of better or different knowledge, but because of their enhanced emotion control.

## Implications for Theory and Research

The current study explored the mechanism through which EMT improves transfer performance with the goal of refining our understanding of why experiencing errors during learning translates into enhanced transfer performance. Prior to the current study, researchers had not examined the effects of metacognition, emotion control, intrinsic motivation, and task knowledge within the same study. Further, and perhaps most importantly, no prior research had attempted to isolate the effects of task knowledge from the effects of these cognitive, emotional and motivational processes. The benefit of experimentally separating the opportunity to explore the task and experience errors from the eventual knowledge that is acquired is that it can isolate the effects of task knowledge from the presumed cognitive, emotional and motivational benefits (Keith & Frese, 2005). That is, such separation was intended to determine whether task knowledge is most important or whether the cognitive, emotional and motivational processes that have been linked to EMT have their own, independent benefits.

The present study points to differences in task exposure as being the primary cause of task knowledge acquired during training. The EMT and error-tailored avoidant groups experienced the task in the same way and did not differ in task knowledge; in contrast, the EMT and error avoidant groups likely encountered different information during the training and the EMT group exhibited more task knowledge. Further, though large differences in metacognition, emotion control, and intrinsic motivation were present for the EMT and error-tailored avoidant individuals, they did not differ in knowledge. In contrast, no differences in emotion control, intrinsic motivation or metacognition were observed between the EMT and error avoidant individuals, but they did differ in task knowledge. This set of findings is in contrast to recent theorizing on EMT having benefits because of metacognition and emotion control (Keith & Frese, 2005). Rather these results suggest that, when task knowledge is the outcome variable of interest, mere exposure to different task features is the primary determinant of differences.

In regards to transfer performance, the results were more in keeping with previous research. Though the EMT group who experienced errors and was allowed to freely explore the task performed better than the error avoidant training condition (who did not experience errors or explore the task) and the error-tailored avoidant condition (who experienced the task information in the same way as the EMT group, but was not allowed to explore), the mechanisms responsible for these differences changed depending on the comparison involved. For the comparison of the EMT and error avoidant training conditions, task knowledge partially explained the difference in transfer performance, though the effect was small. Thus, although metacognition, emotion control and intrinsic motivation clearly were not responsible for the differences in transfer performance between the EMT and error avoidant conditions, task knowledge was only partially responsible. This task knowledge explanation for differences is in contrast to past theorizing on this issue (Frese et al., 1991; Heimbeck et al., 2003, Keith & Frese, 2005; Nordstrom et al., 1998; Wood et al., 2000). Of course, task knowledge only partially explained the effect; one potential explanation for this partial mediation is that another unmeasured mediator was responsible for the remaining difference. For instance, mental focus may help explain differences in transfer performance between the EMT and error avoidant conditions (Gully et al., 2002). Mental focus refers to the extent to which a person is able to concentrate and become engrossed in a task (Lee, Sheldon, & Turban, 2003). Lee, Sheldon, and Turban demonstrated in a classroom setting that a student's mental focus was positively related to their course performance and their enjoyment of the course. Future research should examine this potential explanatory variable as a mediator of the effects of training type on transfer performance. Another potential explanation for the partial mediational effect of task knowledge is that the measure did not tap the full content domain of knowledge that individuals acquired during training and brought to bear when working on the transfer task. That is, the measure may have been deficient in assessing task knowledge. Although steps to construct a valid test of knowledge were taken, which included having experts at using the presentation software review the content domain of the knowledge test; these items had not been validated in previous studies.

For the EMT and error-tailored avoidant comparison, emotion control was fully responsible for the differences in transfer performance. Thus, while knowledge did not differ between these conditions, the ability of individuals in the EMT condition to manage their emotions in response to errors translated into superior transfer performance. This finding is consistent with Heimbeck et al. (2003) and Keith and Frese (2005) and contributes to the EMT literature by showing that increasing emotion control during training may result in increased transfer performance. Kanfer and Ackerman (1996a) examined the effects of providing emotion control instructions, which encourage the trainee to increase the frequency of their positive thoughts and to decrease the occurrence of negative thoughts such as worry or rumination and frustration following an error, on performance. Their results showed that trainees receiving traditional training who received emotion control instructions made fewer errors during training and reported fewer negative affective self-reactions during task performance (Kanfer & Ackerman, 1996a). Therefore, future studies may wish to explicitly incorporate emotion control strategies to assist trainees receiving all types of training as a way to make individuals more aware of and capable of appropriately handling problems during training and in the workplace.

In the part of the study that served as a replication of past work – i.e., the comparison of the EMT and error avoidant training conditions – results indicated that metacognition, emotion control and intrinsic motivation were not responsible for the observed differences in task knowledge or transfer performance. This finding provides a more direct test of these effects than prior work by assessing all three presumed mediators in the same study (Frese et al., 1991; Heimbeck et al., 2003, Keith & Frese, 2005; Nordstrom et al., 1998; Wood et al., 2000). Additionally, these results suggest that task knowledge is the only factor that partially explained differences in transfer performance. Of course, such effects must be replicated in future research, but these initial results suggest that the theoretical explanation for the benefits of EMT may be simplified to focus primarily on task knowledge.

However, the new comparison presented in this study – that between the EMT and error-tailored avoidant conditions – suggests a potential role of emotion control in explaining the differences. Recall that the primary difference between these conditions was that the error-tailored avoidant condition was not free to explore and experience errors; everything else was the same, including each step they went through while working on the task. Indeed, as demonstrated in this study, their knowledge was the same and could not explain the significant difference in transfer performance observed. However, the enhanced emotion control of the EMT group compared to the error-tailored avoidant group, which was derived from learning how to interpret and cope with errors experienced during training, fully explained the differences in transfer performance. These results are consistent with the theorizing of Keith and Frese (2005).

Of course the difficult question at this point is how to reconcile the seemingly different conclusions for transfer performance when comparing the EMT condition to the error avoidant condition and the error tailored avoidant condition. For the first comparison, which is a replication of past work (Chillarege, et al., 2003; Dorman & Frese, 1994; Frese et al., 1991; Heimbeck et al., 2003; Keith & Frese, 2005; Nordstrom et al., 1993; Wood et al., 2000), knowledge, and not emotion control, intrinsic motivation and metacognition, partially explained the difference in transfer performance. For the second comparison, which is a new test in the literature, emotion control fully explained the difference in transfer performance. Which mechanism is responsible for the benefits of EMT, knowledge or emotion control? Examining the pattern of findings for the error avoidant and error-tailored avoidant conditions may yield some insight here. A peculiar aspect of the data is the fact that the error avoidant condition did not exhibit lower levels of metacognition, emotion control and intrinsic motivation than the EMT condition. Such an effect has been found in prior work (Frese et al., 1991; Keith & Frese, 2005; Nordstrom et al., 1998; Wood et al., 2000). However, the error-tailored avoidant condition did show significantly lower levels of these variables than both the EMT and error avoidant conditions. Prior theory would suggest that both the error avoidant and error-tailored avoidant conditions should exhibit relatively low levels of metacognition, intrinsic motivation and emotion control because neither group could naturally explore the task and experience errors.

To better understand the efficacy of the training conditions, I compared the results for the mediator variables in present study to that of past studies, with the expectation that the EMT group would be similar to EMT groups in prior research and the error tailored avoidant and the error avoidant groups would be similar to prior error avoidant groups in past research. Of the mediators measured in this study, only the emotion control measure was used in prior error management research (Keith & Frese, 2005). Comparing the means of emotion control in the present study to that of the EMT condition in Keith and Frese (2005) ($M$ = 4.04)[2] reveals that the EMT ($M$ = 4.14) and error avoidant training conditions ($M$ = 4.01) in the present study did not differ significantly ($t$ =1.60, n.s., and $t$ = -.47, n.s., respectively), and that both were higher than the error avoidant training condition ($M$ = 3.60) in Keith and Frese (2005) ($t$ =8.81, $p$ < .05, and $t$ = 5.99, $p$ < .05, respectively). Further, the difference between the error tailored avoidant condition in the present investigation ($M$ = 3.53) and the error avoidant training condition in

Keith and Frese (2005) was non-significant ($t$ = .58, n.s.). Together, these results suggest that the level of emotion control for the error avoidant condition was out of line with expectations, whereas the emotion control for the error-tailored avoidant condition was in line with expectations (i.e., similar to the prior error avoidant training condition). As such, it may be the case that the error avoidant condition in my study did not induce the proper mindset in participants; i.e., that they should avoid errors and not freely explore the task. This is surprising as the training materials and instructions used in the current study were adapted from Keith and Frese (2005). However, one difference between the studies is that the present study conducted the experimental session with four participants at a time, whereas Keith and Frese conducted their sessions individually. Although conducting training in a group setting is a common practice, it may have provided the opportunity for the error avoidant training participants to explore covertly, which may have led to the higher levels of emotion control. In contrast, the results for the error tailored avoidant condition for emotion control were very consistent with prior work, suggesting that this condition may have induced the levels of emotion control that was expected. Indeed, it seems that the cumbersome, step-by-step nature of this task created a strong situation that may have prevented the opportunity to explore and experience errors, when compared to the EMT condition. Although it is difficult to tell for certain, these results suggest that the error avoidant training condition did not function as it had in past research. Therefore, the reader might place more weight on the results comparing the EMT and error-tailored avoidant training conditions, which suggest that increased emotion control from EMT has benefits independent of task knowledge. This idea suggests that helping trainees learn to regulate their emotions and cognitively reframe errors may have benefits for transfer performance.  Errors are bound to occur and having the ability to handle those errors may mean better performance.

