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An Evaluation of Game Fiction-Enhanced Training: Using Narrative to Improve Trainee Reactions and Learning

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AN EVALUATION OF GAME FICTION-ENHANCED TRAINING: USING

NARRATIVE TO IMPROVE TRAINEE REACTIONS AND LEARNING

by

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ABSTRACT

AN EVALUATION OF GAME FICTION-ENHANCED TRAINING: USING
NARRATIVE TO IMPROVE TRAINEE REACTIONS AND LEARNING

Michael Beaumont Armstrong
Old Dominion University, 2015
Director: Dr. Richard N. Landers

Gamification is growing in popularity in instructional contexts like education and
workplace training, but it is unclear which game elements are specifically conducive to
improve learning outcomes. Narratives, which represent one way the game element
"game fiction" is commonly implemented, have been used to improve learning outcomes
over expository texts in the context of psycholinguistics, whereas the Technology-
Enhanced Training Effectiveness Model (TETEM) proposes that certain individual
differences impact the relationships between technology-enhanced training and learning
outcomes. From this theoretical basis, this study gamified a training session with game
fiction in order to improve reactions to training and learning over the original training
content. Utilizing an experimental design, it was found that trainees were more satisfied
with training enhanced with game fiction over the control text. Trainees did not differ in
posttest declarative knowledge scores by condition. Pre-existing attitudes toward game-
based learning and trainee experience with games were tested as moderators of the
condition-learning outcome relationships using hierarchical multiple regression but were
not supported. From this, it is concluded that game fiction may be used to improve
reactions to training without decreasing learning using fairly simple and low-cost
techniques.

This thesis is dedicated to my wife, Beth. Someday, I'll bring home the bacon.

ACKNOWLEDGMENTS

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CHAPTER I

INTRODUCTION

Gamification, defined as the use of game elements in non-game contexts (Deterding, Khaled, Nacke, & Dixon, 2011), is growing in popularity in instructional contexts like education and workplace training. Within education, game elements have been applied to improve student reactions to and engagement with course material (Landers & Callan, 2011; Denny, 2013). In a recent whitepaper, the American Society for Training & Development (ASTD; 2014) reported that 25% of surveyed organizations use gamification in workplace learning. ASTD (2014) also reported that 46% of surveyed organizations do not currently use gamification in learning but are considering its use within the next year. Of responding organizations using gamification in workplace learning, more than 75% reported that gamified learning efforts were at least moderately effective (ASTD, 2014). One such gamification technique is the use of game fiction, defined as the use of a fictional game world or story (Landers, 2014). Game fiction describes the nature of both the game world and the story, each of which may include elements of fantasy (Bedwell, Pavalas, Heyne, Lazzara, & Salas, 2012; Garris, Ahlers, & Driskell, 2002). For example, a game would employ a fantasy game fiction when using images of aliens to convey game context to the player (i.e., the game world) or when demonstrating that the player is a space marine on a mission to defeat those aliens (i.e., the story). In both cases, fiction is used to increase the degree to which the player identifies with a fictional person or role (Garris et al., 2002). Story, or narrative, is a specific type of game fiction that has previously been applied to instructional contexts in order to improve instructional outcomes. In this context, narrative passages are superior

to expository texts in facilitating learning comprehension, retention, and recall (Graesser, Hauft-Smith, Cohen, & Pyles, 1980; Kozminsky, 1977; Thorndyke, 1977), with narrative-expository manipulations accounting for up to 84% of the variance in recall scores (Graesser, Hauft-Smith et al., 1980) and for 62-70% of the variance in reading time (Graesser, Hoffman, & Clark, 1980). Tun (1989) found that narrative passages were consistently recalled faster and comprehended better than expository texts across age groups. In short, narratives are easier to read and remembered more accurately than expository texts.

Although narrative has been used to improve learning in laboratory studies with well-defined parameters, the effectiveness of narrative within the context of serious games, which is an area closely related to gamification, has been more mixed. A review by Bedwell and colleagues (2012) indicates that the use of game fiction in serious games has been linked to increases in learning outcomes such as knowledge (e.g., Virvou, Katsionis, & Manos, 2005) and motivation (e.g., Parker & Lepper, 1992). However, Adams, Mayer, MacNamara, Koenig, and Wainess (2012) found that learning scores for students playing a digital serious game with a narrative game element were no different than scores for students playing a digital serious game without a narrative game element.

The source of this discrepancy in the effects of narrative across contexts is currently unknown. First, Orvis, Horn & Belanich (2009) demonstrated the role of videogame experience, videogame self-efficacy, and goal orientation in the impact of serious games on learning, suggesting that individual differences play a role in the effectiveness of serious games. However, the authors did not explore game fiction specifically. Second, the differences between serious games, in which a complete game is

developed and used as a learning tool, and gamification, in which individual game elements are extracted from serious games and applied in isolation or limited combination in other contexts (Landers, 2014), may be important in understanding this conflicting research. Specifically, many game elements are active simultaneously in serious games, and the effect of any of those elements may have interacted with the effect of narrative, suppressing the effect of the narrative game element.

The impact of game fiction (as gamification) on training outcomes can be better understood via the Technology-Enhanced Training Effectiveness Model (TETEM, Landers & Callan, 2012), which describes the relationship between training technologies and training outcomes. Using the paths it describes, training technologies such as gamified training can be evaluated. Furthermore, by gamifying a training course with a single game element (e.g., game fiction), the effects of that element on training outcomes can be isolated and examined. Many training evaluation models exist that could be used to compare two different training designs (e.g., Baldwin & Ford, 1988; Kraiger, Ford, & Salas, 1993; Kirkpatrick, 2008), but these designs lack an incorporation of the effects of individual differences and contextual variables relevant to the use of specific training technologies like gamification. TETEM incorporates these variables and their relationships with training outcomes according to updated theoretical and empirical findings, making it the best model from which to evaluate game fiction-enhanced training.

In summary, gamification is applied to instructional contexts with the intent of improving learning outcomes, but the effect of game fiction on learning outcomes has not yet been examined. The present study isolated and explored the effect of game fiction on

learning outcomes by evaluating a text-based training versus a text-based training enhanced with game fiction. The present study also examined the moderating effects of individual trainee differences. TETEM suggests that technology-enhanced training, such as game fiction-enhanced training, will vary in effectiveness depending on an individual's pre-existing attitudes toward and past experiences with the training technology. Specifically, this study examines the moderating effects of attitudes toward game-based learning and experience with games on the relationship between game fiction-enhanced training and learning outcomes. Figure 1 illustrates the hypotheses the present study tested within the theoretical model of TETEM.
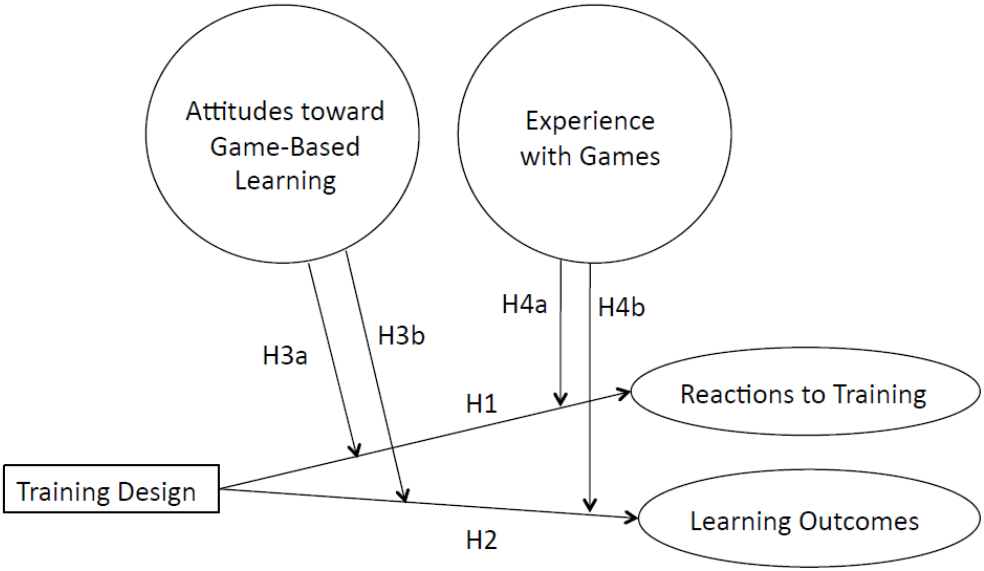
Figure 1. The theoretical model and hypotheses tested.

Gamification of Training

Gamification can be conceptualized as the extraction of game elements from successful games and the use of those game elements in non-game contexts. Points, badges, and leaderboards are some of the most common game elements utilized this way (Deterding et al., 2011). Such game elements can be used to improve general user experience, increase enjoyment in a given process or application, or improve outcomes like health, work performance, or learning outcomes (Deterding, Khaled, et al., 2011, Deterding, Sicart, Nacke, O'Hara, & Dixon, 2011). Determining which game elements to apply to improve a given outcome will depend in large part upon the context of those outcomes.

Game elements in serious games can serve as the starting point to identify game elements to be used in the gamification of learning (Landers, 2014). The success of serious games, defined as "a game in which education (in its various forms) is the primary goal, rather than entertainment" (Michael & Chen, 2005, p. 17), has demonstrated the effectiveness of game-based learning (Wouters, van Nimwegen, van Oostendorp, & van der Spek, 2013), and a successful serious game is comprised of individual game elements that either 1) facilitate learning individually, 2) facilitate learning when combined, or 3) both. In contrast, the gamification of learning consists of extracting a game element that is conducive to learning and applying it to an instructional context outside the context of a game. Landers proposed that any element comprising a serious game could be extracted and applied in the gamification of learning, integrating Bedwell and colleagues' (2012) taxonomy of serious game elements with the gamification of learning. As a result, Landers presented an exhaustive and parsimonious

taxonomy of game elements used to improve learning. This taxonomy includes 9 major game element categories: action language, assessment, conflict/challenge, control, environment, game fiction, human interaction, immersion, and rules/goals. Bedwell and colleagues summarized the use of these game elements in serious games to affect a number of learning outcomes across 42 different studies. Although Bedwell and colleagues identified the specific game elements used in each study, the studies did not usually isolate the effects of individual elements. Instead, the effects on the outcomes measured were representative of entire serious games. Fewer studies have investigated the individual effects of game elements on learning outcomes.

Instructional designers have been successful using game elements to improve a variety of outcomes across a wide variety of subjects. Early in serious games research, Malone (1981) sought to understand the motivating effects of games on student learners. By deconstructing popular games at the time, Malone was able to observe the changes in effect on student motivation to learn by experimentally isolating individual elements like assessment (i.e. feedback and scoring), game fiction (i.e. fantasy), and immersion (i.e. music and graphics). Game elements were found to be more interesting overall than non-interactive learning drills. Specifically, elements of game fiction were indicated as impacting student interest the most, followed by immersion elements, assessment elements, and no elements, respectively. More recently, Landers and Landers (2014) combined the elements of conflict/challenge, rules/goals, and assessment together in the form of a leaderboard intended to impact academic performance. The authors experimentally demonstrated that the presence of a leaderboard increased student time-on-task learning, which increased academic performance for those students. In a small

qualitative study, Dong, Dontcheva, Joseph, Karahalios, Newman, and Ackerman (2012) evaluated a prototype of a gamified program designed to teach participants how to use Adobe Photoshop. The authors used puzzles to facilitate learning, incorporating the game elements assessment, conflict/challenge, control, and rules/goals throughout the program. Participant reactions indicated that the gamified program was effective and fun. Furthermore, the researchers noted improvements in learning, and students were able to transfer their learned skills to new contexts. These studies of individual and combined game elements are promising for the impact of gamification on learning, but further research is necessary. The effects of other individual game elements on learning outcomes not mentioned here have yet to be tested.

One element, game fiction (or narrative), has great promise as a technique to improve learning outcomes. In psycholinguistics, narrative is defined as writing that "delineates actions and events which causally unfold over time" and exposition is defined as writing that "both describes and explains how something operates" (Graesser, Hauft-Smith, et al., 1980, p. 283). As mentioned previously, narrative passages have demonstrated superiority over expository texts in facilitating comprehension, retention, and recall (Graesser, Hauft-Smith, et al., 1980; Kozminsky, 1977; Thorndyke, 1977; Tun, 1989). Across studies, narrativity, defined as the degree to which a passage conveys active information with events unfolding over time, accounted for large portions of variance in learning recall, learning retention, and ease of reading (Graesser, Hauft-Smith, et al., 1980; Graesser, Hoffman, et al., 1980). Given this research, transforming descriptive or expository training content into narrative content without altering its substance should improve learning outcomes.

The Technology-Enhanced Training Effectiveness Model (TETEM)

TETEM was developed to understand training effectiveness in technology-enhanced training and provides an effective framework to examine the circumstances under which game fiction might positively or negatively impact training outcomes. Landers and Callan (2012) reviewed many different types of training effectiveness models, summarizing how each of the models reviewed was limited in its application to training enhanced with technology. The authors then integrated empirical research findings related to technology into an existing mediational model of training effectiveness theorized by Baldwin and Ford (1988). Finally, the authors proposed additional moderating relationships not previously included in training effectiveness models.