## Limitations and Future Research

The present study did not find evidence of a mediating effect of metacognition on the relationship between type of training and transfer performance.  This comes as somewhat of a surprise because Keith and Frese (2005) found strong evidence of such an effect.  However, their study measured metacognition by having participants think aloud as they went through the training phase and statements were then coded as metacognitive statements if the statement was focused on planning, monitoring, and evaluation.  The proportion of metacognitive statements to the total number of statements then served as the metacognition score.  In contrast, the present investigation had individuals report on metacognitive strategies after training, as it was thought that having individuals say what they were thinking during training possibly created additional cognitive load and hindered their ability to learn.   It is possible that participants were not able to accurately recall the metacognitive activity that took place during training; therefore, their responses to the items did not reflect their actual levels of metacognition making the detection of real differences between the training conditions difficult.  Future research may want to consider other methods for measuring metacognitive activity during training such as asking participants about their metacognition several times throughout the training phase.

In order to isolate the effects of knowledge acquisition, the present study created a new training condition, the error-tailored avoidant training condition.  Participants in this training condition exhibited low levels of metacognition, emotion control, intrinsic motivation, and transfer performance, and it is possible that the lower scores on these variables were due to the difficulty of the training condition.  Participants receiving this type of training were given detailed, step-by-step instructions, but because the instructions were created based on the training experience of a participant in the EMT condition, they included errors. Therefore, the training phase for this training condition could be quite arduous as participants were informed that they should follow these instructions exactly as they were written. However, in an effort to reduce the negative effect of these training instructions, participants were told that their instructions were created by a novice who was learning to use the software.

A recent study by Lorenzo, Salas, and Tannenbaum (2005) examined a method of training called guided error training. In this training method the most common errors are identified and the participant is guided toward these errors during training and provided with strategies to use when they encounter that type of an error. Lorenzet et al. found that participants who received this type of training to learn to use Microsoft PowerPoint demonstrated higher levels of performance compared to participants who received error avoidant training. An area for future research would be to compare the effects of guided error training and EMT on metacognition, emotion control, intrinsic motivation, task knowledge, and transfer performance. Theoretically this could be beneficial because the guided error training is somewhat similar to the error-tailored avoidant condition in the current study in that participants are exposed to errors made during training, but they are not allowed to explore the system freely. Therefore, comparing the effects of these two methods of training may be able to parcel out the effects of exploration from task knowledge. It may also be that participants do not find guided error training as arduous as the error-tailored avoidant training.

## Conclusion

The current study showed that participants in the EMT condition had higher levels of metacognition, emotion control, intrinsic motivation, and transfer performance compared to participants in the error-tailored avoidant training condition, and participants in the EMT condition had more task knowledge and higher levels of transfer performance than participants in the error avoidant training condition.  When comparing participants in the EMT condition to participants in the error avoidant condition, the current study suggests that task knowledge partially mediated the relationship with transfer performance.  The results also suggested that when comparing participants in EMT to participants in error-tailored avoidant training, the relationship with transfer performance is mediated by emotion control.  The current study sought to better identify the mechanisms through which EMT works to increase transfer performance by examining metacognition, emotion control, intrinsic motivation, and task knowledge in one study.  Consistent with previous findings, the current study found that EMT participants obtained the highest levels of transfer performance compared to participants in the other two training conditions; therefore, organizations should still consider use of EMT the best way to increase transfer performance.

End Note

[2]Keith and Frese (2005) used a scale of 0 to 4 for participants' ratings of their emotion control; it was converted to a scale of 1 to 5 in order to provide a proper comparison.

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APPENDIX A

TRAINING MANUAL

# Welcome to the Presentations™ Training

(*To be given to all participants*)

First, you are going to be given some basic information about the computer program Presentations™. Some of this information may be familiar to you if you have already worked with similarly structured programs, such as WordPerfect.

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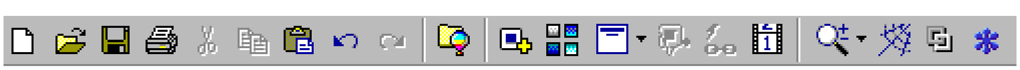
In Presentations™, each slide consists of 3 separate layers. The bottom layer is called the ***background layer***. The background layer contains designs and colors that will make up the general appearance of the slide. Over the background layer is the ***layout layer***. This determines the general position and type of contents for each slide. The contents are represented by placeholders, which are boxes that appears onscreen suggesting the type of items (for example, text) that should be on the slide. The top layer is called the ***slide layer***. This is where you enter the text, drawings, clip art, or other items that you want to appear on the slide.

With Corel ® Presentations™ you can work on slides in three views: *Slide Editor, Slide Outliner*, and *Slide Sorter*. *You can change the view of your slide by clicking on the desired view tab located on the right side of the screen.*

## The Presentations™ Toolbars

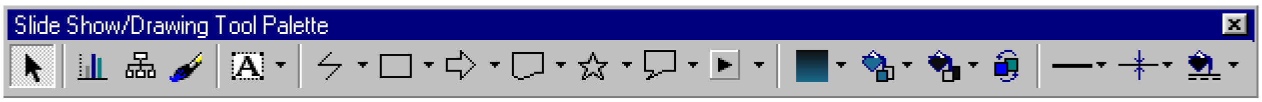
The first toolbar is the **Menus** toolbar. This contains the File, Edit, View, Insert, Format, Tools, Window, and Help menus.

Below the **Menus** Toolbar is the **Standard** toolbar. The **Standard** toolbar provides quick, one-click access to basic commands. For example, the **Standard** toolbar helps you insert new slides, modify a slide's design, undo an action, and add text to your slides. By default, the **Standard** toolbar is displayed above the **Property bar**.



The **Property** toolbar helps you customize the text in a slide show by setting the text attributes, such as font style and size.


The **Tool Palette** is a group of flyouts and pickers that help you create objects and text boxes in a slide. A flyout is a tool or menu command that displays additional tools or commands when selected. Tools or commands that have a flyout have a small arrow located in the bottom right corner of the tool button or to the right of the command name. The **Tool Palette** is displayed along the left side of the screen.




Along the bottom edge of the slide are tabs for each slide you create. You can click on a desired tab to quickly move back and forth between slides.

To activate Presentations™ functions

1. Click, using the left mouse button, on the symbol for the desired function (for example, to draw a rectangle click on the icon for a rectangle located on the **Tool Palette**)
2. Then, move the mouse to the slide and click the left mouse button to make a rectangle appear
3. Continue holding down the left mouse button while moving the mouse to make a rectangle of the desired size.

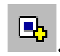
**To highlight an object**

- In order to use a function or command to change or format an existing object or text, (for example, to format text to have bold lettering), you must first highlight the object or text.
- To highlight text move the mouse over the text while holding down the left mouse button. When text is highlighted it will appear with a black background.
- To highlight an object click on it with the mouse. When an object is highlighted small white squares will appear around the edges.
- Several objects may be highlighted at the same time by moving the mouse over the objects while holding down the left mouse button.

**To resize or move an object**

1. Highlight the object.
2. To resize the object, click on one of the small white squares located around the edge of the object and hold down the left mouse button as you move the mouse to create an object of the desired size.
3. To move the object, click the mouse in the center of the object and continue to hold down the left mouse button as you move the object to the desired location on the slide.

**To insert a new slide into a slide show**

1. On the **Standard** toolbar, click the new slide button .
2. In the New slide dialog box, click the Blank layout on the Layout palette (last option).
3. Type 1 in the Number to add box.

**Important Points:**

- ✓ The different Presentations™ toolbars offer different functions and commands.
- ✓ The different functions are executed by a mouse click.
- ✓ In case the function is supposed to used on an already existing object, this object must be highlighted prior to executing the function.
- ✓ Clicking on it highlights an object.  Clicking and then moving the mouse across it while holding down the left mouse button highlights text.
- ✓ The functions of the different icons contained in the toolbars are shown when the mouse is pointed on the icon (without clicking on the icon).
- ✓ You can use the undo icon (an arrow pointing to the left) located in the Standard toolbar to reverse commands or actions you did unintentionally.
- ✓ You may delete an object from the slide by highlighting it and pressing the delete key (located on the right side of the keyboard above the directional keys).

You may use this booklet containing the basic information throughout the training session.

## Enjoy the Presentations™ training!

## APPENDIX B

## INTRODUCTORY TRAINING SLIDE INSTRUCTIONS
**(***To be completed by all participants***)**

**Task:** Design a slide using Presentations™ that looks like the printed original.
***Note****: your slide does not have to match the original down to the millimeter, but the objects and text in the original should be present in your slide and should match the original as close as possible in shape, color and position.*

1) **Formatting the text:**
   a) To insert the text box use the mouse to click on the icon "Text Object Tools", the 5th icon down on the **Tool Palette**.
   b) Now, move the mouse to the slide and click the left mouse button to create a text box.
   c) Type the text inside the text box "Big circle, small rectangle, thick double arrows".
   d) You may now move the text box to its desired location by clicking on the text box and continuing to hold down the left mouse button while moving the mouse.
   e) You may resize the text box by left clicking with the mouse on one of the small boxes along the edge of the text box and while continuing to hold down the left mouse button move the mouse to make the text box the desired size.
   f) To format the individual words in the text box, begin by increasing the font on the words "Big circle". Highlight the words by moving the mouse with the left mouse button held down across the two words. These words are now displayed in front of a black background.
   g) Now, on the **Property** toolbar click on the flyout (small black arrow pointing down) next to the field showing the font size (presently 32) and select the new font size, 42. If necessary, you can use the upward arrow or the downward arrow to scroll to the desired font size.
   **h)** Next, use the same process to scale down the words "small rectangle". Highlight the words in the text box, then select the new font size, 22, from the **Property** toolbar**.**
   i) Change the format of the words "thick double arrows" to **Bold.** First, highlight these words in the text box. Then, click on the "Bold" icon (B in bold lettering) on the **Property** toolbar.
   j) Underline the word "double" by first highlighting the word. Then, click on the "Underline" icon (a U with a line under it) located on the **Property** toolbar.
   k) To center the text in the text box highlight the text, click the flyout on the "Justification" icon (looks like several horizontal lines next to a vertical line on the left) located on the **Property** toolbar, and click on "Center".
   l) You have now finished formatting the text. If necessary you may go back to points c or d to resize or move the text box.

**2) Formatting the objects in the slide:**
   a) To insert the circle, click on the "Basic Shapes" icon on the **Tool Palette** (the 7th icon down).
   b) Now move the mouse to click on the icon of an ellipse.

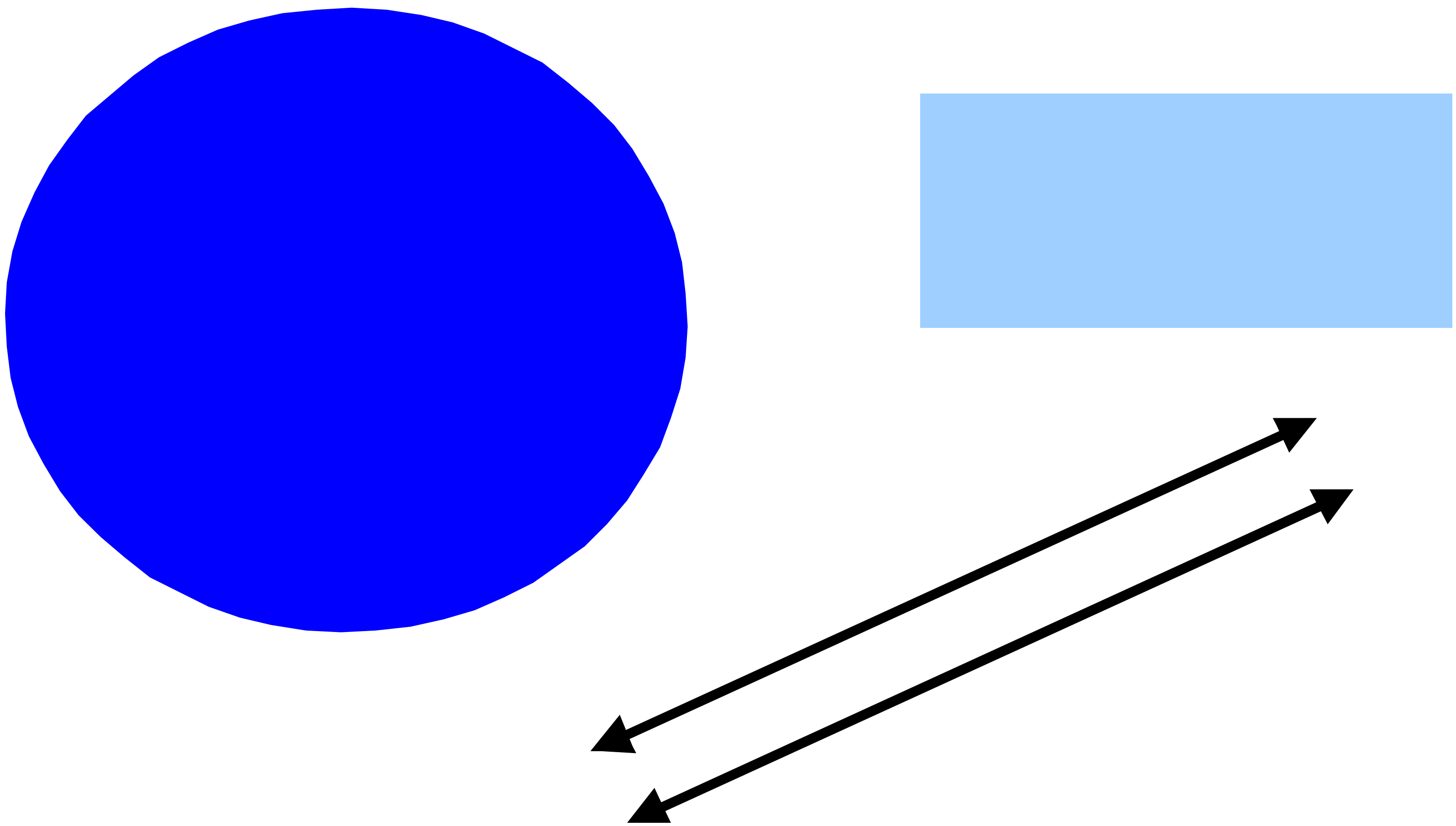
c) Then, move the mouse to the approximate position on the slide where the circle should appear. Click on that point and release the mouse button. A green circle framed by several white squares will appear.
d) You can enlarge the circle by clicking on one of the small squares and holding down the left mouse button while moving the mouse to make the circle the desired size. Release the mouse button when the circle is the right size and shape.
e) If the circle needs to be moved to its correct position, click on the circle (not on one of the small squares along its edges) and move the circle by moving the mouse (keeping the mouse button pressed down).
f) You can change the circle's color by clicking on the "Foreground Fill Color" icon located on the **Tool Palette** ($14^{th}$ icon down). Click on the color "Baby Blue".
g) To create the rectangle, begin by clicking on the "Basic Shapes" icon on the **Tool Palette**. Click on the icon of a rectangle.
h) Then, move the mouse to the approximate position on the slide where the rectangle should appear. Click on that point and release the mouse button. A green rectangle framed by several white squares will appear.
i) Enlarge the rectangle by clicking on one of the small squares and holding down the left mouse button while moving the mouse to make the rectangle the desired size. Release the mouse button when the rectangle is the right size and shape.
j) You may position the rectangle by clicking on the object and while holding down the left mouse button moving the mouse to position the rectangle in the correct spot.
k) Change the rectangle's color by clicking on the "Foreground Fill Color" icon located on the **Tool Palette**. Click on the color "Pale Blue".
l) To create the arrows, begin by clicking on the flyout for the "Line Shapes" icon on the **Tool Palette** ($6^{th}$ icon down). Click on the icon "Draw a line with an arrow on each end" and release the mouse button.
m) Move the mouse to the position on the slide where the lower end of the arrow is supposed to be positioned.
n) Press down the left mouse button and keep it pressed while moving the mouse to the right where the upper end of the arrow is supposed to be positioned. Release the mouse button when you have reached that position.
o) Change the thickness of the double-headed arrow by clicking on the "Line Width" icon on the **Tool Palette** ($2^{nd}$ icon from the bottom).
p) Click on the line thickness that is the $4^{th}$ down in the first column.
q) You might want to correct the position or length of the arrow. In order to change the length use one of the little squares on either end of the arrow. The position is changed by clicking on the arrow (not on one of the little squares) and moving the mouse.
r) To create the second arrow, make certain that the first arrow is highlighted (the little squares will be visible around the edges). Click on the "Copy" icon (looks like 2 sheets of paper overlapping one another) located on the **Standard** toolbar ($6^{th}$ icon from the left). Then, click on the "Paste" icon, which looks like a clipboard with a piece of paper located next to the "Copy" icon.
s) The second arrow will now be placed on top of the first arrow (It may seems as if there is only one arrow there). Click on the arrow and hold down the left mouse button while positioning the second arrow.