TETEM suggests that new training technologies might not lead to expected outcomes when trainees are not comfortable or experienced with the specific technology (Landers & Callan, 2012). Although the technology itself may be effective at improving learning outcomes (Armstrong & Landers, 2014), other variables may interact with the training design to worsen these outcomes. Specifically, existing attitudes toward the technology used to enhance training may moderate how the training design affects reactions and learning. If a trainee is opposed to a given technology for whatever reason, that trainee may not like the training, find it useful, or learn as much from that training as he or she could have learned. If the trainee's attitudes toward a technology are positive, he or she may enjoy the training, find it more relevant to their job, and learn more from the training. Another variable that may have a similar moderating effect is experience with the specific technology. Learning a new technology or training interface takes time

and more mental effort than using a familiar technology. By being more experienced with a given technology or training interface, trainees do not have to expend as much mental effort to accomplish the same training objectives, making it more pleasant and allowing them to learn more in the process. Given these relationships, TETEM provides a framework to evaluate the effectiveness of gamification and the individual differences related to its success. The present study seeks to explore the impact of training enhanced with gamification, specifically game fiction, in the framework of TETEM.

The Impact of Game Fiction on Reactions to Training

The use of game fiction can improve overall reactions to training by improving affective reactions to training. Research by Kopfman, Smith, Yun, and Hodges (1998) suggests that narrative texts might have a larger effect on affective reactions than descriptive or expository texts. The authors examined cognitive and affective reactions to persuasive passages about organ donation. Persuasive passages using narratives about organ donors and the individuals saved by those donations had a greater effect on reactions than did passages using statistical evidence about organ donation. However, utility reactions were more positive for persuasive passages employing statistical evidence. In a replication study, Feeley, Marshall, and Reinhart (2006) corrected for an order effect by condition unaccounted for by Kopfman and colleagues and found that utility reactions were more positive for persuasive passages utilizing narrative rather than statistical evidence, although the difference was not statistically significant. In a study examining narrative and game-based learning, Cordova and Lepper (1996) found that affective reactions were more positive for game fiction-enhanced learning conditions than for the no game fiction condition. However, their sample consisted of elementary school

students, so the degree to which these findings will generalize to working-age adults is unknown. Armstrong and Landers (2014) gave preliminary evidence for the positive impact of training video games on reactions to training, although the study was not specific to game fiction alone and used hypothetical scenarios instead of an actual video game. These findings further indicate the need to explore the relationship between game fiction-enhanced training and reactions.

The potential of game fiction can be understood by exploring psycholinguistics in greater depth. In psycholinguistics, narratives are considered to be privileged over expository texts in human understanding in that humans tend to favor narratives over other genres of prose (Norris, Guilbert, Smith, Hakimelahi, & Phillips, 2005). The most basic elements of narratives are germane to human life. Individuals are actors or agents with a purpose of some sort living through a series of events over time (Norris et al., 2005). Because human lives are essentially narratives, it is easier for people to relate to (or find relevant, as in utility reactions) and enjoy (as in affective reactions) narrative texts than it is expository texts.

Hypothesis 1. Trainees will react more positively to web-based instruction gamified with game fiction than to instruction without such gamification.

The Impact of Game Fiction on Learning Outcomes

Passages employing narrative are superior to expository texts in facilitating knowledge acquisition, retention, recall, and ease of reading (Graesser, Hauft-Smith, et al., 1980; Graesser, Hoffman, et al., 1980; Kozminsky, 1977; Thorndyke, 1977; Tun, 1989). Zabrucky and Moore (1999) found that narratives were read faster than expository texts, with a greater effect for older adults. In that study, narratives were also better

recalled than expository texts. Participants also read expository texts multiple times to achieve a similar level of comprehension as narrative texts, suggesting they found the narrative texts easier to process. With better learner comprehension and recall of material, instructional outcomes like declarative knowledge can be better achieved. Because of the increased ease of narrative processing, instructional content may also be acquired at a faster rate in narrative form versus expository form. In a summary of the psycholinguistics literature, Norris and colleagues (2005) identified 20 of 23 experimental studies conducted comparing narrative and expository texts that identified a positive effect of narrative on learning outcomes, suggesting broad value of narrative.

More recent theoretical and empirical evidence for the impact of narrative as a game fiction upon learning outcomes is mixed but generally positive. Serrano and Anderson (2004) found significant improvements in skills related to using the Food Guide Pyramid when comparing elementary students playing a game with a narrative game element to control group students. However, Adams and colleagues (2012) found no significant differences in learning when comparing a serious game with a strong narrative game element versus the same game without a narrative game element. The authors noted that the learning curve for navigating the game used in their study might have detracted from the learning process, highlighting the difficulties of studying a narrative game element in the company of many different game elements (e.g., rules/goals, immersion, environment, etc.). Within gamified learning contexts, Hamari, Koivisto, and Sarsa (2014) identified four empirical studies employing game fiction, all of which produced positive learning outcomes. However, none of the studies isolated the effect of game fiction on learning, incorporating elements of assessment,

conflict/challenge, environment, immersion, and/or rules/goals as well (Gustafsson, Katzeff, & Bang, 2009; Halan, Rossen, Cendan, & Lok, 2010; Smith & Bakker, 2011; Li, Grossman, & Fitzmaurice, 2012). In a qualitative case study, Dickey (2011) explored the impact of a narrative game element on a game-based learning environment for fostering argumentation writing and found that the narrative game element was conducive for improving learning outcomes. Overall, these findings suggest that gamification with game fiction (i.e., adding a narrative without a game) should increase learning.

Hypothesis 2. Measures of declarative knowledge learning will be greater among trainees experiencing web-based instruction gamified with game fiction than to instruction without such gamification.

Attitudes Toward Game-based Learning as a Moderator of Game Fiction's Impact

Attitudes toward game-based learning should affect how the use of game fiction in training design influences reactions to training. If training is enhanced to become more game-like, trainees with preferences toward using games in a learning context should report more positive reactions than trainees with a preference against using games in learning. Bourgonjon, Valcke, Soetaert, and Schellens (2010) assessed preference for video games, defined as "positive feelings about games for learning and predicted choice for video games in the classroom" (p. 1147). Bourgonjon and colleagues predicted preference for video games with other attitudinal constructs from the technology acceptance model (Davis, 1989; 1993), indicating that preference for video games can be used to assess overall attitudes toward video game-based classroom learning. The construct operationalization can easily be broadened to include not only video games, but all types of games (e.g., board games, role playing games, sports, etc.). Further, this

definition can be inclusive of not only classroom learning, but of all learning contexts, including workplace training. This attitudinal construct, which is defined here as "positive feelings about games for learning and predicted choice for games in learning contexts", is expected to moderate the relationship between game fiction and reactions.

Constructivist learning theory can explain how attitudes toward game-based learning might impact the effect of game fiction on reactions to training. Constructivist learning theory was developed as a departure from previous "objectivist" approaches, which focused on an objective world of knowledge outside of the learner that must be handed down to the learner (Kraiger, 2008). In constructivist learning approaches, learners actively create their own knowledge structures by integrating new information with their own prior knowledge. How these knowledge structures are built is based on the context of the learning environment, which is framed by learners' attitudes toward that particular environment (Landers & Callan, 2012). In the present study, attitudes toward game-based learning frame the trainees' experiences in the game-like training environment. If trainees' attitudes about technology-enhanced training, or in this case, game-based learning, are positive, they will find game fiction-enhanced training more enjoyable and useful to their learning. If attitudes toward game-based learning are negative, trainees may dislike the training and find it irrelevant to their learning or job. Attitudes toward game-based learning should not otherwise impact reactions to non-gamified training, thus the attitudes toward game-based learning interact with the presence of game-based learning to create a moderating effect on reactions.

Hypothesis 3a. Attitudes towards game-based learning will moderate the relationship between the use of game fiction and reactions to training; specifically, the

difference in reactions between narrative and expository instruction will be larger for learners with more positive attitudes.

Attitudes toward game-based learning should also affect how game fiction-enhanced training influences learning. If training is enhanced to become more game-like, trainees with preferences toward using games in a learning context should learn more than trainees with a preference against using games in learning. According to the theory of planned behavior (Ajzen, 1991), attitudes toward a behavior affect intentions to perform that behavior, which in turn affects actual performance of that behavior. Positive attitudes toward playing games have been found to predict intention to play games (Hsu & Lu, 2004), which in turn predict game play behaviors (Venkatesh & Davis, 2000; Venkatesh & Bala, 2008). If attitudes toward games influence game behavior (i.e., initiating and continuing play), then attitudes toward game-based learning should indirectly influence learning. Training can become more game-like by the addition of even a single game element, such as game fiction. Thus, trainees with preferences toward the use of game-based learning will interact more with the training, thereby improving their learning. Trainees with preferences against game-based learning will disengage from the training and not learn as much as those engaged with the training, which has been demonstrated in the serious games context (Yusoff, Crowder, & Gilbert, 2010) and e-learning, more broadly (Park, 2009).

Constructivist learning theory can again explain how attitudes toward game-based learning might impact the effect of game fiction on learning. Because learners actively create their own knowledge structures, a trainee with positive attitudes is more likely to choose to integrate training content into their previous knowledge structures, thus

increasing their learning. If attitudes about game-based learning are negative, the trainee will more likely dismiss the idea of learning from a game or anything resembling a game. By disengaging from gamified training, specifically a game fiction-enhanced training, the trainee also disengages from the training content, thereby learning less than he or she could have from the training.

Hypothesis 3b. Attitudes towards game-based learning will moderate the relationship between the use of game fiction and measures of learning; specifically, the difference in learning outcomes between narrative and expository instruction will be larger for learners with more positive attitudes.

Experience with Games as a Moderator of Game Fiction's Impact

Experience with games should affect how game fiction-enhanced training influences reactions to training. Within the Technology Acceptance Model, experience with a particular technology plays a role in predicting perceptions of usefulness (i.e., utility reactions) of that technology (Venkatesh & Davis, 2000). According to that model, experience with games should play a role in predicting reactions to gamification as a technology (Venkatesh & Davis, 2000). Recent research supports this in the context of game experience. Orvis, Orvis, Belanich, and Mullin (2005) found that general videogame experience was positively related to satisfaction with training via a serious game. Armstrong and Landers (2014) found that game experience moderated the relationship between the use of videogame-based training and overall reactions. The present study extends this research by investigating this moderating relationship in the context of game fiction.

Cognitive load theory (Sweller, 1988) provides a theoretical basis for the moderating effect of game experience on reactions to training. Cognitive load theory states that an individual mind has a limited amount of cognitive resources that it can expend at any given time. Spending cognitive resources on a given task allocates fewer resources to spend elsewhere (e.g., another task competing for the individual's attention). Landers and Callan (2012) explained cognitive load theory in terms of using a novel technology. When encountering a technology for the first time (e.g., a new training technology or system), users must expend cognitive resources in order to learn how to operate that new technology. In the case of a training technology, trainees must spend cognitive resources learning the technology while also attempting to learn training material. Similarly, trainees more experienced with game technologies should not require as many cognitive resources to process training enhanced with game elements versus those with less experience. Trainees spending fewer cognitive resources on processing information extraneous to the training content will enjoy the training more, anticipating greater benefits as an outcome. Trainees spending much of their cognitive resources will dislike the training and anticipate fewer benefits. This is drawn from the education literature, where learners who perceive instruction to be too difficult tend to evaluate the courses poorly (Bergstrand & Savage, 2013; Centra, 2003).

Hypothesis 4a. Experience with games will moderate the relationship between the use of game fiction and reactions to training; specifically, the difference in reactions between narrative and expository instruction will be larger for learners with greater game experience.

Experience with games also can lead to learning differences in game-based learning. A lack of experience with games can lead to decreased learning, while significant experience can lead to increased learning in game-based training. While studying a serious game, Orvis, Horn, and Belanich (2008) found that prior videogame experience led trainees to perform better in the serious training game by demonstrating procedural knowledge and skills (i.e., shooting virtual targets in-game). When training resembles prior videogame experiences of the trainee, there is less information to learn and fewer skills needing practice. Although not yet confirmed by the gamification literature, prior game experience in general should benefit trainees in game-like training similarly to trainees in a serious training game.

Cognitive load theory can also explain why experience with games might impact the effect of game fiction on learning. If trainees must allocate a significant portion of their cognitive resources to learning a new technology, they will have fewer resources to focus on learning training content simultaneously. In game-based learning, this has been extended into what is called the distraction hypothesis (Adams et al., 2012), which states that a strong narrative theme can reduce learning in serious games when learners allocate too many of their cognitive resources on the narrative content instead of on academic content when the narrative is not carefully aligned to the academic content. This effect is not consistent across learners, however, suggesting that individual differences moderate the effect of game fiction on learning. Piccoli, Ahmad, and Ives (2001) proposed that one individual difference, previous experience with a learning technology, affects individual learning outcomes such that those with less experience have poorer outcomes due to their unfamiliarity with the technology. They suggested that novel skill sets (e.g., the ability to

communicate effectively through electronic media) might be necessary to take advantage of particular learning technologies. Krentler and Willis-Flurry (2005) hypothesized that experience moderated the relationship between learning technology and learning outcomes, testing their hypothesis in the context of an online discussion board. Use of the learning technology was positively correlated with learning, moderated by learner experience with using the Internet. Among learners who used the learning technology less frequently, those more experienced with using the Internet exhibited higher learning outcomes than learners less experienced with the Internet. Similarly, learners with more game experience are likely to have greater expertise in the many different aspects of games that cost cognitive resources (e.g., learning rules, remembering goals, comprehending action language, exploring a new environment), which may help learners focus more directly on the learning content by minimizing the cognitive burden associated with understanding unfamiliar game elements. Thus, greater experience with games should allow learners to spend fewer cognitive resources on interpreting and participating in the game narrative and learning content.