**You have now finished creating your first slide!**

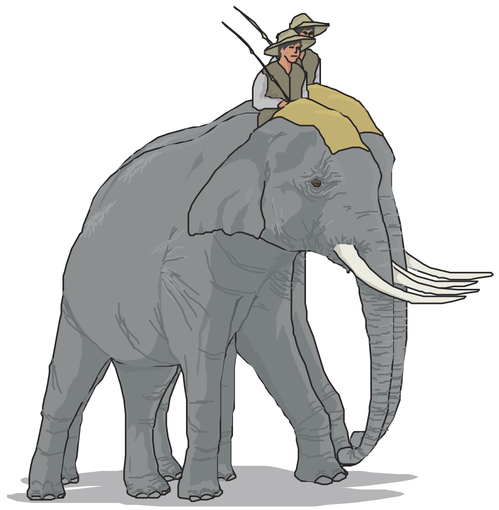
**Please let the experimenter know that you are finished.**

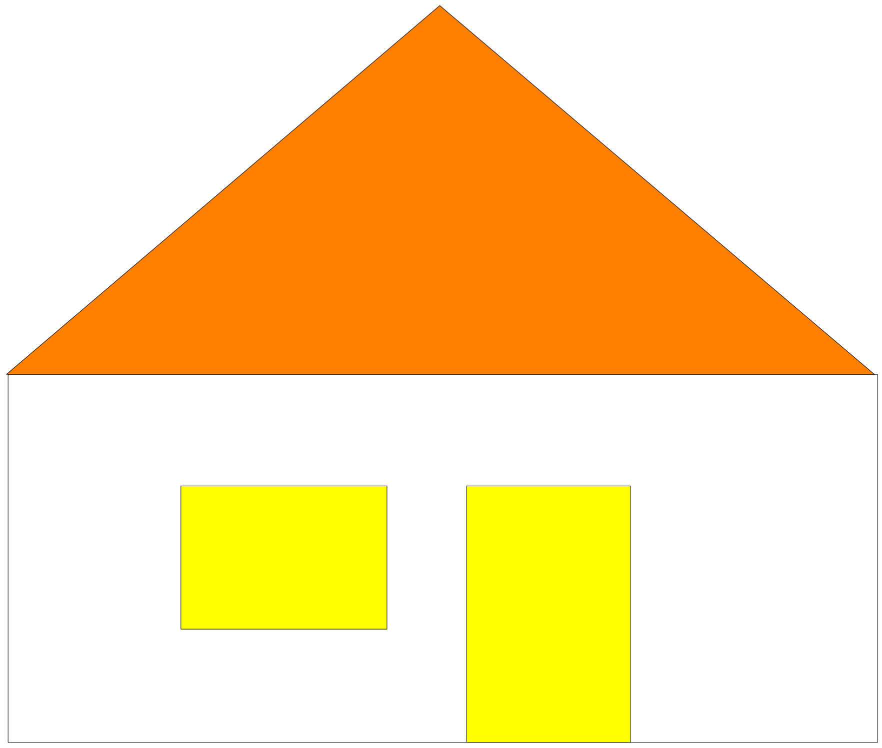
## APPENDIX C
## INTRODUCTORY TRAINING SLIDE

# Big circle, small rectangle, **thick <u>double</u> arrows**

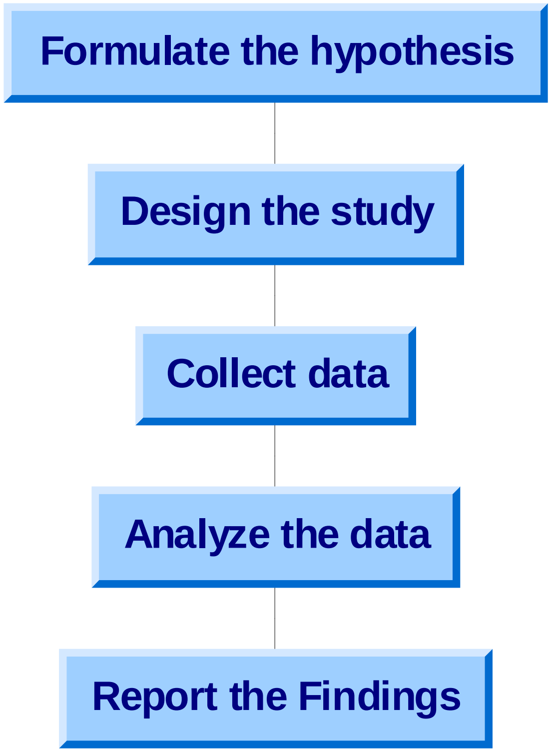


# ❁ Learning to Use Presentations! ❁



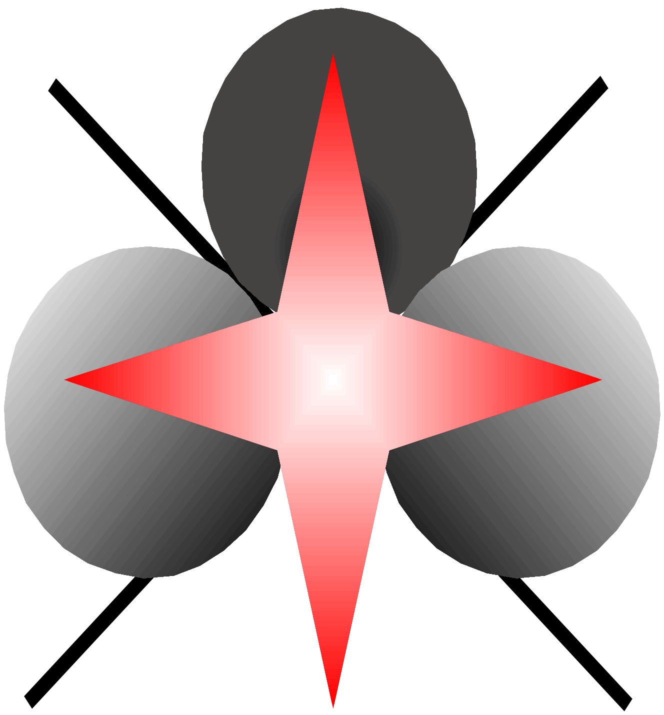


# Stage Model of the Research Process




(Levy, 2003)

# An Interesting Combination of Objects



# APPENDIX E

## ERROR AVOIDANT TRAINING INSTRUCTIONS

In the last few minutes you designed your first slide according to the printed original by following the instructions.

The second part of the training is structured in a similar way. Your task is to design additional slides on the basis of a printed original. Again you will receive instructions concerning the steps leading to the creation of each slide. In addition to these instructions you may feel free to consult the manual containing basic information on Presentations$^{TM}$ that you were given at the start of the training session. Please work on your slide independently, using the written manual.

Please follow the written instructions carefully while working on the slide. Both the slide and the written instructions are designed in a way that ensures that you will be “led” to the most important parts of the slide within a short space of time. This allows you to train the correct steps in working with Presentations$^{TM}$ right from the start.

In case an error occurs, please notify the experimenter.

## Training Slide 1

**<u>Task:</u>** Design a slide using Presentations™ that looks like the printed original.
***Note**: your slide does not have to match the original down to the millimeter, but the objects and text in the original should be present in your slide and should match the original as close as possible in shape, color and position.*

**1) Formatting the text:**

a) To insert the text box use the mouse to click on the icon "Text Object Tools", the 5th icon down on the Tool Palette.
b) Now, move the mouse to the slide and click the left mouse button to create a text box.
c) Type the text inside the text box "Learning to use Presentations!"
d) You may now move the text box to its desired location by clicking on the text box and continuing to hold down the left mouse button while moving the mouse.
e) You may resize the text box by left clicking with the mouse on one of the small boxes along the edge of the text box and while continuing to hold down the left mouse button move the mouse to make the text box the desired size.
f) To format the words in the text box, begin by increasing the font size. Highlight the text by moving the mouse with the left mouse button held down across the text. The text is now displayed in front of a black background.
g) Now, on the **Property** toolbar click on the flyout (small black arrow pointing down) next to the field showing the font size (presently 32) and select the new font size, 42. If necessary, you can use the upward arrow or the downward arrow to scroll to the desired font size.
h) While the text is still selected
i) To center the text in the text box highlight the text, click the flyout on the "Justification" icon (looks like several horizontal lines next to a vertical line on the left) located on the **Property** toolbar, and click on "Center".
j) To insert the shapes, first click in the text box where you want the shape to appear. Then, click Insert on the **Menus** toolbar. Click on Symbol. A box displaying various symbols should now appear in the lower right corner of the screen.
k) Use the downward facing arrow to scroll to the star shaped symbol in the 16th row and the 2nd column. Select this symbol by clicking on it with the left mouse button. Click on Insert at the bottom of the symbols box. Now, repeat these steps to insert the second symbol.
l) After both symbols are inserted, click close at the bottom of the symbols box.
m) You have now finished formatting the text. If necessary, you may go back to points d or e to resize or move the text box.