Hypothesis 4b. Experience with games will moderate the relationship between the use of game fiction and measures of learning; specifically, the difference in learning outcomes between narrative and expository instruction will be larger for learners with greater game experience.

CHAPTER II

PILOT STUDY

Participants and Method

Participants were trained in company-issued laptop security training intended to improve declarative knowledge regarding laptop security practices. The training covered the importance of laptop security, as well as best practices for preventing damage or loss and protocol to follow in the event of losing a company-issued laptop. Before the main study, a declarative knowledge learning measure was developed and pilot tested in order to ensure that measurement was reliable and valid and to ensure changes in learning resulting from training were detectable using it. First, a list of prototype items intended to assess declarative knowledge gained from the training content were developed. Four items measuring declarative knowledge from the training content that were developed by the training creator were used as a model for developing more questions. Psychometric data of the creator's items were not available. In order to obtain a final measure consisting of 20 items, two researchers drafted 60 potential items (see Appendix A). Each researcher thoroughly reviewed the control training content in order to gain subject matter expertise in company-issued laptop security. Next, learning objectives were drafted based on subject matter expert judgments for what trainees should learn from receiving the material. Each subject matter expert then drafted approximately 30 multiple-choice items using each bullet point from the original training content. The subject matter experts reviewed all 60 items, revising the set at their discretion.

Second, a sample of trainees was recruited to complete the training module and the full list of items. In order to establish validity of this learning measure, differences in

declarative knowledge scores prior to training and after receiving training must be found, requiring a within-subjects pre-test/post-test training evaluation design. A power analysis was conducted using G*Power3 (Faul, Erdfelder, Buchner, & Lang, 2009) in order to determine the number of participants necessary for this design. For this paired-samples t-test analysis with one tail, alpha set to .05, and power of .80, the power analysis indicated that 27 participants would be required to detect a moderate effect size of $d = .50$. To account for unusable data, a total sample size of 51 was obtained.

Participants were recruited through Amazon Mechanical Turk (MTurk) and were compensated $2.00 for their participation. This compensation is calculated based upon 30 minutes of effort at a rate of US$4.00 per hour. This pay rate is based upon Horton and Chilton's (2010) examination of the wage expected by MTurk workers, which they found to be US$3.63 per hour. Criteria established for participation in this pilot study included a 95% or higher task acceptance rate on MTurk, completion of at least 50 previous MTurk tasks, and a location in the United States. These criteria were selected to invite a broad participant pool from MTurk, varying in MTurk work experience. MTurk was chosen as a participant source because of the wide range of individuals across a variety of industries and career stages (Landers & Callan, 2014), which aids in the generalization of the findings of this study. The population of interest for this training consists of all possible trainees working at all possible organizations and using a sample from MTurk provides a more stratified sample of workers from various organizations compared to a college student or single organization sample. Landers and Behrend (2015) highlight four types of concerns with crowdsourced samples that must be addressed before sampling. First, the possibility of repeated participation must be addressed.

Participants in the pilot study were screened out from participating in the main study. Second, concerns over compensation as a source of motivation to complete the study should be noted. In this study, participants may be more motivated to learn from the training content by increasing the amount of compensation, but too great a pay rate may motivate them to cheat. In order to balance these concerns, a moderate wage was offered, near the mean expectation according to Horton and Chilton. Third, selection bias must be considered if such bias would be correlated with study variables, although this issue is common to all samples. The pilot study was advertised as a laptop security training module and quiz. Gamification, games, and narrative were not be mentioned in either advertisements or in consent documentation in order to minimize bias. MTurk workers viewed a general description of the work task before choosing to accept it and be redirected to Qualtrics. Fourth, the sample should be relevant to the target population. Out of all convenience sampling techniques used in industrial/organizational psychology, crowdsourced data collection such as through MTurk may be ideal for obtaining an appropriate sample of the population of all trainees in all possible organizations due to its increased diversity in comparison to both college student samples and individual organizations (Landers & Behrend, 2015).

Upon accepting the task in MTurk, participants were redirected to the Qualtrics website where they completed the training and a 60-item declarative knowledge measure. A pretest assessment was used to establish baseline knowledge levels about the training content for MTurk workers. Participants then completed the control training module (see Appendix B) within Qualtrics. Each training module consisted of plain text across several webpages within a regular formatted Qualtrics survey. Each participant progressed

through the training at his or her own pace, reading the information on each webpage and clicking an on screen link to continue. After completing the training module, all participants were assessed again on the declarative knowledge measure. This posttest assessment will verify that 1) the training content does affect responses on the learning measure and 2) there is variance among participants in the learning measure. In order to reduce the possibility of cheating, participants were required to submit their surveys within one hour in order to receive payment. Additionally, payment was not contingent upon correct answers, but instead on survey completeness. Cheating would take more time than completing the HIT honestly or carelessly.

Results and Discussion

Before conducting analyses on the pilot data, the data were cleaned by checking for missing data points, outliers, and confirming exclusionary criteria. One participant located in Sweden via internet protocol address and latitude/longitude coordinates was excluded from the sample. One participant did not complete the posttest assessment of declarative knowledge. This participant was excluded from analysis. Four other participant cases were excluded from the dataset for various reasons. Participants failing to correctly answer both bogus declarative knowledge items were excluded. Additionally, participants completing either the training content or entire survey too quickly were excluded. These participants completed the control training content in Appendix B in less than one minute. Excluded participants failed either one or both of these checks. Posttest declarative knowledge scores for some of these participants were notably lower than the rest of the sample as seen in a boxplot graph. After excluding cases based on location,

completeness, failing bogus items, and completion time, the starting sample size of 51 was reduced to 45 participants.

In order to assess that the training content did affect responses on the learning measure, a paired-samples t-test was conducted to determine the effect of the training module on declarative knowledge learning from pretest to posttest measures. Assumptions for a repeated measures t-test were checked. Participants were recruited randomly and independently of one another to the best of the knowledge of the researcher. Because the within-subjects design had only two levels for condition (i.e., time 1 and time 2), the assumption of sphericity was met. The assumption of normality was violated, with both time 1 and time 2 item means displaying a negative skew. Because a difference score was to be analyzed, the normality of that score was also checked for normality. This score was positively skewed due to a single outlying participant, so this violation was ignored. The time 1 data point was the pretest score and the time 2 data point was the posttest score for each participant. The positive change in pretest ($M = 0.67$, $SD = 0.17$).to posttest ($M = 0.80$, $SD = 0.14$) declarative knowledge was large and statistically significant, $t(44) = 8.35$, $p < .001$, $d = 0.86$.

After responses to the full list of prototype items were collected, an item-by-item analysis was conducted on the posttest data in order to develop a final measure with a mean item difficulty of .50, coefficient alpha of .80 or higher, item-total correlations above .30, and a normal distribution. Item statistics for the original 60-item set, including item difficulty, corrected item-total correlations, and rotated factor loadings, are presented in Table 1. First, items 34 and 47 were excluded due to negative corrected item-total correlations. Item 41 also was excluded for having an extremely low item-total

correlation (.116). Next, several item correlation pairings corrected for attenuation were found to be over 1.00, likely indicating identical content. From these pairs of items, items 3, 5, 44, and 48 were removed based on having lower corrected item-total correlations and lower difficulty within each correlated item pair in order to improve the internal consistency of the scale while maximizing variance in scores. An exploratory factor analysis was performed in order to determine the empirical factor structure for the 53-item set. Parallel analysis (O'Connor, 2000) was used to determine that four factors best describe the item set. Principal components analysis was used for extraction in the factor analysis. The item loadings were rotated using the Promax method. Items loading highly onto multiple factors were eliminated. Retained items had factor loadings equal to or greater than .40 on a single factor. Factor loadings of the retained items were at least .30 higher than all other factor loadings for that item. Thirty-four items were identified in this method. From these 34 items, the 20 most difficult items were selected while balancing items across factors. This was intended to maintain the broad sampling of the content domain while targeting a scale difficulty of .50 and a reasonable scale length. Because the four factors were empirically derived and largely uninterpretable, it was difficult to balance content across the domain of laptop security knowledge. Hypotheses for the main study based on existing literature regard a single factor declarative knowledge construct, thus this construct was operationalized as such. The final item statistics for the 20-item set, including item difficulty, corrected item-total correlations, and rotated factor loadings, are presented in Table 2.

Table 1
Original Item Set Statistics

			Factor			
Item	Mean	C-ITC	1	2	3	4
41	0.18	0.116				0.118
47	0.36	-0.291		-0.136		-0.182
43	0.44	0.047			0.128	
21	0.53	0.327	-0.112	0.405		0.191
59	0.58	0.362		0.485		0.153
12	0.60	0.098		-0.188		0.445
28	0.60	0.266	0.383	-0.253	0.156	0.159
18	0.64	0.467	0.384	0.240		
27	0.64	0.325	0.421			0.123
44	0.67	0.600	0.250	0.348		0.184
55	0.67	0.291	0.306	0.199		
46	0.69	0.332		0.678		-0.189
3	0.71	0.531	0.333	0.384		0.120
31	0.71	0.531		0.318	0.143	0.404
42	0.71	0.239	0.354	-0.121	-0.178	0.298
45	0.71	0.652	0.273	0.284		0.290
19	0.73	0.482		0.191	0.185	0.422
48	0.73	0.594	0.456	0.285		
57	0.73	0.334	-0.117	0.555	0.104	-0.122
6	0.76	0.286		0.254	0.122	
17	0.76	0.421	0.176	0.360	0.102	
5	0.80	0.329	0.160	0.456		-0.122
23	0.80	0.644	0.443	0.396		
38	0.80	0.793	0.322	0.550		0.328
4	0.82	0.652		0.631		0.243
8	0.82	0.578	0.159	0.118	0.402	0.145
37	0.82	0.425	0.560		0.133	
7	0.84	0.502	-0.132	0.464	0.359	
16	0.84	0.599	0.143	0.560	0.115	
39	0.84	0.742	0.542	0.233	0.141	0.104
13	0.87	0.546	0.319	-0.203	0.396	0.405
53	0.87	0.642	-0.130	0.677	0.159	0.234
60	0.87	0.746		0.544	0.255	0.160
1	0.89	0.417			0.539	0.220
9	0.89	0.373	0.279		-0.248	0.598
22	0.89	0.163	0.223	0.520	-0.359	-0.275
25	0.89	0.439			0.736	0.111
26	0.89	0.543	0.144	0.742	-0.372	0.191
33	0.89	0.543		0.362	-0.200	0.596
35	0.89	0.469	0.708		-0.358	0.357
49	0.89	0.721	0.767		0.144	0.177

Table 1 continued

Item	Mean	C-ITC	Factor 1	2	3	4
24	0.91	0.547	0.904			-0.192
29	0.91	0.817	0.808		0.186	0.221
36	0.91	0.743	0.721	0.420		-0.247
40	0.91	0.256	-0.328		0.149	0.661
2	0.93	0.648	-0.111	0.124	0.628	0.462
10	0.93	0.565			0.680	0.357
14	0.93	0.667	0.964		0.106	-0.212
56	0.93	0.380	-0.277	0.186		0.806
11	0.96	0.523	0.546	-0.303		0.727
15	0.96	0.590	0.709	-0.224	0.408	
20	0.96	0.691			0.755	0.314
32	0.96	0.590		0.667	0.478	-0.332
50	0.96	0.379			0.794	-0.243
52	0.96	0.691			0.755	0.314
54	0.96	0.379	0.119		0.716	-0.284
58	0.96	0.590	0.569	0.232	0.346	-0.422
30	0.98	0.525	0.156		0.876	-0.346
34	0.98	-0.042	-0.149		0.155	-0.158
51	0.98	0.294	-0.239	0.866	-0.207	-0.118

N = 45

Note: C-ITC = corrected item-total correlations. Factor loadings below an absolute value of .10 were suppressed and left blank. Scale mean = .804. Coefficient alpha = .935.

Table 2
Final Item Set Statistics

Item	Mean	C-ITC	Factor			
			1	2	3	4
21	0.53	0.377		0.313	0.165	
59	0.58	0.434		0.69		
46	0.69	0.383	-0.19	0.646		
57	0.73	0.351		0.874	-0.293	-0.19
6	0.76	0.297	0.237	0.385	0.129	-0.512
38	0.80	0.798	0.305	0.447	0.37	-0.114
4	0.82	0.664		0.658		0.159
37	0.82	0.374	0.861		-0.331	
16	0.84	0.623		0.315	0.405	0.102
39	0.84	0.673	0.638		0.105	0.21
53	0.87	0.619	-0.271	0.416	0.666	0.11
60	0.87	0.741	0.198	0.66	-0.183	0.369
1	0.89	0.261		-0.14	0.12	0.724
9	0.89	0.332		-0.355	1.001	-0.147
25	0.89	0.332			-0.215	0.821
26	0.89	0.566	-0.142	0.389	0.61	
49	0.89	0.658	0.83	-0.182	0.154	0.166
24	0.91	0.514	0.953			-0.165
29	0.91	0.736	0.813	-0.142	0.221	0.188
36	0.91	0.716	0.805	0.253		-0.2

N = 45

Note: C-ITC = corrected item-total correlations. Factor loadings below an absolute value of .10 were suppressed and left blank. Scale mean = .817. Coefficient alpha = .888.

For the final scale, Cronbach's alpha was calculated to be .89. The mean item difficulty was calculated to be .82, within a possible range of 0.0 as impossibly difficult to 1.0 as perfectly easy. A difficulty mean of .82 is generally considered to be easy, but reliability analyses with more difficult items led to reliability estimates under .70. The mean corrected item-total correlation was .522, with correlations ranging from .261 to .798. A confirmatory factor analysis was performed to confirm acceptable fit with a single latent factor, as would be used in analyses for the main study. The model demonstrated good fit, CFI = 1.00, RMSEA = 0.00, $\chi^2(170) = .571$, providing some evidence supporting construct-related validity. The final 20-item set used in the main study is presented in Appendix C.

CHAPTER III

METHOD

Participants

A power analysis was conducted using G*Power 3 (Faul, Erdfelder, Buchner, & Lang, 2009) in order to determine the number of participants necessary for detecting an effect size of $f^2 = .0526$, which was derived from an incremental R^2 of .05. Landers and Armstrong (*in press*) found that the direct effect of experience on learning outcomes was .37 with an R^2 of .14 and that the effect of attitude on learning outcomes was .53 with an R^2 of .28, so .05 was chosen as a conservative estimate of the effect to be observed. The power analysis indicated that for a fixed model linear multiple regression with alpha of .05, power of .80, one tested predictor (i.e., a moderator variable), and three total predictors (i.e., a dummy-coded condition variable, a moderator variable, and the interaction variable), 152 participants would be necessary to detect an increase of .05 in R^2 as evidence of moderation. When increasing power to .90, 202 participants are required. In order to better facilitate the recruitment level necessary, this study initially recruited 301 participants using MTurk, compensating participants at the same rate as in the pilot study. The main study was advertised as a personality questionnaire, laptop security training module, and quiz. Gamification, games, and narratives were not mentioned in either MTurk advertisements or the consent form. Demographic information was assessed to determine representativeness of the sample (see Appendix G), although these sample characteristics should not affect the outcome or generalizability of the present study. Participants were financially compensated for their time spent completing the study.

Participant demographic information is presented in Table 3. The mean participant age was 34.72 years ($SD = 11.10$). After excluding cases based on geographic location and improbable completion times (i.e., reading more than 600 words per minute; Masson, 1982; Duggan & Payne, 2009), 273 participants were retained.

Design

In order to compare differences in training outcomes across training conditions, this study utilized a two-group posttest comparison only experimental design. Classical experimental designs range in rigor and the extent to which definitive conclusions can be made (Quiñones & Tonidandel, 2003). As the rigor of the design increases, experimental results become more conclusive. However, practical constraints often limit the type of designs that can be used, thus a balance is struck between rigor and practicality. The most stringent design for this training evaluation would be Solomon's (1949) four-group design. This design consists of four conditions which aim to control for both effects of experimental manipulation as well as testing effects, maximizing both internal and external validity. In the first condition, trainees would take a pretest, experience training, then take a posttest. In the second condition, trainees would take a pretest, experience no training, then take a posttest. This difference highlights the effects of the training. In the third condition, trainees skip the pretest, experience training, then take the posttest. In the fourth and final condition, trainees skip the pretest, experience no training, and only take the posttest. These latter conditions isolate the effects of the pretest on later posttest scores. Although this design is rigorous, it requires four distinct groups. In order to maintain adequate statistical power, double the participants would be needed over a two-group posttest only design. Typically, the next most stringent design would be a two-

group design with pretest and posttest assessments in both. However, in assessing

learning, a pretest may harm the internal validity of the experiment, as pretests alone may

improve posttest scores over additional reading of material (McDaniel, Anderson,

Derbish, & Morrisette, 2007). The next most rigorous experimental design would be the

two group posttest only design (Quiñones & Tonidandel, 2003) where experimental and

control groups are utilized, but no pretest measures are administered to assess pre-

existing knowledge of the content. Due to the practical constraints of the four-group

design (Solomon, 1949) and the testing effects of a pretest-posttest design, the two group

posttest only comparison was used.

Table 3

Participant Demographic Information

Category	Sub-category	Percent of Sample
Gender	Male	51.3%
	Female	48.4%
	Other	0.3%
Race	African American	6.2%
	Arab American	1.1%
	Asian American	8.4%
	Caucasian	73.6%
	Hispanic or Latino/a	6.6%
	Indian American	1.1%
	Multiracial	2.9%
Education	Some high school	0.4%
	High school diploma/GED	10.6%
	Some college	24.5%
	Two-year associate's degree	16.1%
	Four-year bachelor's degree	38.1%
	Master's degree	8.8%
	Doctoral degree	1.5%
Employment Status	Full-time	59.3%
	Part-time	18.7%
	Unemployed	22.0%
Industry	Business services	17.4%
	Education	12.2%
	Finance	5.6%
	Health care	10.8%
	Information technology	8.9%
	Insurance	3.3%
	Manufacturing	4.7%
	Retail	16.9%
	Wholesale	0.5%
	Other	19.7%
Job Tenure	Less than 1 month	2.4%
	Less than 6 months	6.6%
	Less than 1 year	6.6%
	Less than 5 years	42.0%
	More than 5 years	42.5%

N = 273

Training Materials

The control training content for this study was the same training content administered in the pilot study (see Appendix B). It was adapted from a text-based 13-slide training presentation on laptop computer security currently used by a company in the health care industry. The training content was sufficiently generic that it could be used in any organization issuing laptop computers to employees. The training was adapted to reference a fictitious company.

To adapt the training, content from each slide was transferred into Qualtrics, dividing content similarly among different webpages in order to resemble the original training. Participants were able to progress through the training at their own pace, either progressing forward or returning to previous content that they may wish to revisit, consistent with the original training program. The content itself consisted of the importance of company laptop protection, safety tips, and information about how to handle stolen or lost property among other topics. The full laptop security training content can be found in Appendix B.

Two sets of guidelines for designing narratives were followed in order to develop the training content gamified with game fiction. Thorndyke (1977) outlined ten rules for structuring simple stories, which was used as the basic structure for designing the game fiction narrative used in the gamified training condition. According to Thorndyke, Rule 1 provides the top level structure for stories: the story consists of a setting, theme, plot, and resolution. Rules 2 through 4 define the composition of setting (characters, location, and time), theme [an event(s) and goal], and plot [episode(s)]. Rule 5 defines an episode [subgoal, attempt(s), and outcome], the most frequently recurring piece of a simple story.

Rules 6 and 7 define an attempt [an event(s) or episode occurs] to complete a subgoal and the outcome [an event(s) or state] of that attempt. Rule 8 defines resolution as an event or state occurring after the episode(s) within the plot. Rules 9 and 10 identify subgoals and goals as desired states and characters, location, and time as states. Following these rules creates a hierarchical structure outlining simple stories. This structure allows for very simple stories or for very complex stories where shorter, episodic stories are nested within episodes within a larger overall story. As for game fiction specifically, Dickey (2006) presents several guidelines for incorporating game design narrative into instruction. Dickey outlines that game design narratives should 1) present an initial challenge; 2) identify potential obstacles and develop puzzles, minor challenges, and resources; 3) identify and establish roles of characters; 4) establish the physical, temporal, environmental, emotional, and ethical dimensions of the environment; 5) create a backstory; and 6) develop cut scenes to support the development of the narrative story line. Many of these guidelines overlap with the structural rules established by Thorndyke, demonstrating that there is some agreement within the literature on the formation of narrative across disciplines. Dickey points out that there is more than one way to create a narrative, but that most of these guidelines generally apply.

Additionally, the game fiction literature refers to two specific features of game fiction that, when altered, vary the learning outcomes in an instructional setting. The first feature is what type of fantasy in the game fiction is used. Although the names differ among authors, the underlying types are the same. Endogenous or intrinsic fantasy is where the fantasy or game fiction is intimately related to the skill being used in an embellished learning task (Malone, 1981). Rieber (1996) generalizes endogenous fantasy

as weaving learning content into the game, or in the case of gamification, game fiction. Alternatively, exogenous or extrinsic fantasy is only weakly related to the skill being used in an embellished learning task (Malone, 1981). Any content can be superimposed on top of this type of fantasy (Rieber, 1996). The advantage to endogenous/intrinsic fantasy is that if the learner is interested in the fantasy or game fiction being used, the learner will inherently be interested in the learning content (Rieber, 1996). This factor may have played a role in the results of Adams and colleagues' (2012) experiment testing the effect of narrative themes in game-based learning. The narrative in their second experiment about solving a mystery had little to nothing to do with the learning content. A story more integrated with the learning objectives may have altered the results. The second feature of game fiction that has demonstrated covariance with learning outcomes is the degree of consistency of the narrator's point of view. Black, Turner, and Bower (1979) tested the effects of narration from a consistent point of view versus an inconsistent point of view across several sentences and found that participants took longer to read sentences when the point of view was inconsistent. Sentences with a consistent point of view were rated as more comprehensible, were more often accurately recalled, and were less likely to be rewritten incorrectly. Applying these findings to maximize learning in a game fiction-enhanced training context means that game fiction should be narrated from the same, continuous perspective, rather than being narrated from multiple, different perspectives. In order to maximize the potential of enhancing learning outcomes with game fiction, the present study created an endogenous fantasy from a consistent narrator point of view.

In enhancing the training content with game fiction, the control training content was first outlined (see Appendix B). Learning objectives were derived from the outline. Next, Thorndyke's (1977) basic structure was applied to the outline. Adhering to Rules 1 through 4, a setting, theme, plot, and resolution were developed apart from the training content. The setting, theme, and plot were applied throughout the training content in the form of episodes, subgoals, and events that occurred. The episodes were developed such that each episode met a different learning objective for the training. The training content was directly integrated into the narrative as often as possible while maintaining the progression of the story. Occasionally, the exact wording of the training content was altered in order to fit the story, but the same learning objectives were maintained throughout both modules. The full game fiction-enhanced training content can be found in Appendix D.

Measures

Reactions to training. Training reactions are one of the most ubiquitous training outcomes in organizations (Kraiger et al., 1993). Although they are often dismissed by researchers for lack of usefulness, meta-analytic evidence supports their use in training evaluation (Alliger, Tannenbaum, Bennett, Traver, & Shotland, 1997). Brown (2005) developed a measure of training reactions based on one overall satisfaction factor consisting of three intercorrelated facets: technology satisfaction, enjoyment (i.e., affective reactions), and relevance to the job (i.e., utility reactions). Brown's measures of these facets were adapted to assess trainee reactions to the training material upon completion of the training module. The measures of the three facets demonstrated adequate internal consistency in prior research (α = .70 - .86). For this study,

the overall satisfaction factor had high internal consistency reliability (α = .83). Although the literature points to conceptual differences in reactions by type (Alliger et al., 1997), the differences matter when using reactions to predict future outcomes. In this study, reactions are one of the outcomes itself, which justifies the use of a single overall score. All responses were on a 5-point Likert-type scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Technology satisfaction was measured with items "The technology interface was easy to use," "The technology allowed for easy review" and "I am satisfied with the technology interface." Enjoyment was measured with items "I enjoyed this training" and "Learning this material was fun." Relevance was measured with items "The training was relevant to laptop security practices" and "The training provided useful examples and illustrations." The full measure and instructions can be found in Appendix E.

Declarative knowledge. There are many learning outcomes that can be assessed within training evaluation including cognitive, skill-based, and attitudinal outcomes (Kraiger et al., 1993). Although each outcome is valuable in its own right, theoretical and empirical support is largest for the effects of game fiction on motivation, an attitudinal outcome, and declarative knowledge, a cognitive outcome (Belanich, Sibley, & Orvis, 2004; Lepper, 1985; Squire, Giovanetto, Devane, & Durga, 2005; Thomas, Cahill, & Santilli, 1997; Bedwell et al., 2012). However, the goal of this training program was beyond improving motivation alone. Trainees need a basic level of declarative knowledge about laptop security in order keep their laptops secure. Motivation without knowledge will not result in laptop security performance (Campbell, McCloy, Oppler, & Sager, 1993). Further, if the effects of game fiction on declarative knowledge are small or zero,

game fiction may not affect other outcomes with less theoretical and empirical support. Changes in declarative knowledge were measured with the measurement instrument developed and validated in the pilot study. All 20 items were based on the control training condition. Out of four possible responses for each item, only one response was considered correct. Composite scores were computed by calculating the average number of correct responses. Internal consistency reliability for the posttest measure was poor (α = .46). The full measure can be found in Appendix C.

Attitudes toward game-based learning. Attitudes toward game-based learning were assessed with Bourgonjon and colleagues' (2010) preference for video games measure. Preference for video games is an attitude construct intended to predict video game related behavior in learning contexts. Bourgonjon and colleagues found high internal consistency reliability for their measure in their study (α = .93). Armstrong and Landers (2014) adapted the measure by changing the word "classroom" to "work training" and also found similarly high internal consistency reliability (α = .96). The measure adapted by Armstrong and Landers was further adapted for the present study by removing the word "video" from instances of "video games" in order to generalize to all game-based learning. Because game fiction is not exclusive to video games, attitudes toward games in general (e.g., role-playing games, board games, etc.) were intended to more fully capture the moderating effect on the relationship between game fiction and learning. Items included, "If I had the choice, I would choose to complete work training in which games were used," "If I had to vote, I would vote in favor of using games in work training," and "I am enthusiastic about using games in work training." Each item was assessed with a 5-point Likert-type scale from 1 (*strongly disagree*) to 5 (*strongly*

agree). Internal consistency reliability for this measure was high (α = .90). The full

measure and instructions can be found in Appendix E.