**2) Formatting the objects in the slide:**

a) Begin by making the image of a house. Start by inserting the rectangular base of the house. Click on the Basic Shapes" icon on the **Tool Palette** (the 7th icon down).
b) Now move the mouse to click on the icon of a rectangle.
c) Then, move the mouse to the approximate position on the slide where the rectangle should appear. Click on that point and release the mouse button. A green rectangle framed by several white squares will appear.

d) You can size the rectangle by clicking on one of the small squares and holding down the left mouse button while moving the mouse to make the rectangle the desired size. Release the mouse button when the rectangle is the right size and shape.
e) If the rectangle needs to be moved to its correct position, click on the rectangle (not on one of the small squares along its edges) and move the rectangle by moving the mouse (keeping the mouse button pressed down).
f) You can change the rectangle's color by clicking on the "Foreground Fill Color" icon located on the Tool Palette ($14^{th}$ icon down). Click on the color "White".
g) To create the rectangular shaped "door", begin by clicking on the Basic Shapes" icon on the **Tool Palette** (the $7^{th}$ icon down).
h) Now move the mouse to click on the icon of a rectangle.
i) Then, move the mouse to the approximate position on the slide where the rectangle should appear. Click on that point and release the mouse button. A yellow rectangle framed by several squares will appear.
j) You can size the rectangle by clicking on one of the small squares and holding down the left mouse button while moving the mouse to make the rectangle the desired size. Release the mouse button when the rectangle is the right size and shape.
k) If the rectangle needs to be moved to its correct position over the larger base rectangle created first, click on the rectangle (not on one of the small squares along its edges) and move the rectangle by moving the mouse (keeping the mouse button pressed down).
l) You can change the rectangle's color by clicking on the "Foreground Fill Color" icon located on the Tool Palette ($14^{th}$ icon down). Click on the color "Yellow".
m) Repeat these steps to create the rectangular shaped "window".
n) To create the triangular shaped "roof" begin by clicking on the Basic Shapes" icon on the **Tool Palette** (the $7^{th}$ icon down).
o) Now move the mouse to click on the icon of a triangle.
p) Then, move the mouse to the approximate position on the slide where the triangle should appear. Click on that point and release the mouse button. A yellow triangle framed by several squares will appear.
q) You can size the triangle by clicking on one of the small squares and holding down the left mouse button while moving the mouse to make the triangle the desired size. Release the mouse button when the triangle is the right size and shape.
r) If the triangle needs to be moved to its correct position over the larger base rectangle created first, click on the triangle (not on one of the small squares along its edges) and move the triangle by moving the mouse (keeping the mouse button pressed down).
s) You can change the triangle's color by clicking on the "Foreground Fill Color" icon located on the Tool Palette ($14^{th}$ icon down). Click on the color "Orange"
t) To insert the image of the elephant go to the "Clipart" icon located on the **Standard** toolbar ($10^{th}$ from the left).
u) Use the downward facing arrow to scroll to the image of a gray elephant.
v) Select the image by clicking on it with the left mouse button and press insert located at the bottom of the clipart box. Then, press close.
w) The image of a large gray elephant with a man atop should now appear on your slide.
x) You can size the elephant image by clicking on one of the small squares and holding down the left mouse button while moving the mouse to make the image the desired size. Release the mouse button when the image is the right size and shape.

y) If the image needs to be moved to its correct position next to the “house”, click on the image (not on one of the small squares along its edges) and move the image by moving the mouse (keeping the mouse button pressed down).

**You have now completed the first training slide.**
**Please continue with the second training slide.**

# Training Slide 2

1) **Inserting a new slide:**
   a) Go up to the **Standard** toolbar and click on the "New Slide" icon (11th icon from the left)
   b) The New Slide box will appear on the screen. Click on the layout with a title and org. chart (located on the far right)
   c) Once the desired layout is selected, click "OK" on the right of the New Slide box.

2) **Formatting the text:**
   a) To insert the text, begin by double clicking with the left mouse button on the box that says "Double Click To Add Title".
   b) A cursor will begin flashing and you can begin typing the words "Stage Model of the Research Process".
   c) To format the words in the text box, begin by highlighting the text. Highlight the text by moving the mouse with the left mouse button held down across the text. The text is now displayed in front of a black background.
   d) Next, go to Format on the **Menus** toolbar. Click on "Font" located at the top. The Font Properties box will appear on the screen.
   e) Under "Face" select the font type as Arial. If necessary, use the upward and downward facing arrow to scroll to it.
   f) Under "Size" select the size "42". Again if necessary, use the upward and downward facing arrow to scroll to it.
   g) Under "Appearance" select **Bold**.
   h) Click on color and select "Dark Blue".
   i) Press "OK" at the bottom of the Font Properties box.
   j) You should now see the slide with the title formatted.

3) **Formatting the object in the slide:**
   a) To insert the object, begin by double clicking with the left mouse button on the box that says "Double Click to Add Org Chart".
   b) A 3-tiered org chart should now appear. To begin creating the object, select the box on the right in the second level.
   c) Right click with the mouse and select "Delete Box".
   d) There should now be only one box coming off the top box.
   e) Next, select the box on the far right on the 3rd level. Right click with the mouse and select "Delete Box".
   f) Repeat the previous step. You should now have 3 levels with one box in each.
   g) To add a box, select the bottom box. On the **Property** toolbar click on the "Subordinate" icon (located next to the "Underline" icon). Select the number 1 to add only one box below. You should now have 4 levels with one box in each.
   h) To add the 5th box, select the bottom box. On the **Property** toolbar click on the "Subordinate" icon (located next to the "Underline" icon). Select the number 1 to add only one box below. You should now have 5 levels with one box in each.

i) To begin formatting the boxes, select the first box. Then, hold down the Control key ("Ctrl") in the lower left corner of the keyboard while you select the $2^{nd}$, $3^{rd}$, $4^{th}$, and $5^{th}$ boxes. Once all the boxes are selected you can let off the Control key.
j) To change the fields that appear in the boxes, click on Format on the **Menus** toolbar. Click on "Box Fields".
k) The Box Fields box should now appear on the screen. Under "Current Fields" on the right side deselect "Title". Press "OK" at the bottom of the Box Fields box.
l) Then to change the fill color of the boxes, click on Format on the **Menus** toolbar. Click on "Box Properties".
m) The Box Properties box should now appear on the screen. Click on the "Fill" Tab.
n) Under "Fill Style" select "Pattern"
o) Next to "Foreground" click the icon that looks like a container of paint being poured. Select the color "Pale Blue".
p) There should now be a box on the right side that is solid pale blue in color.
q) Press "OK" at the bottom of the Box Properties box.
r) To format the font, click on Format on the **Menus** toolbar. Click on "Font". The Font Properties box should now appear.
s) Under "Face" select the font type as Arial. If necessary, use the upward and downward facing arrow to scroll to it.
t) Under "Size" select the size "16". Again if necessary, use the upward and downward facing arrow to scroll to it.
u) Under "Appearance" select **Bold**.
v) Click on color and select "Dark Blue".
w) Press "OK" at the bottom of the Font Properties box.
x) To change the border style, click the "Border Style" icon on the **Property** toolbar. Select the "Beveled" option at the bottom of the menu.
y) You are now ready to insert the text into each box. Double click with the left mouse button on the $1^{st}$ box and type the text "Formulate the hypothesis".
z) Then, double click with the left mouse button on the $2^{nd}$ box and type the text "Design the study".
aa) Next, double click with the left mouse button on the $3^{rd}$ box and type the text "Collect data".
bb) Then, double click with the left mouse button on the $4^{th}$ box and type the text "Analyze the data".
cc) Finally, double click with the left mouse button on the $5^{th}$ box and type the text "Report the Findings".
*dd)* If the object needs to be moved, click on the edge of the object (not on one of the small squares along its edges) and move the object by moving the mouse (keeping the mouse button pressed down).
*ee)* To insert the text below the object, *use the mouse to click on the icon* "Text Object Tools", the $5^{th}$ icon down on the **Tool Palette**.
ff) Now, move the mouse to the slide and click the left mouse button to create a text box.
gg) Inside the text box type "(Levy, 2003)".
hh) To format the words in the text box, decrease the font size. Highlight the text by moving the mouse with the left mouse button held down across the text. The text is now displayed in front of a black background.

ii) Now, on the **Property** toolbar click on the flyout (small black arrow pointing down) next to the field showing the font size (presently 32) and select the new font size, 14. If necessary, you can use the upward arrow or the downward arrow to scroll to the desired font size.

**You have now completed the second training slide.**
**Please continue with the third training slide.**

# Training Slide 3

**1) Inserting a new slide:**

a) Go up to the **Standard** toolbar and click on the "New Slide" icon (11th icon from the left)

b) The New Slide box will appear on the screen. Click on the layout with only a title (1st slide layout)

c) Once the desired layout is selected, click "OK" on the right of the New Slide box.

**2) Formatting the text:**

a) Click once on the box that says "Double Click to Add Title".

b) Click on Format on the **Menus** toolbar. Select "Title Properties". The Title Properties box should now appear on the screen.

c) Click on the Box tab at the top. Under "Position" select "Behind".

d) Under "Fill Style and Color" click on "Properties". Under "Fill Style" select "Pattern"

e) Next to "Foreground" click the icon that looks like a container of paint being poured. Select the color "Light Gray".

f) There should now be a box on the right side that is solid pale gray in color. Click "OK" at the bottom.

g) In the section titled "Corner Style" select "Rounded rectangle". Now click "OK" at the bottom of the Title Properties box.

h) Now, double click with the left mouse button in the "Double Click to Add Title" box.

i) Type the text "An Interesting Combination of Objects".

j) To format the text in the text box, begin by highlighting the text. Highlight the text by moving the mouse with the left mouse button held down across the text. The text is now displayed in front of a black background.

k) Next, go to Format on the **Menus** toolbar. Click on "Font" located at the top. The Font Properties box will appear on the screen.

l) Under "Face" select the font type as Arial. If necessary, use the upward and downward facing arrow to scroll to it.

m) Under "Size" select the size "42". Again if necessary, use the upward and downward facing arrow to scroll to it.

n) Under "Appearance" select **Bold**.

o) Click on color and select "Black".

p) Press "OK" at the bottom of the Font Properties box.

q) You should now see the slide with the title formatted.

**3) Formatting the objects in the slide:**

a) To create the lines, begin by clicking on the flyout for the "Line Shapes" icon on the **Tool Palette** (6th icon down). Click on the icon "Draw a line" and release the mouse button.

b) Move the mouse to the position on the slide where the lower end of the line is supposed to be positioned.

c) Press down the left mouse button and keep it pressed while moving the mouse to the right where the upper end of the line is supposed to be positioned. Release the mouse button when you have reached that position.

d) Change the thickness of the line by clicking on the “Line Width” icon on the **Tool Palette** (2nd icon from the bottom).
e) Click on the line thickness that is the 4th down in the first column.
f) You might want to correct the position or length of the line. In order to change the length use one of the little squares on either end of the line. The position is changed by clicking on the line (not on one of the little squares) and moving the mouse.
g) To create the second line, begin by clicking on the flyout for the “Line Shapes” icon on the **Tool Palette** (6th icon down). Click on the icon “Draw a line” and release the mouse button.
h) Move the mouse to the position on the slide where the lower end of the line is supposed to be positioned (so that once completed the 2 lines will form an X).
i) Press down the left mouse button and keep it pressed while moving the mouse to the right where the upper end of the line is supposed to be positioned. Release the mouse button when you have reached that position.
j) Change the thickness of the line by clicking on the “Line Width” icon on the **Tool Palette** (2nd icon from the bottom).
k) Click on the line thickness that is the 4th down in the first column.
l) You might want to correct the position or length of the line. In order to change the length use one of the little squares on either end of the line. The position is changed by clicking on the line (not on one of the little squares) and moving the mouse.
m) Next, to create the circular shapes, click on the “Basic Shapes” icon on the **Tool Palette** (the 7th icon down).
n) Now move the mouse to click on the icon of an ellipse.
o) Then, move the mouse to the approximate position on the slide where the circle should appear (The circle should fit within one of the triangular shaped spaces created by the lines forming an X). Click on that point and release the mouse button. A circle framed by several white squares will appear.
p) You can enlarge the circle by clicking on one of the small squares and holding down the left mouse button while moving the mouse to make the circle the desired size. Release the mouse button when the circle is the right size and shape.
q) If the circle needs to be moved to its correct position, click on the circle (not on one of the small squares along its edges) and move the circle by moving the mouse (keeping the mouse button pressed down).
r) Repeat these steps to insert the other 2 circles. There should now be circles positioned to the left, top, and right of the X.
s) To change the appearance of the circle, click on the “Fill Pattern” icon located on the **Tool Palette** (13th icon down). When the box appears, select “More”.
t) In the Object Properties box click on the “Fill” tab. Under “Fill Style” click on the 3rd icon, “Gradient”.
u) Next to “Foreground” click the icon that looks like a container of paint being poured. Select the color “Black”.
v) Next to “Background” click the icon that looks like a container of paint being poured. Select the color “White”.
w) From the box below select the appropriate gradient. Consider type of gradient and the direction of the gradient.
x) The selected fill will appear in the box on the right side of the Object Properties box.

y) Click "OK" at the bottom of the Object Properties box.
z) Repeat these steps to select the fill pattern for the 2 remaining circles.
aa) To create the star shape, click on the flyout next to the "Star Shapes" icon on the **Tool Palette** (the 10th icon down).
bb) Now move the mouse to click on the icon of a four-point star (1st icon).
cc) Then, move the mouse to the approximate position on the slide where the star should appear (The star should fit over the center point of the X). Click on that point and release the mouse button. A star framed by several white squares will appear.
dd) You can resize the star by clicking on one of the small squares and holding down the left mouse button while moving the mouse to make the star the desired size. Release the mouse button when the star is the right size and shape.
ee) If the star needs to be moved to its correct position, click on the star (not on one of the small squares along its edges) and move the star by moving the mouse (keeping the mouse button pressed down).
ff) To change the appearance of the circle, click on the "Fill Pattern" icon located on the **Tool Palette** (13th icon down). When the box appears, select "More".
gg) In the Object Properties box click on the "Fill" tab. Under "Fill Style" click on the 3rd icon, "Gradient".
hh) Next to "Foreground" click the icon that looks like a container of paint being poured. Select the color "Red".
ii) Next to "Background" click the icon that looks like a container of paint being poured. Select the color "White".
jj) From the box below select the appropriate gradient. The gradient should appear white in the center and become redder as it moves out to the edges.
kk) The selected fill will appear in the box on the right side of the Object Properties box.
ll) Click "OK" at the bottom of the Object Properties box.

**You have now completed the third training slide.**
**Please let the experimenter know that you have completed this portion of the training.**

## APPENDIX F

## ERROR MANAGEMENT INSTRUCTIONS

You have spent the last few minutes designing a slide according to a printed original using detailed instructions. You now have some general knowledge of the workings of Presentations. The next part of the training session is designed to consolidate and expand your knowledge of Presentations. Therefore, it is important that during this next segment you work intensively with the program. You will work independently throughout the rest of the training session because working **independently** with Presentations results in an **intensive dealing with the program**.

Similar to the first portion of the training it is now your task to **design each slide according to the printed original**. During this segment of the training you will not receive written information about the steps leading to the solution and you will not receive any instructions from the experimenter. You may refer to the manual containing the basic information about the program Presentations that was given to you at the beginning of the first training segment.

While working on your own on the second slide you will certainly make some **errors**. **This is a good thing and in line with the idea of this training**! By making errors you will learn to deal with the program Presentations more effectively. Errors are a natural part of the learning process!

It is worth it to try some of the functions of the program even when you are not sure whether you are on the right track. No matter what there is always a way to leave the error situation.

For example, if an error occurs, you can fix it by clicking on the "**undo**" icon in the toolbar (the icon shows a little arrow pointing to the left). By clicking it you can reverse the previous action that did not lead to the desired outcome. In case you want to delete an object from the slide, highlight it with a mouse click and push the "**delete**" key (key "delete" on the right hand side of your keyboard).

In case you make an error, think about the following:

- The more errors that you make, the more you learn!
- Errors tell you about what you still have to learn!
- There is always a way to leave the error situation!
- Errors are a natural part of the learning process!

APPENDIX G

ITEMS ASSESSING METACOGNITIVE ACTIVITY

For each of the following items, please indicate your response using the following scale.

| Strongly Disagree | Disagree | Neither Agree Nor Disagree | Agree | Strongly Agree |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

1. _____ During this training program, I made up questions to help focus on my learning.
2. _____ During this training program, I asked myself questions to make sure I understood the things I had been trying to learn.
3. _____ During this training program, I tried to change the way I learned in order to fit the demands of the situation or topic.
4. _____ During this training program, I tried think through each topic and decide what I was supposed to learn from it, rather than just jumping in without thinking.
5. _____ During the training program, I tried to determine which things I didn't understand well and adjusted my learning strategies accordingly.
6. _____ During this training program, I set goals for myself in order to direct my activities.
7. _____ If I got confused during this training program, I made sure I sorted it out as soon as I could before moving on.
8. _____ During this training program, I thought about how well my tactics for learning were working.
9. _____ During this training program, I thought carefully about how well I had learned material I had previously studied.
10. _____ During this training program, I thought about what skills needed the most practice.
11. _____ During this training program, I tried to monitor closely the areas where I needed the most improvement.
12. _____ During this training program, I thought about what things I needed to do to learn.
13. _____ During this training program, I carefully selected what to focus on to improve on weaknesses I identified.
14. _____ During this training program, I noticed where I made mistakes and focused on improving those areas.
15. _____ When I practiced a new skill in this training program, I monitored how well I was learning its requirements.