Experience with games. Experience with video games measure is generally

consider a proxy variable combining the amount of time spent playing games, diversity in

experiences with games, and the extent to which an individual identifies with game

culture. To assess it, Bourgonjon and colleagues (2010) developed a 5-item measure that

was adapted to this study. Previous studies using this measure have shown high internal

consistency reliability (α = .90 – 92; Bourgonjon et al., 2010; Armstrong & Landers,

2014). This measure was adapted for the present study by removing the word "video"

from instances of "video games" in order to generalize to all game experiences. Items

included "I like playing games," "I often play games," "Compared to people of my age, I

play a lot of games," "I would describe myself as a gamer," and "I play different types of

games." Each item was assessed with a 5-point Likert-type scale from 1(*strongly*

disagree) to 5 (*strongly agree*). Internal consistency reliability for this measure was high

(α = .91). The full measure and instructions can be found in Appendix E.

Demographic information. In order to determine the representativeness of the

sample, demographic information was collected. Age, gender, racial ethnicity, level of

education, employment status, employment industry, and job tenure were assessed,

although these sample characteristics did not affect the outcome of the present study. A

variety of participant employment industries should strengthen the generalizability of the

study. The complete demographic information assessment can be found in Appendix E.

Procedure

For the main study, participants were recruited through MTurk and were compensated $4.00 for their participation in this online study. Participants followed a link from MTurk to Qualtrics where they read a document of informed consent. Consent was established by proceeding with the remainder of the online survey. Participants then completed the attitude toward game-based learning and experience with games measures. Participants were then assigned to one of the two training conditions randomly by Qualtrics, counter-balanced to maintain equal size groups by condition. Participants in the control condition completed an 11 webpage training module on laptop security training. Participants in the experimental game fiction condition completed an 11 webpage training module gamified with game fiction on laptop security training. After the training module was completed, all participants completed a measure about their reactions to the training content. Next, participants completed a posttest assessment of declarative knowledge about the training content. Participants then completed demographic items before being debriefed. In order to reduce the possibility of cheating, participants were required to submit their surveys within two hours in order to receive payment. Again, payment was not contingent upon correct answers, but instead on survey completeness. Cheating would take more time than completing the HIT honestly or carelessly.

CHAPTER IV

RESULTS

Before analyzing the data and testing hypotheses, the data were cleaned and checked for missing data. Item-level frequency analyses detected no missing data for any of the four study variables (i.e., reactions, declarative knowledge, attitudes toward game-based learning, and experience with games). Next, the assumptions necessary for regression analyses were checked. The relationships among all independent and dependent variables were found to be linear by plotting the standardized residuals against the dependent variables. Loess lines were plotted on scatterplots of each independent-dependent variable combination in order to see if error variance could be further predicted with extra variables. All plotted lines yielded linear relationships. Descriptive statistics for each variable are presented in Table 4. Variable measurement was checked by calculating Cronbach's alpha for each variable. Alphas can be found along in the diagonal of Table 5. All variables met acceptable standards of internal consistency reliability for basic research (i.e., $\alpha > .80$; Nunnally, 1978; Peterson, 1994) except for the declarative knowledge measure. Residual errors were checked for homoscedasticity via Levene's test for homogeneity. None of the residuals significantly varied by condition. Residual errors were found to be independent by plotting them against case number. Finally, the residual errors were checked for normality by plotting the errors with histograms. All four residual errors were negatively skewed. In order to account for the non-normality of the data, Box-Cox transformations (Osborne, 2010) were made to find the ideal point of lowest skew for transforming the data. Although various transformations reduced skew, the end results of the analyses were the same. Thus, the

results reported here are from the original, untransformed data. A correlation matrix of

the variables of interest is found in Table 5.

Table 4
Descriptive Statistics

Variable	N	Minimum	Maximum	Mean	SD	Skewness	Kurtosis
Reactions	273	1.57	5.00	3.94	0.67	-0.59	0.27
Declarative Knowledge	273	0.45	1.00	0.87	0.09	-0.94	1.25
Game-Based Learning Attitudes	273	1.33	5.00	4.20	0.71	-0.97	1.23
Game Experience	273	1.00	5.00	3.68	0.95	-0.52	-0.18

N = 273

Table 5
Correlation Matrix

Variable	Condition	Gender	Age	Reactions	Declarative Knowledge	Game-Based Learning Attitudes	Game Experience
Condition	(-)						
Gender	.05	(-)					
Age	.10	.28**	(-)				
Reactions	.22**	.10	.06	(.83)			
Declarative Knowledge	.01	.10	.09	.13*	(.46)		
Game-Based Learning Attitudes	.00	-.12*	-.10	.17**	.01	(.90)	
Game Experience	-.05	-.31**	-.30**	.08	.02	.42**	(.91)

N = 273. *$p < .05$; **$p < .01$

To test Hypothesis 1, which stated that trainees would react more positively to web-based instruction gamified with game fiction than to instruction without such gamification, I regressed reactions onto a dummy-coded indicator of experimental condition. Full results for the test of Hypothesis 1 are presented in Table 6. Trainees in the game fiction condition ($M = 4.08$, $SD = 0.69$) reacted significantly more positive to the training compared to trainees in the control condition ($M = 3.79$, $SD = 0.62$), such that as training condition changes from control to game fiction, reactions increased by a Cohen's d value of 0.44. Thus, Hypothesis 1 was supported.

Table 6
Regression Results for Hypothesis 1

Variable	B	S.E.	Beta	t	p	R	R^2
Constant	3.79	0.06		67.02	< .001		
Condition	0.29	0.08	.22	3.69	< .001	.219	.048

N = 273

To test Hypothesis 2, which stated that measures of declarative knowledge would be greater among trainees experiencing web-based instruction gamified with game fiction than to instruction without such gamification, I regressed declarative knowledge on a dummy-coded indicator of experimental condition. Full results for the test of Hypothesis 2 are presented in Table 7. Trainees in the control ($M = 0.87$, $SD = 0.10$) and game fiction conditions ($M = 0.87$, $SD = 0.09$) did not significantly differ in terms of declarative knowledge scores after the training module. Thus, Hypothesis 2 was not supported.

Table 7

Regression Results for Hypothesis 2

Variable	B	S.E.	Beta	t	p	R	R^2
Constant	0.87	0.01		106.21	< .001		
Condition	0.00	0.01	.01	0.19	.854	.011	.000

N = 273

To test Hypotheses 3a, 3b, 4a, and 4b, I conducted hierarchical multiple regressions in order to test moderation (Baron & Kenny, 1986). Hypothesis 3a stated that attitudes toward game-based learning would moderate the relationship between the use of game fiction and reactions. In step 1, I regressed reactions onto a dummy-coded indicator of condition and attitudes toward game-based learning. In step 2, I regressed reactions onto the product of the condition multiplied by the game-based learning attitude score. The full results for the test of Hypothesis 3a are presented in Tables 8 and 9. Main effects were present for both condition on reactions and game-based learning attitudes on reactions, but the interaction effect was not significant. The change in R^2 from step 1 to step 2 was not significant; thus, Hypothesis 3a was not supported. Hypothesis 3b stated that attitudes towards game-based learning would moderate the relationship between the use of game fiction and measures of learning. In step 1, I regressed declarative knowledge scores onto both the dummy-coded indicator of condition and game-based learning attitudes. In step 2, I regressed declarative knowledge onto the product of the condition multiplied by the game-based learning attitudes score. The full results for the test of Hypothesis 3b are presented in Tables 10 and 11. Neither main effects of condition nor attitudes on declarative knowledge were present. Likewise, the expected interaction effect was not present. The change in R^2 from step 1 to step 2 was not significant; thus, Hypothesis 3b was not supported.

Table 8

Hierarchical Multiple Regression Results for Hypothesis 3a.

Model	Variables	B	S.E.	Beta	t	p
1	Constant	3.10	0.24		12.92	< .001
	Condition	0.29	0.08	.22	3.75	< .001
	Game-Based Learning Attitudes	0.17	0.06	.17	2.98	.003
2	Constant	3.13	0.33		9.46	< .001
	Condition	0.22	0.47	.16	0.46	.646
	Game-Based Learning Attitudes	0.16	0.08	.17	2.01	.045
	Condition x Attitudes Interaction	0.02	0.11	.06	0.16	.870

N = 273

Table 9

Model Summary for Hypothesis 3a.

Model	R	R^2	Adjusted R^2	S.E.	R^2 Change	F Change	df1	df2	p
1	.280	.078	.071	0.65	.078	11.45	2	270	< .001
2	.280	.078	.068	0.65	.000	0.03	1	269	.870

N = 273

Table 10

Hierarchical Multiple Regression Results for Hypothesis 3b.

Model	Variables	B	S.E.	Beta	t	p
1	Constant	0.87	0.04		24.59	< .001
	Condition	0.00	0.01	.01	0.19	.854
	Game-Based Learning Attitudes	0.00	0.01	.01	0.09	.927
2	Constant	0.84	0.05		17.33	< .001
	Condition	0.05	0.07	.26	0.70	.485
	Game-Based Learning Attitudes	0.00	0.01	.05	0.54	.590
	Condition x Attitudes Interaction	-0.01	0.02	-.25	-0.68	.498

N = 273

Table 11

Model Summary for Hypothesis 3b.

Model	R	R^2	Adjusted R^2	S.E.	R^2 Change	F Change	df1	df2	p
1	.013	.000	-.007	0.10	.000	0.02	2	270	.979
2	.043	.002	-.009	0.10	.002	0.46	1	269	.498

N = 273

Hypothesis 4a stated experience with games would moderate the relationship between the use of game fiction and reactions to training. In step 1, I regressed reactions onto both the dummy-coded indicator of condition and game experience. In step 2, I regressed reactions onto the product of condition multiplied by the game experience score. The full results of the test of Hypothesis 4a are presented in Tables 12 and 13. Again, a main effect of condition on reactions was present, but the main effect of experience with games on reactions was not significant. The expected interaction effect was also not significant. The change in R^2 from step 1 to step 2 was not significant; thus, Hypothesis 4a was not supported.

Hypothesis 4b stated that experience with games would moderate the relationship between the use of game fiction and measures of learning. In step 1, I regressed declarative knowledge onto the dummy-coded indicator of condition and game experience. In step 2, I regressed declarative knowledge onto the product of the condition multiplied by the game experience score. The full results of the test of Hypothesis 4b are presented in Tables 14 and 15. Main effects of condition and game experience on declarative knowledge scores were not statistically significant. Likewise, the expected interaction effect also was not statistically significant. The change in R^2 from step 1 to step 2 was not significant; thus, Hypothesis 4b was not supported. B weights for each hypothesized relationship are presented in Figure 2, which represent the main effects of Hypotheses 1 and 2 and the interaction effects of Hypotheses 3a, 3b, 4a, and 4b.

Table 12

Hierarchical Multiple Regression Results for Hypothesis 4a.

Model	Variables	B	S.E.	Beta	t	p
1	Constant	3.55	0.17		21.49	< .001
	Condition	0.30	0.08	.22	3.77	< .001
	Game Experience	0.07	0.04	.09	1.58	.116
2	Constant	3.41	0.22		15.84	< .001
	Condition	0.61	0.32	.46	1.92	.056
	Game Experience	0.10	0.06	.15	1.85	.065
	Condition x Experience Interaction	-0.09	0.08	-.24	-1.02	.311

N = 273

Table 13

Model Summary for Hypothesis 4a.

Model	R	R^2	Adjusted R^2	S.E.	R^2 Change	F Change	df1	df2	p
1	.238	.057	.050	0.66	.057	8.09	2	270	< .001
2	.245	.060	.050	0.66	.004	1.03	1	269	.311

N = 273

Table 14

Hierarchical Multiple Regression Results for Hypothesis 4b.

Model	Variables	B	S.E.	Beta	t	p
1	Constant	0.86	0.02		35.96	< .001
	Condition	0.00	0.01	.01	0.20	.843
	Game Experience	0.00	0.01	.02	0.30	.763
2	Constant	0.89	0.03		28.44	< .001
	Condition	-0.06	0.05	-.29	-1.20	.233
	Game Experience	-0.01	0.01	-.05	-0.63	.530
	Condition x Experience Interaction	0.02	0.01	.32	1.29	.199

N = 273

Table 15

Model Summary for Hypothesis 4b.

Model	R	R^2	Adjusted R^2	S.E.	R^2 Change	F Change	df1	df2	p
1	.021	.000	-.007	0.10	.000	0.06	2	270	.940
2	.081	.007	-.005	0.10	.006	1.66	1	269	.199

N = 273
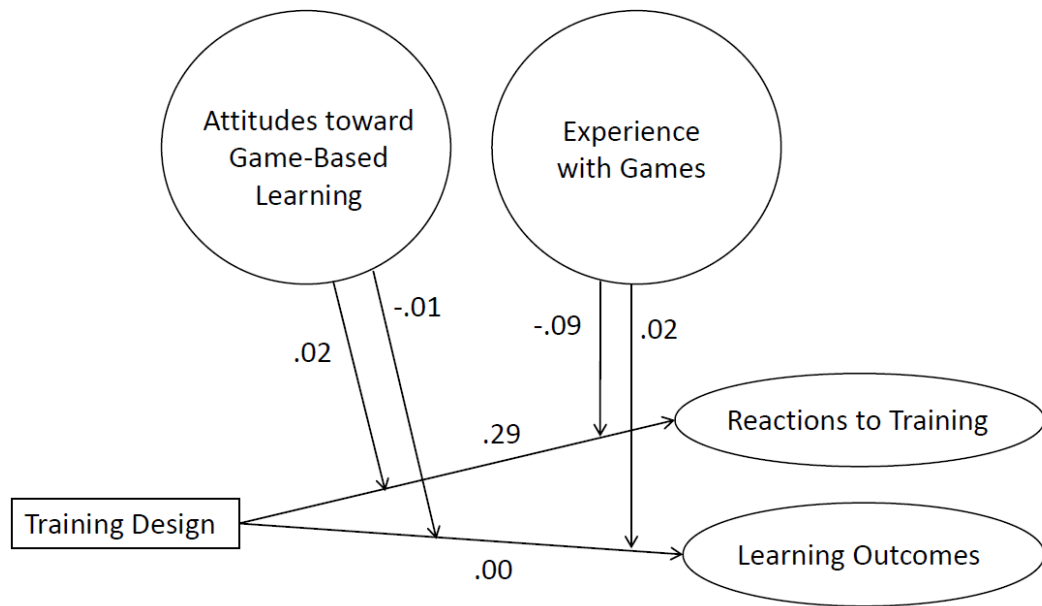
Figure 2. Final Regression Weights Framed within the Theoretical Model.
Note: The moderation effects are represented by the regression weights of the interaction between each condition and each moderator variable.