## APPENDIX H

## ITEMS ASSESSING EMOTION CONTROL

Some difficulties may have arisen while working on the task(s). Please indicate the response that best describes your reaction to these difficulties.

| Strongly Disagree | Disagree | Neither Agree Nor Disagree | Agree | Strongly Agree |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

1. _____ When difficulties arose, I did not allow myself to lose my composure.
2. _____ When difficulties arose, I purposely continued to focus myself on the task.
3. _____ When difficulties arose, I calmly considered how I could continue the task.
4. _____ When difficulties arose, I allowed myself to be distracted by worrisome thoughts.
5. _____ When difficulties arose, I let myself become distracted.
6. _____ When difficulties arose, I let myself be sidetracked from the task.
7. _____ When difficulties arose, I was able to focus all my attention on the task.
8. _____ When difficulties arose, I was able to motivate myself to continue.

APPENDIX I

ITEMS ASSESSING INTRINSIC MOTIVATION

For each of the following statements, please indicate how true it is for you, using the following scale:

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| not at all true | | | somewhat true | | | very true |

1. _____ I enjoyed doing this training very much

2. _____ This training was fun to do.

3. _____ I thought this training was boring.

4. _____ This training did not hold my attention at all.

5. _____ I would describe this training as very interesting.

6. _____ I thought this training was quite enjoyable.

7. _____ While I was doing this training, I was thinking about how much I enjoyed it.

## APPENDIX J

## ITEMS ASSESSING KNOWLEDGE

The following are questions about Presentations™ and various aspects of the software. Please indicate the best answer for each question.

1. Corel Presentations allows you to work on slides in three views. Which of the following is ***no***t a slide view?
   A. Slide Outliner
   B. Slide Sorter
   C. Slide Master
   D. Slide Editor

2. If you would like to add a picture from a file to your slide, how would you proceed?
   A. Insert →Graphics→Clipart
   B. Insert→File
   C. Insert →Graphics→From File
   D. Format→Object Properties

3. The Tool Palette can be used to:
   A. Add clipart
   B. Add an organizational chart
   C. Run spellcheck
   D. Change the justification

4. To make a change that will appear on all slides in a slideshow, the change must be made on the:
   A. Slide Layer
   B. Layout Layer
   C. Outline Layer
   D. Background Layer

5. When creating an organization chart, you can add a box next to an existing box by:
   A. Insert→Coworker
   B. Insert→Employee
   C. Insert→Manager
   D. Insert→Staff

6. Which of the following is ***not*** a way to add a picture to your slide?
   A. Click the Clipart icon on the Toolbar
   B. Insert →Graphics→Clipart
   C. Create a Bitmap image
   D. View→Selected Object Viewer

7. Which of these will allow you to specify a keystroke to play a sound while playing your slide show?
   A. SpeedKey
   B. Animation
   C. SpeedLink
   D. Insert→Sound

8. Which function can QuickCorrect perform?
   A. Correct sizing of objects
   B. Correct words as you type
   C. Correct object formatting
   D. Correct use of words

9. You can group various objects such as pictures that you place in your slide. The benefit of grouping objects is that:
   A. Once objects are grouped, they can be formatted as one object
   B. Once objects are grouped, it saves hard disk space
   C. Once objects are grouped, it speeds up processing while running a slide show
   D. Once objects are grouped, it creates links to all objects

10. To have an organization chart display a person's name, title, and department how would you proceed?
   A. Format→Box Properties
   B. Format→Get Attributes
   C. Format→Box Fields
   D. Format→Font

11. If you wish to view all the slides you have created at the same time, which slide view would you use?
   A. Slide Outliner
   B. Slide Sorter
   C. Slide Editor
   D. Slide Master

12. Which of these is ***not*** a function that can be performed using the Tool Palette (the toolbar along the left side of the screen)?
   A. Change the fill color of an object
   B. Create a chart
   C. Run Grammatik
   D. Insert a shape

13. Which function can be performed by placing the mouse over the handles (little white boxes along the edge of an object) and holding down the left mouse button while moving the mouse?
   A. Reposition the object
   B. Resize the object
   C. Change the fill color
   D. Move the object to the front/back

14. Which of these is ***not*** an example of an object fill pattern?
   A. Gradient
   B. Picture
   C. Spray Paint
   D. Texture

15. To group objects you must first:
   A. Make all the objects the same size
   B. Bring all of the objects to front
   C. Select all of the objects
   D. Make all objects touch

16. A symbol can be inserted:
   A. Anywhere on the slide
   B. Only in a text box
   C. Only inside a picture
   D. On a chart

17. Which of these is an example of a chart that can be inserted in a slide?
   A. Data Chart
   B. Business Chart
   C. Weather Chart
   D. Statistical Chart

18. Clicking on Object Properties will allow you to:
   A. Insert text over the object
   B. Insert a sound
   C. Create a shadow
   D. Resize the object

19. When creating an organization chart, box properties can be used to:
   A. Select the number of branches
   B. Change the size of the box
   C. Insert a subordinate
   D. Format the connector

20. Which of these is ***not*** something that can be inserted in a slide?
   A. Equation
   B. Spreadsheet
   C. Movie
   D. Image Tools

21. For which of these can you ***not*** select a shadow option?
   A. Clipart
   B. Basic Shape
   C. Equation
   D. Text

22. To make an object such as a square appear behind an existing text box, you must highlight the object and select:
   A. To Back
   B. To the Side
   C. Flip
   D. Rotate

23. Image Tools can be used to:
   A. Rotate an object
   B. Add text to an object
   C. Change the color of an object
   D. Resize an object

24. To change the fill effect and the color of an object, you must:
   A. select the fill effect, then select the color
   B. select the color, then select the fill effect
   C. a or b
   D. none of the above

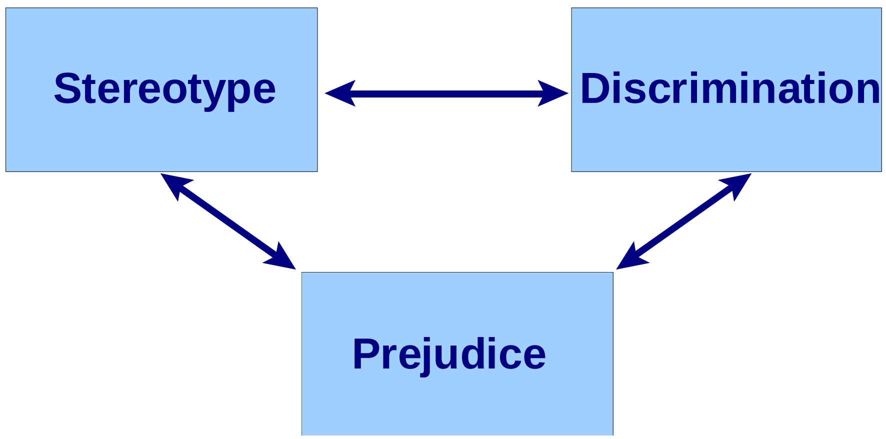
25. Which of these can you use to create a shadow on an object?
   A. Format→Manual Kerning
   B. Shadow Options
   C. Format→Line
   D. Insert→Graphics→Shadow

26. You can format a clipart object to appear in only black and white using:
   A. Image Tools
   B. Object Properties
   C. Foreground Fill Color
   D. Bitmap Image

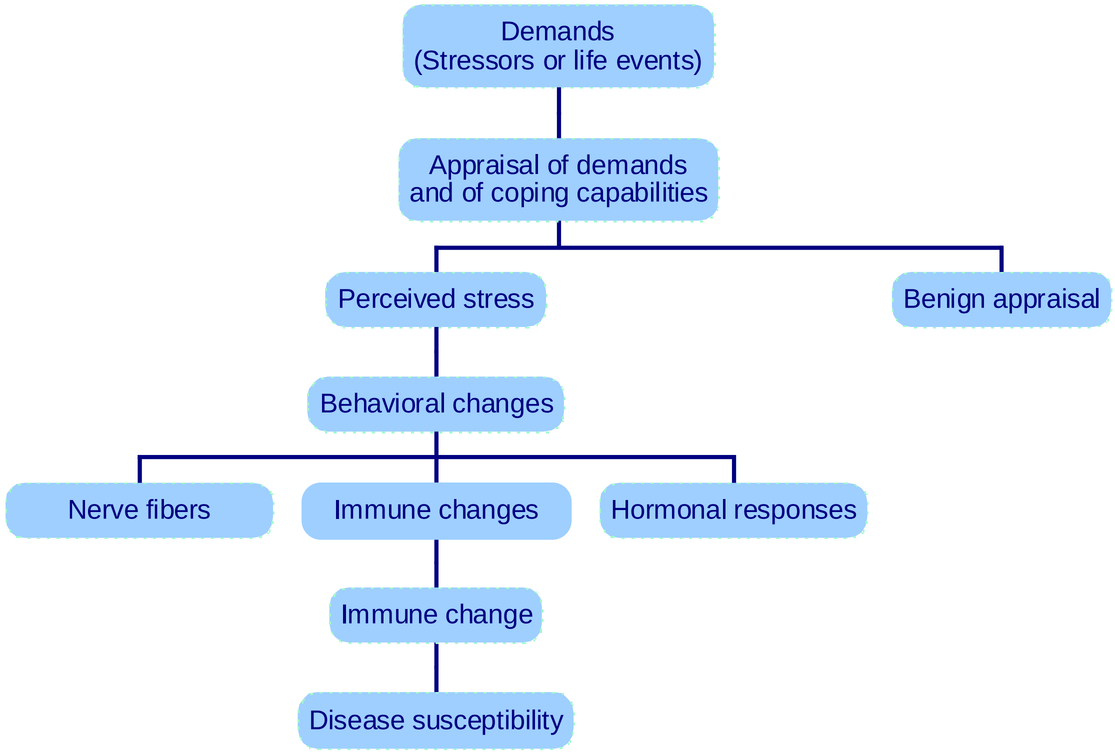
APPENDIX K
TRANSFER SLIDES

# Definitions

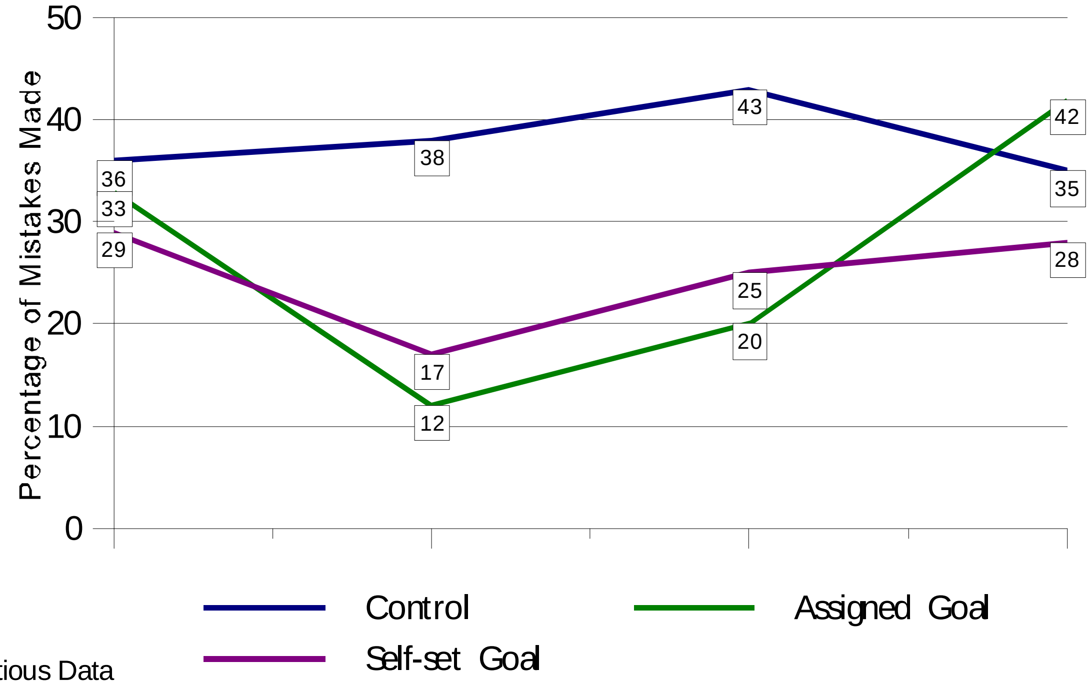
- Stereotype - A fixed or conventional notion or conception.
- Prejudice - An opinion held in disregard of facts that contradict it.
- Discrimination - A distinction in treatment.



# Could stressful life events lead to illness?



# Effects of Goal Setting on Performance Mistakes




*Note*: Fictitious Data

## APPENDIX L

## ITEMS ASSESSING COMPUTER AND SOFTWARE EXPERIENCE

What is your major? ________________________________________________

How many years have you been using a computer? ______________________

Do you use a computer at least once a day?
❑ Yes ❑ No

The following is a list of popular computer software packages. Please place a check in the box next to each piece of software that you have used at one time or another.

| | | |
|---|---|---|
| ❑ Microsoft Word | ❑ Picture It! Photo | ❑ Corel KPT |
| ❑ Microsoft PowerPoint | ❑ Corel WordPerfect | ❑ Corel Presentations |
| ❑ Microsoft Excel | ❑ Corel Ventura | ❑ OpenOffice Writer |
| ❑ Microsoft Access | ❑ CorelDRAW | ❑ OpenOffice Calc |
| ❑ Microsoft Publisher | ❑ PaintShop Pro | ❑ OpenOffice Impress |
| ❑ Digital Image Pro | ❑ Animation Shop | ❑ OpenOffice Draw |
| ❑ Microsoft OneNote | ❑ Corel Knockout | ❑ StarOffice |

The following items will ask you about your experience with computers and various software packages. Please mark your response to each question.

How would you rate your level of experience using word processing software such as Microsoft Word?
❑ Very Inexperienced ❑ Inexperienced ❑ Some Experience ❑ Experienced ❑ Very Experienced

Have you ever created a document using spreadsheet software such as Microsoft Excel?

❑ Yes ❑ No

How would you rate your level of experience using spreadsheet software such as Microsoft Excel?
❑ Very Inexperienced ❑ Inexperienced ❑ Some Experience ❑ Experienced ❑ Very Experienced

Have you ever created a document using presentation software such as Microsoft PowerPoint?

❑ Yes ❑ No

Have you ever created a document using Corel® Presentations™?

❑ Yes ❑ No

How would you rate your level of experience using presentation software such as Microsoft PowerPoint?

❑ Very Inexperienced ❑ Inexperienced ❑ Some Experience ❑ Experienced ❑ Very Experienced

Have you ever created a table using word processing, spreadsheet, or presentation software?

❑ Yes ❑ No

How would you rate your level of experience creating tables using word processing, spreadsheet, or presentation software?

❑ Very Inexperienced ❑ Inexperienced ❑ Some Experience ❑ Experienced ❑ Very Experienced

Have you ever created a graph using word processing, spreadsheet, or presentation software?

❑ Yes ❑ No

How would you rate your level of experience creating graphs using word processing, spreadsheet, or presentation software?

❑ Very Inexperienced ❑ Inexperienced ❑ Some Experience ❑ Experienced ❑ Very Experienced

Have you ever inserted or edited a picture using word processing, spreadsheet, or presentation software?

❑ Yes ❑ No

How would you rate your level of experience inserting and editing pictures using word processing, spreadsheet, or presentation software?

❑ Very Inexperienced ❑ Inexperienced ❑ Some Experience ❑ Experienced ❑ Very Experienced

APPENDIX M

ITEMS ASSESSING COGNITIVE ABILITY

Sample Items from the Wonderlic Personnel Test™

1. Assume the first 2 statements are true. Is the final one:
   1 true, 2 false, 3 not certain?
   The boy plays baseball. All baseball players wear hats.
   The boy wears a hat.
2. Paper sells for 21 cents per pad. What will 4 pads cost?
3. How many of the five pairs of items listed below are exact duplicates?
   Nieman, K.M. Neiman, K.M.
   Thomas, G.K. Thomas, C.K.
   Hoff, J.P. Hoff, J.P.
   Pino, L.R. Pina, L.R.
   Warner, T.S. Wanner, T.S.
4. PRESENT RESENT Do these words
   1 have similar meanings, 2 have contradictory meanings, 3 mean neither the same nor opposite?
5. A train travels 20 feet in 1/5 second. At this same speed, how many feet will it travel in three seconds?
6. When rope is selling at $.10 a foot, how many feet can you buy for sixty cents?
7. The ninth month of the year is
   1 October, 2 January, 3 June,
   4 September, 5 May.
8. Which number in the following group of numbers represents the smallest amount?
   7 .8 31 .33 2
9. In printing an article of 48,000 words, a printer decides to use two sizes of type. Using the larger type, a printed page contains 1,800 words. Using smaller type, a page contains 2,400 words. The article is allotted 21 full pages in a magazine. How many pages must be in smaller type?
10. Three individuals form a partnership and agree to divide the profits equally. X invests $9,000, Y invests $7,000, Z invests $4,000. If the profits are $4,800, how much less does X receive than if the profits were divided in proportion to the amount invested?
11. Assume the first two statements are true. Is the final one:
    1 true, 2 false, 3 not certain?
    Tom greeted Beth. Beth greeted Dawn.
    Tom did not greet Dawn.
12. A boy is 17 years old and his sister is twice as old. When the boy is 23 years old, what will be the age of his sister?

**Answers**

1. true 2. 84 cents 3. 1 4. 3 5. 300 feet 6. 6 feet
7. September 8. .33 9. 17 10. $560 11. not certain
12. 40 years old

# VITA

Natalie Trask Bourgeois is originally from Baton Rouge, Louisiana. She received her Bachelor of Science degree in psychology from Texas Christian University in 1999 and she completed a Master of Arts degree in industrial/organizational psychology at Louisiana State University in 2003. Following the completion of her degree, Natalie will be working for the Home Depot as part of the Organizational Effectiveness team in Atlanta, Georgia.