No strong theoretical reason was identified for including control variables in regression analyses. Spector and Brannick (2011) advised against the use of demographic control variables, as these variables often serve as proxies for variables that are of real theoretical interest in the data. Within the gaming and gamification literatures, gender differences are often explored (Koivisto & Hamari, 2014), with males favoring and performing better at games than females on average. Gender differences may be a proxy variable for game experience, as males tend to play the types of games that are traditionally studied more so than females (Yee, 2006). For these reasons, gender was not included as a control variable in the initial analyses. However, in order to investigate the hypotheses further, post-hoc analyses uses gender as a control variable in a hierarchical regression step before entering condition and the moderator variable in regression

analyses for Hypotheses 3a, 3b, 4a, and 4b. Hypothesized effects and interactions did not

significantly change with the inclusion of gender as a control variable. However, in the

re-testing of Hypothesis 4a, a significant main effect of game experience on reactions was

found ($B = 0.10$, $SE = 0.04$, $p = .029$).

CHAPTER V

DISCUSSION

This study provides evidence that modifying training content with game fiction can improve reactions to training, but the effects of game fiction on learning remains unclear. Participants were overall more satisfied with training enhanced with game fiction than with the control training. Satisfaction reactions were almost a half standard deviation higher for the game fiction training condition, providing support for Hypothesis 1. However, no difference was found across experimental groups in terms of declarative knowledge post training. Game fiction training was neither superior nor inferior to the control training condition, which did not support Hypothesis 2 but is consistent with Adams and colleagues (2012), who found no differences in learning between a serious game with a narrative element and the same game without a narrative element. However, because of the low reliability of the declarative knowledge measure, this conclusion is tentative.

Given the findings regarding game fiction and declarative knowledge, there are four possible conclusions. First, game fiction could possibly harm learning. The distraction hypothesis states that narratives in instruction might require cognitive resources which could otherwise be utilized on learning content, thus detracting from learning (Adams et al., 2012). Within the framework of TETEM (Landers & Callan, 2012), the results of this study might suggest that training design differences involving gamification affect change in reactions but not in learning. Second, game fiction may facilitate the learning of declarative knowledge, as hypothesized. Third, despite the low reliability of the declarative knowledge measure, game fiction may have no effect on

declarative knowledge learning. According to the recently developed theory of gamified learning (Landers, 2014), both instructional content and game characteristics can affect learning outcomes independently of one another. In this study, the two were operationalized as one construct (i.e., training design). Within the framework of the theory of gamified learning, it would seem that instructional content for both conditions was equivalent, leading to equivalent learning outcomes. This assumption would mean that the game characteristic, game fiction, had no effect on learning. Fourth, the effect of game fiction on learning may vary depending on other factors, as hypothesized, although not necessarily on the specific variables observed in this study. An essential piece for explaining the lack of effect of game fiction on learning in this study might be found in the mediational path proposed in the theory of gamified learning (i.e., game characteristics affect behavior or attitudes which in turn affect learning; Landers, 2014). Game fiction may have had no effect on learning in this study if it did not directly affect some behavior or attitude which would in turn affect learning. If the use of game fiction increased the training valence (i.e., an attitude), for example, trainees might be more motivated to learn the content, which would then lead to higher declarative knowledge scores (Colquitt et al., 2000). Alternatively, if the use of game fiction distracts trainees such that they focus more on the story than the content (i.e., a behavior), trainees might consequently score lower on declarative knowledge regarding the training content. Further research will be necessary to clarify the effects of game fiction on learning.

Conclusions regarding the effects of game fiction on learning may not be clear, but the effects on trainee reactions to gamified training content may still be useful. Although some criticize the usefulness of improving trainee reactions, Kirkpatrick (2008)

emphasizes that trainee satisfaction is important for two reasons. First, unsatisfied trainees are likely to report to other employees or upper management if they perceive a training program to be unpleasant or useless. If other employees hear negative reports about a training program, they might avoid the training or disregard the content, even if the training is relevant to their job. If upper management hears these reports, the training program might be terminated when it could have provided value. Second, training reaction measures are important for receiving feedback from trainees. By not assessing trainee satisfaction, trainees may feel as though their thoughts and opinions regarding a training program are not wanted. Further, correlations between reactions and learning (i.e., declarative knowledge and procedural knowledge/skills) are small but positive, and correlations between reactions and training transfer are moderately positive (Alliger et al., 1997). Thus, the gamification of training to improve reactions may be a worthwhile endeavor, even without explicit gains in knowledge compared to traditional training.

The relationships between training condition and training outcomes were hypothesized to be moderated by pre-existing attitudes toward game-based learning and experience with games, respectively. None of the four hypothesized interaction effects reached statistical significance, thus Hypotheses 3a, 3b, 4a, and 4b were unsupported. This may be attributed to the measures that were used to assess the attitudes and experiences of the participants. Game fiction may not be as game-like as other elements such as rules/goals or challenge/conflict. Instead, the use of narrative alone may be experienced as a type of play, which is free-form, expressive, and improvisational (Deterding, Dixon, Khaled, & Nacke, 2011), rather than as a type of game. As such, experience with play and attitudes toward play in learning may have been more relevant

constructs theoretically than the experience with games and attitudes toward games constructs tested. For example, experience with games might be replaced with experience with reading fiction or experience with role playing. Attitudes toward game-based learning might be replaced with attitudes toward the use of stories in learning.

Despite this, a main effect of attitudes toward game-based learning on reactions was found, demonstrating that people who like the idea of game-based learning also liked training more in general. According to Przybylski, Rigby, and Ryan (2010), games can provide players with a sense of autonomy, which motivates them to play. The authors explain that games can provide a variety of roles, choices, goals, and strategies, which supports player autonomy. Within self-determination theory (Deci & Ryan, 2000), having more autonomy is believed to prompt a greater internal locus of control, which is associated with positive attitudes about training broadly (Noe, 1986; Noe & Schmitt, 1986; Colquitt, LePine, & Noe, 2000). Trainees with an internal locus of control are likely to understand how training applies to their job and career, and thus, how it can be useful to them as employees (Colquitt et al., 2000). Trainees may view game-based learning as more autonomous than traditional learning, in which case trainees with a high internal locus of control would tend to favor game-based learning, as they would favor training broadly.

Limitations

The largest limitation to this study was the declarative knowledge measure. The overall difficulty of the measure was very low with a mean score of .82 on the pilot study and .87 on the main study. This decreased the variability of the knowledge scores across participants, which artificially inflated the reliability of the measure during the pilot

study, but not during the main study. Demographic differences across the two studies were compared to check for sampling differences, but there were no meaningful conceptual differences in the two samples. It is possible that if the sample from the main study had more exposure to or experience with company laptop security than the sample from the pilot study, the difficulty of the declarative knowledge measure might have been lower. Participants from the business services and information technology industries might have more exposure to and experience with laptop security than employees in other industries. The proportion of business services industry participants increased from 4.4% of the pilot study sample to 13.6% of the main study sample, while the proportion of information technology industry participants decreased from 20.0% in the pilot study to 7.0% in the main study. Combining these industries resulted in 24.4% of the pilot study sample with a background in one of these two industries and only 20.5% of the main study sample with one of these industry backgrounds. In order to further investigate sampling differences, posttest scores on the final item set from the pilot study were compared to posttest scores from the control group in the main study. A Mann-Whitney U-test was used to compare the scores of the two samples because both samples were negatively skewed. There was no significant difference in knowledge scores between the pilot and main study samples ($U = 5986.50$, $p = .782$), thus sampling differences cannot explain the differences in findings from the pilot to main study. Regardless, the knowledge measure had poor internal consistency reliability for the main study, which may have contributed to the finding that game fiction training and the control training did not yield differences in learning. When correcting for attenuation due to unreliability, the correlation between condition and knowledge only increased from .011 to .016.

However, this approach assumes both normality and unidimensionality, which were not properties of the measure used. An exploratory factor analysis conducted on the knowledge measure yielded a four-factor structure for a declarative knowledge construct intended to be unidimensional. The four factors were largely uninterpretable, which made it difficult to balance content across the domain of laptop security knowledge. Although the final measure contained items from all four factors, it is unclear what factor structure of laptop security knowledge was sampled. Therefore, a measure with better psychometric properties might have revealed differences in knowledge.

Another major limitation to this study is the choice of training evaluation design. As discussed previously, Solomon's (1949) four-group design would address most threats to internal and external validity. Controlling for pretest scores on laptop security knowledge would have highlighted the true changes in learning due to the two training modules. Although randomization does not seem to be an issue, it is still unknown how much pre-existing knowledge each training condition had on average without a pretest assessment. It is possible that the game fiction condition had a strong effect on learning, but that the pre-existing knowledge of the control same was much higher in the first place, cancelling the differences in learning. Conversely, game fiction might have had a strong negative effect on learning, but was countered by the participants' high pre-existing knowledge.

A third limitation to this study is the limited operationalization of learning. The game-based learning literature seemed to provide support for an effect of game fiction on declarative knowledge learning (e.g., Serrano & Anderson, 2004; Dickey, 2011; Bedwell et al., 2012). However, the hypothesized effect was not found. Expanding the

operationalization of learning to include other outcomes such as skill-based or attitudinal change (Kraiger et al., 1993) might have resulted in different outcomes. Without assessing these types of learning, the nomological net surrounding game fiction in training remains incomplete.

Future Directions

Future research might seek to replicate and confirm the effects produced in this study, but with improved measurement instruments. Because of the limitations associated with the declarative knowledge measure, a study with a different knowledge measure might yield different results. There are several approaches that could be taken to improve the measurement of declarative knowledge learning. One approach would be to use a different training module with a well-validated learning measure. Even though the purpose of the pilot study was to create a reliable and valid declarative knowledge measure for the main study, it does not appear that this was achieved in this study. Using a training program with previously validated learning measures would support in attaining reliable and valid measurement of gamified training. Another approach might be to develop a new learning measure for this same training program. Items could be revised to be more difficult and new items could be drafted. Extended pilot studying with larger samples would aid in creating a reliable and construct valid measure of declarative knowledge.

Another future direction for improving the present study would include using a different evaluation design. Ideally, a four-group design would be used with one group experiencing pretest, training, and posttest assessments; one group experiencing pretest and posttest assessments only; one group experiencing training and posttest assessment;

and a final group experiencing only posttest assessment of knowledge. Considering this design requires larger sample sizes, and thus more resources, it may be prudent to collect data from an alternative sample such as an organization or student sample.

Another direction for future research is to investigate possible mediators between the training design condition and learning outcomes. Although game fiction training was more satisfying for trainees than control training, it is likely that other variables are involved in the process, such as behavioral or attitudinal constructs (Landers, 2014). According to the theory of gamified learning, the relationship between game characteristics and learning outcomes is mediated by behaviors and attitudes. For example, when students are not engaged in their schoolwork, academic performance is lower (Carini, Kuh, & Klein, 2006). Adding game elements like game fiction to a course might increase student engagement with the course material, which then improves academic performance. In this same way, training engagement might mediate the relationship between training design and training outcomes. Alternatively, game fiction training design might increase cognitive load, which could then decrease learning, as suggested by the distraction hypothesis (Adams et al., 2012). The study of mediators in the gamification of training is a valuable next step after establishing which game elements are associated with training outcomes.

Finally, the gamification of training using game fiction might be examined in a broader training context, including within TETEM. A portion of TETEM was tested within this study, but other important relationships remain to be tested (Landers & Armstrong, *in press*). For example, the effects of game fiction-enhanced training on behavioral change or transfer was not tested within this study, as it would have required

an organizational sample. Attitudes toward game-based learning should moderate the relationship between learning and transfer, as per proposition 3 of TETEM (Landers & Callan, 2012). Even if trainees were to learn via game fiction, they may choose not to transfer their learning to the workplace if they do not value that narrative (Grossman & Salas, 2011). In addition, there are other training outcomes that may be impacted by game fiction-enhanced training. The effect of game fiction training on leaning outcomes like procedural knowledge/skills and affective outcomes like attitudes and motivation should be examined. Future research should attempt to theoretically link different game elements (Bedwell et al., 2012; Landers, 2014) to the specific learning outcomes in Kraiger and colleagues' (1993) taxonomy. For example, game fiction may have an effect on attitudinal change, which is considered a form of learning by Kraiger and colleagues.

Conclusion

This study demonstrates a scientific approach to enhance text-based training programs with game fiction in order to improve learning outcomes. By conforming training content to an outline format, Thorndyke's (1977) rules for creating simple stories can be used to transform the training content into a game fiction. Training enhanced with game fiction can be more satisfying to trainees than a bullet list formatted training while yielding equal knowledge outcomes in trainees, demonstrating the positive potential of this technique. Additionally, a large portion of TETEM was tested within this study. Training design condition significantly affected reactions to training, but did not produce a significantly different effect on learning. The attitude and experience moderators proposed by TETEM were not supported in the context of training enhanced with game fiction alone. However, due to the limitations of the knowledge measure, it remains

uncertain whether attitudes toward game-based learning and experience with games moderated the effect of training design on learning. These effects may be better established with an improved measurement of declarative knowledge.

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APPENDIX A

DECLARATIVE KNOWLEDGE PILOT MEASURE

1. Are all ABC Consulting-issued laptops shipped with encryption? If so, what kind of encryption?

    a. Yes, with full disk encryption

    b. Yes, with partial disk encryption

    c. Yes, with hard disk encryption

    d. No, not all laptops are shipped with encryption

2. Which of these methods is NOT appropriate for laptop storage?

    a. Leave the laptop on the floor

    b. Lock the laptop

    c. Store the laptop out of sight

    d. Fasten laptop to your desk

3. What information should be stored separately in case of theft or loss?

    a. Personal contact information

    b. Make, Model, Serial Number, And Asset Number

    c. Passwords to social media websites

    d. Your Wifi password

4. What information should be stored separately in case of theft or loss?

    a. Proprietary ABC Consulting information

    b. Personal photos, music, and files

    c. Passwords to social media websites

    d. Corporate office contact information

5. What information should be stored separately in case of theft or loss?

    a. Personal bank account information

    b. Company training content

    c. Client identifiable data

    d. Personal contact information

6. Who is the first contact should your laptop become lost or stolen?

    a. Local authorities & IT Security

    b. Your colleagues

    c. Your supervisor

    d. IT Service Desk

7. When is the worst time of day to leave your laptop in the car unattended?

    a. Early morning

    b. Lunch time

    c. Afternoon

    d. Overnight

8. If concealing your laptop in the trunk of your car, when should you do so?

    a. Prior to reaching your destination

    b. As soon as you reach your destination

    c. After checking-in at your destination

    d. Before going to bed

9. How do you contact the IT Service Desk?

    a. Call them at 777-555-1234

    b. Call them at 777-555-5678

  c. **Email them at ithelp@abcconsulting.com**

  d. Email them at ithelp@abcconsult.com

10. Most laptop thefts are _____.

  a. **Preventable**

  b. Unpreventable

  c. Unfortunate

  d. Surprising

11. When using a laptop security cable, which is the best object to attach it to?

  a. A chair

  b. **A table**

  c. A laptop bag

  d. A lamp

12. How should difficult laptop passwords and access codes be stored?

  a. Separately from the laptop

  b. With the laptop, but encrypted

  c. **Separate from the laptop and encrypted**

  d. Commit them to memory

13. How should you treat your company laptop?

  a. Like a ball and chain

  b. Like a child

  c. **Like cash**

  d. Like a pet

14. Within an office setting, if you step away from your laptop for an extended amount of time, to what should you attach your laptop?

    a. Your desk

    b. A coat rack

    c. Your chair

    d. Your laptop bag/case

15. To lock your computer, what keys must be pressed?

    a. Ctrl-Alt-Del

    b. Shift-Alt-Del

    c. Ctrl-Shift-Del

    d. Shift-Alt-Backspace

16. When you step away from your desk for an extended period of time, where should NOT you store your laptop?

    a. On a windowsill

    b. In a laptop bag/case

    c. In a drawer

    d. In a safe

17. In which area(s) do laptop security practices apply?

    a. Only while traveling

    b. In the office, at the store, and while traveling

    c. At the store, at home, and while traveling

    d. In the office, at home, and while traveling

18. Which of the following is a favorite trick of thieves?

    a. **Grab a sleeping passenger's laptop bag or backpack from a shelf or accessible place**

    b. Use an accomplice to distract a passenger while stealing a laptop bag or backpack

    c. Offer to buy a passenger a drink, and then steal a laptop bag or backpack when the passenger receives the drink.

    d. Compliment a passenger on their laptop bag or backpack, ask to see it, then steal it and run away.

19. Carrying a laptop in a computer case may advertise what is inside. Which of the following is <u>not</u> a good alternative way to carry your laptop?

    a. **A padded briefcase with the company logo**

    b. A suitcase

    c. A padded briefcase with no company logo

    d. A backpack

20. When you check-in or check-out of a hotel, where should you keep your laptop?

    a. On a luggage cart

    b. **On your shoulder**

    c. Behind you

    d. With a bellhop.

21. When leaving your laptop in a hotel room, which precaution is least effective?

    a. Hiding the laptop in a safe in the room

    b. Hiding the laptop in a suitcase

    c. **Hanging the "Do Not Disturb" sign on your door**

    d. Using a security cable and hanging the "Do Not Disturb" sign on your

       door

22. With rental cars, cabs, shuttles, or your own personal vehicle, for what should you

be alert?

    a. Laptop theft

    b. Laptop loss

    c. Both theft and loss

    d. Neither theft nor loss

23. Which of the following is a favorite target of thieves?

    a. Hotel rooms

    b. Homes in the suburbs

    c. Office buildings

    d. Parked cars

24. When should you leave your laptop in the car unattended?

    a. When you are pumping gas

    b. Overnight

    c. When you are at a restaurant

    d. Never

25. If your laptop must be stored in your car unattended, where should it be stored?

    a. In the passenger seat

    b. In the back seat

    c. On the floor behind the passenger seat

    d. In the trunk

26. Why should you backup your files?

    a. Because it wards off thieves

    b. In case you need to rebuild your work/environment

    c. Because two is better than one

    d. In case you save over your work

27. What information should you record from your laptop computer in order to be prepared for the worst-case scenario?

    a. The laptop's make, model, and Microsoft Office version number

    b. The laptop's model, serial number, and Microsoft Office version number

    c. The laptop's asset number, serial number, and operating system version number

    d. The laptop's make, model, and serial number

28. When should you know what you would need to do if your laptop is stolen?

    a. Right after finishing training

    b. Before it is stolen

    c. While it is being stolen

    d. After it is stolen

29. When your laptop is gone, what information does the IT Service Desk need?

    a. The height, weight, and clothing worn by the thief

    b. The name of the last person you saw before losing the laptop

    c. The color and screen size of the laptop

    d. The location, date, and description of what happened

30. When your laptop is stolen or lost, when should you report it to the local

   authorities?

   a. Immediately

   b. Within 24 hours

   c. Within 48 hours

   d. Within 72 hours

31. Where is an <u>inappropriate</u> location to use a laptop security cable?

   a. At the office on your desk

   b. At home in your living room

   c. At a hotel in the lobby

   d. At a restaurant on the ground

32. Leaving what kinds of items on the seats or floor of a car may encourage a thief to

   break into a car?

   a. Leather bags/purses

   b. Sporting equipment

   c. Snack foods

   d. Clothes

33. What types of information should you NOT save to your ABC Consulting laptop

   unless absolutely necessary?

   a. Social media website information

   b. Client identifiable information

   c. Web application favorites

   d. Emergency contact information

34. Leaving passwords or access numbers in either a laptop carrying case or on your laptop is like what?

    a. Leaving the cat out

    b. Leaving the keys in your car

    c. Leaving your spouse

    d. Leaving the roast in the oven too long

35. Why should you backup your files?

    a. So that you can delete the original files and free up hard drive space

    b. So that your computer will work faster

    c. So that you can rebuild your work/environment if you need to

    d. You should not backup your files because backups are easier to steal

36. When must you protect your ABC Consulting laptop?

    a. During the week while at work

    b. On the weekend while at home

    c. While traveling during the holidays

    d. At all times

37. According to the Computer Security Institute and the Federal Bureau of Investigation Crime & Security Survey, about how much money does it cost companies annually for lost or stolen laptops?

    a. $750,000

    b. $2,000,000

    c. $1,500,000,000

    d. $3,000,000,000

38. What is the average cost to the company for a lost or stolen laptop?

   a. $31,975

   b. $2,950

   c. $41,568

   d. $15,410

39. When placing your belongings on the ground where should you place them?

   a. Place your laptop against the wall so that it will not be in the way

   b. Place your laptop against the chair you are sitting in and warn people to walk around

   c. Place your laptop between your feet or against your leg so that you are always aware of it

   d. Place your laptop in a bag out of the way so that you can keep it concealed

40. When securing your laptop it is recommended that you use which of the following?

   a. A piece of furniture that is easily moved

   b. A laptop security cable

   c. A rolling desk that is easily pushed against a wall

   d. A padlock that only uses a key

41. What percentage of laptops is stolen inside of office environments?

   a. 10 to 20%

   b. 20 to 30%

   c. 30 to 40%

   d. 40 to 50%

42. When you step away from your desk for an extended period of time, where should you store your laptop?

   a. As long as it is securely locked with a cable to your desk, it can be left out in the open

   b. In a locked drawer or safe in your desk at home or the office, out of sight

   c. In the back seat of a car

   d. In a locked box in the trunk of the car

43. When having visitors over to your home you should do which of the following?

   a. Once the doorbell rings you should immediately shut down your computer and lock it in a safe that is not immediately movable to reduce temptation for others to steal it

   b. Leave it out on your desk and "Log off"

   c. Once the doorbell rings leave it open and operating so that you can return quickly and get straight back to work.

   d. Once the doorbell rings, ensure that your cable lock is on your laptop and press "Ctrl-Alt-Del" then click "Lock Computer," then answer the door

44. When waiting in the check-in line at the airport you should always do which of the following?

   a. Keep your laptop in front of you until the person in front of you has passed through the metal detector

b. Place your laptop on the conveyor belt first so that it is out of your control and you can remove objects from your pockets

c. Wait until instructed by security officials to place it in a plastic tub

d. Refuse to place the laptop in the x-ray machine because it will erase your laptop memory

45. When traveling by airplane, where should you place your laptop?

a. In the overhead compartment to allow you to have more leg room

b. In a laptop case to keep it protected from other shifting baggage

c. Under the seat in front of you during your flight

d. Keep it in the seat pocket in front of you

46. When going through the metal detector, you should always try to do which of the following?

a. Keep an eye on your laptop at all times as it emerges through the security screener

b. Never let it go until you are told to do so by the security screener

c. Keep your laptop in its case at all times and never let anyone see what is inside of the case

d. Put your laptop in your checked baggage so that no one in the airport will know that you have it.

47. When you are traveling you should NOT do which of the following?

a. You should be proud that you are a member of ABC Consulting and should put company logos on all of your bags.

b. **You should hide the fact that you are a member of ABC Consulting and remove all logos from your bags.**

c. You should not worry about anything and just keep everything as normal.

d. You should be mindful of your surroundings and always try to blend in.

48. When you are sleeping on buses and trains it is a favorite trick of thieves to do which of the following?

    a. Watch you from a distance and study the contents of your bags

    b. Wake you up and ask you for a piece of gum

    c. Pay a child money to pick up your laptop from under the seat in front of you

    d. **Grab a laptop bag or backpack from a shelf or accessible place and keep walking with it until he or she is safely away**

49. While you are traveling it is imperative that you do which of the following?

    a. **Be alert and aware**

    b. Be friendly and likable

    c. Be courteous and kind

    d. Be trustworthy and neutral

50. Not only is there a threat of your laptop being stolen, but there are also threats to your rental car, cabs, and shuttles, so you need to be extra _____ for risks of theft or loss.

    a. Kind

    b. **Alert**

    c. Fretful

d. Creative

51. When leaving your vehicle unattended, you should always close your windows,

turn off your lights, and _____.

    a. Leave your doors unlocked

    b. Leave your radio on

    c. Lock your doors

    d. Open your hood to make your car appear to be in distress

52. When should you start planning in case you laptop is stolen or lost?

    a. Tomorrow

    b. Next week

    c. While on a trip

    d. Immediately

53. Who will generate and assign the loss of your laptop to the IT Security Team?

    a. The IT Service Desk

    b. Your supervisor

    c. The Police

    d. The Department of Homeland Security

54. You should always keep your unique passwords in a safe place _____

_____ your laptop.

    a. Along with

    b. Away from

    c. In with

    d. Secured with

55. According to the Computer Security Institute/FBI Computer Crime & Security Survey, how many laptops thefts occur annually?

    a. 1,000,000

    b. 500,000

    c. 360,000

    d. 170,000

56. More than ____ in _____ laptops are stolen within their lifetime

    a. 10, 20

    b. 1,10

    c. 3, 15

    d. 4,5

57. In general, when your laptop is not in use you should NOT do which of the following?

    a. Keep your laptop out of sight

    b. Find a secure place to keep your laptop

    c. Keep it out in the open so everyone knows you have it

    d. Lock it up with a laptop security cable

58. Which setting on the computer must never be changed or removed?

    a. Windows

    b. Display settings

    c. Microsoft Office templates

    d. Full Disk Encryption

59. Once your laptop is either lost or stolen you must notify which of the following?

    a. Your supervisor, IT Risk Management, and IT Security

    b. The IT Service Desk, IT Risk Management, and IT Security

    c. The Corporate office, your supervisor, and the authorities

    d. IT Risk Management, IT Security, and the authorities

60. What are the two main concepts of the training?

    a. Laptop security practices, what to do if your laptop is lost or stolen

    b. How to keep your computer safe from thieves, parts of the computer

    c. How to travel, and what to expect when traveling

    d. Computer systems that come standard to company laptops, and where to find help with computer issues

APPENDIX B

CONTROL CONDITION TRAINING CONTENT

- Page 1
    - Please imagine that you are an employee for a new software company, ABC Consulting. You have recently been hired by the company and are in the process of completing company training. Today's training session consists of laptop security training, as well as learning what to do if your laptop is stolen or lost. Please review the online training content.
- Page 2 – Laptop Theft/Loss Security Training: Addressing Security Concerns for your Laptop
    - **Congratulations on your new company Laptop!**
    - **As an ABC Systems Laptop owner, please be aware of the following:**
        - Your ABC Consulting laptop is a documented ABC Consulting asset. If you have any problems with your ABC Consulting laptop, you must contact the Information Technology (IT) Service Desk at ithelp@abcconsulting.com for Support
        - Your ABC Systems laptop was shipped by the ABC Consulting National Distribution Center with Full Disk Encryption (FDE) which must not be removed under any circumstances.
        - Do NOT save ABC Consulting confidential, proprietary, or client identifiable information on your laptop unless absolutely necessary for your job function.
        - You **must** protect your ABC Consulting laptop at all times.
        - If your ABC Systems Laptop is lost or stolen, report the incident immediately to IT Risk Management and Security.
- Page 3 - Laptop Theft/Loss
    - **According to the Computer Security Institute/FBI Computer Crime & Security Survey:**
        - On average 360,000 laptop thefts occur annually
        - More than 1 in 10 laptops are stolen within their lifetime
        - Re-creating critical data/files from stolen or lost laptops costs over $1.5 billion annually
        - Average theft/loss of a laptop costs a company $31,975
        - Most laptop thefts are **preventable**
- Page 4 - Tips & Recommendations: General
    - **What Can I Do to Protect My ABC Systems Laptop?**
        - **Treat Your Laptop Like Cash** – Keep a careful eye on your laptop, just as you would a pile of cash.
        - **Keep It Locked** – Use a Laptop security cable: attach it to something immovable or to a heavy piece of furniture that's difficult to move, such as a table or a desk.
        - **Keep It Away from the Floor** – No matter where you are, avoid putting your laptop on the floor. If you must put it down, place it

> > between your feet or at least up against your leg, so that you're aware of it.
> >
> > - **Keep Passwords in a Different Location** – Remembering strong passwords or access numbers can be difficult. However, leaving either in a laptop carrying case or on your laptop is like leaving the keys in your car. Store them separately and encrypted if possible.

- Page 5 - Tips & Recommendations: Office
  - **Secure Your Laptop In The Office (Over 40% Of Laptop Thefts Occur Here)**
    - **Lock Your Laptop** – Click on Ctrl-Alt-Del, and click "Lock Computer" when you briefly step away.
    - **Fasten it to Your Desk** – Use a laptop security cable to attach your laptop to your desk or something immovable.
    - **Store Out of Sight** – When you step away from your desk for an extended period of time, store your laptop out of sight.
- Page 6 - Tips & Recommendations: Home
  - **Secure Your Laptop at Home**
    - **Enable an Alarm** – Activate your home system so the police can be notified and respond if thieves enter your home when you're not around.
    - **Hide your laptop** – When not in use, store your laptop in a secure out-of-sight location or ideally in a safe which can't be easily carried. A laptop on a desk which can be seen from a window may encourage a break-in.
    - **Consider your visitors** – New acquaintances may see an unsecured laptop as a spur of the moment opportunity.
- Page 7 - Tips & Recommendations: Traveling
  - **Notice Your Surroundings At The Airport**
    - **Focus When You Fly The Friendly Skies** – The confusion and shuffle of security checkpoints can be fruitful ground for theft.
      - Keep your laptop with you in the check-in line, and hold onto it until the person in front of you has gone through the metal detector
      - Beware of scams and keep an eye out when it emerges on the other side of the screener.
      - Store your laptop under the seat in front of you while on board your flight.
- Page 8 - Tips &Recommendations: Traveling
  - **Recognize That Traveling is a Major Distraction**
    - **Mind Your Bag** – When you travel, carrying your laptop in a computer case may advertise what's inside. Consider using a suitcase, a padded briefcase, or a backpack instead and remove any organizational logos.
    - **Be On Guard** – Keep your Laptop close by you at all times and position it where it can't be easily reached when traveling by bus or train. A favorite trick of thieves is to grab a laptop bag or

> backpack of a sleeping passenger from a shelf or accessible place and keep walking with it until they're safely away.

- Page 9 - Tips & Recommendations: Traveling
  - o **Recognize That Traveling is a Major Distraction**
    - ▪ **Be Alert In Hotels –** Keep your laptop on your shoulder or in front of you when you check-in or check-out. Try not to leave your laptop out in your room. Use the safe in your room (if there is one) or hide it in a suitcase. If you use a security cable to lock down your laptop, consider hanging the "Do Not Disturb" sign on your door.
    - ▪ **Be Aware –** There are numerous distractions with rental cars, cabs, shuttles, and even your own personal vehicle, so be alert for risks of theft or loss.
- Page 10 - Tips & Recommendations: On the Road
  - o **Vehicles are easily broken into – Out of Sight, Out of Mind!**
    - ▪ **Nothing of Interest –** Do not leave your laptop in the car unattended (especially overnight) and certainly not on the seat. If it must be left in a car, conceal your laptop in the trunk prior to reaching your destination, and always lock your doors. Do not leave items which appear valuable (such as purses, leather bags, etc.) on the seats or floor – they may encourage a thief to smash and grab, and look in the trunk. Parked cars are a favorite target of thieves.
- Page 11 - Be Prepared
  - o **Always Be Prepared For The Worst Case Scenario**
    - ▪ **Backup Your Files –** Save your files to a secure location in case you need to rebuild your environment.
    - ▪ **Carry A List –** Note your laptop's Make, Model, Serial Number, and Asset Number along with emergency contact information.
    - ▪ **Don't Store Confidential Data –** Do Not save ABC Consulting confidential, proprietary, or client identifiable information on your laptop unless absolutely necessary for your job function
    - ▪ **Have a Plan –** Know what you'll need to do if your laptop is stolen . . . before it happens.
- Page 12 - Who to Contact
  - o **Worst Case – Your Laptop is Gone, What Do You Do?**
    - ▪ **Report it immediately to the local authorities**
    - ▪ **Email the IT Service Desk at ithelp@abcconsulting.com, and provide**
      - • Name, Phone Number
      - • Location, Day and Time, Description of what happened
      - • Make and Model (Serial and Asset Numbers if known)
      - • Data Type involved (e.g. confidential, proprietary, client identifiable)
    - ▪ **A Service Desk ticket will be generated, with assignment to the "IT Security" team**

APPENDIX C

DECLARATIVE KNOWLEDGE FINAL MEASURE

1. Are all ABC Consulting-issued laptops shipped with encryption? If so, what kind of encryption?

    a. Yes, with full disk encryption

    b. Yes, with partial disk encryption

    c. Yes, with hard disk encryption

    d. No, not all laptops are shipped with encryption

2. What information should be stored separately in case of theft or loss?

    a. Proprietary ABC Consulting information

    b. Personal photos, music, and files

    c. Passwords to social media websites

    d. Corporate office contact information

3. Who is the first contact should your laptop become lost or stolen?

    a. Local authorities & IT Security

    b. Your colleagues

    c. Your supervisor

    d. IT Service Desk

4. How do you contact the IT Service Desk?

    a. Call them at 777-555-1234

    b. Call them at 777-555-5678

    c. Email them at ithelp@abcconsulting.com

    d. Email them at ithelp@abcconsult.com

5. When you step away from your desk for an extended period of time, where should NOT you store your laptop?

    a. On a windowsill

    b. In a laptop bag/case

    c. In a drawer

    d. In a safe

6. When leaving your laptop in a hotel room, which precaution is least effective?

    a. Hiding the laptop in a safe in the room

    b. Hiding the laptop in a suitcase

    c. Hanging the "Do Not Disturb" sign on your door

    d. Using a security cable and hanging the "Do Not Disturb" sign on your door

7. When should you leave your laptop in the car unattended?

    a. When you are pumping gas

    b. Overnight

    c. When you are at a restaurant

    d. Never

8. If your laptop must be stored in your car unattended, where should it be stored?

    a. In the passenger seat

    b. In the back seat

    c. On the floor behind the passenger seat

    d. In the trunk

9. Why should you backup your files?

a. Because it wards off thieves

b. **In case you need to rebuild your work/environment**

c. Because two is better than one

d. In case you save over your work

10. When your laptop is gone, what information does the IT Service Desk need?

a. The height, weight, and clothing worn by the thief

b. The name of the last person you saw before losing the laptop

c. The color and screen size of the laptop

d. **The location, date, and description of what happened**

11. When must you protect your ABC Consulting laptop?

a. During the week while at work

b. On the weekend while at home

c. While traveling during the holidays

d. **At all times**

12. According to the Computer Security Institute and the Federal Bureau of
Investigation Crime & Security Survey, about how much money does it cost
companies annually for lost or stolen laptops?

a. $750,000

b. $2,000,000

c. **$1,500,000,000**

d. $3,000,000,000

13. What is the average cost to the company for a lost or stolen laptop?

a. **$31,975**

b. $2,950

c. $41,568

d. $15,410

14. When placing your belongings on the ground where should you place them?

    a. Place your laptop against the wall so that it will not be in the way

    b. Place your laptop against the chair you are sitting in and warn people to walk around

    c. Place your laptop between your feet or against your leg so that you are always aware of it

    d. Place your laptop in a bag out of the way so that you can keep it concealed

15. When going through the metal detector, you should always try to do which of the following?

    a. Keep an eye on your laptop at all times as it emerges through the security screener

    b. Never let it go until you are told to do so by the security screener

    c. Keep your laptop in its case at all times and never let anyone see what is inside of the case

    d. Put your laptop in your checked baggage so that no one in the airport will know that you have it.

16. While you are traveling it is imperative that you do which of the following?

    a. Be alert and aware

    b. Be friendly and likable

    c. Be courteous and kind

    d. Be trustworthy and neutral

17. Who will generate and assign the loss of your laptop to the IT Security Team?

    a. The IT Service Desk

    b. Your supervisor

    c. The Police

    d. The Department of Homeland Security

18. In general, when your laptop is not in use you should NOT do which of the

following?

    a. Keep your laptop out of sight

    b. Find a secure place to keep your laptop

    c. Keep it out in the open so everyone knows you have it

    d. Lock it up with a laptop security cable

19. Once your laptop is either lost or stolen you must notify which of the following?

    a. Your supervisor, IT Risk Management, and IT Security

    b. The IT Service Desk, IT Risk Management, and IT Security

    c. The Corporate office, your supervisor, and the authorities

    d. IT Risk Management, IT Security, and the authorities

20. What are the two main concepts of the training?

    a. Laptop security practices, what to do if your laptop is lost or stolen

    b. How to keep your computer safe from thieves, parts of the computer

    c. How to travel, and what to expect when traveling

    d. Computer systems that come standard to company laptops, and where to

       find help with computer issues

APPENDIX D

GAME FICTION CONDITION TRAINING CONTENT

- Page 1
    - Jim is an employee at a new consulting company, ABC Consulting, located in Philadelphia, Pennsylvania. ABC Consulting is contracted by client companies to collect, analyze, and report on important, confidential data. Jim's job is to analyze the client data and draft a report of the results for the client company. This is a story about Jim…
- Page 2
    - Jim was sitting in his office at ABC Consulting, finishing his morning cup of coffee, while he listened to an online video news report. "Laptop thefts in Philadelphia are on the rise," said the reporter.
    - Someone knocked on the door. Jim paused the video. "Come in," he said. Jim's supervisor entered the room, holding a sleek new laptop.
    - "Congratulations Jim, this is your new laptop for the Johnson project," Jim's supervisor said. "You won't have to use that old desktop any longer."
    - Jim's eyes lit up. His desktop computer got the job done, but he had begun to grow envious of all the new laptops his coworkers had been assigned.
    - "Your ABC Consulting laptop is a documented ABC Consulting asset," his supervisor continued. "If you have any problems with your ABC Consulting laptop, you must contact the Information Technology Service desk via email at ithelp@abcconsulting.com for support. Your ABC Consulting laptop was shipped by the ABC Consulting National Distribution Center with Full Disk Encryption which must not be removed under any circumstances. Do not save ABC Consulting confidential, proprietary, or client identifiable information on your laptop unless absolutely necessary for your job function."
    - Jim nodded in agreement as he listened to his supervisor.
    - "You must protect your ABC Consulting laptop at all times," his supervisor continued. "If your ABC Consulting laptop is lost or stolen, report the incident immediately to IT Risk Management and Security."
    - Jim's supervisor sighed as he finished his monologue. "Remember your laptop theft and loss security training from a few weeks ago, and you should be good to go. Now that I've given that spiel for the one hundredth time, I'll leave you to your work," as he presented Jim the new laptop with care. Jim's supervisor left his office, shutting the door behind him.
- Page 3
    - Jim clicked *Play* on the video he had been watching. As he listened to the news on his desktop computer, he turned on his new laptop and began to set it up for work.
    - The reporter continued speaking, "On average, 360,000 laptop thefts occur annually. More than one in ten laptops are stolen within their lifetime."

- o Jim began to transfer the data from the Johnson project from his desktop to his laptop.
- o "Re-creating critical data and files from stolen or lost laptops costs over $1.5 billion annually," said the reporter. "Average theft or loss of a laptop costs a company $31,975. Most laptop thefts are preventable."
- o Jim pressed pause on the video again. "Wow," he thought to himself, "those are some pretty serious numbers. I really need to be careful. If the data from this project were stolen, thousands of people could have their identities stolen."
- o "I'm not going to let that happen to me," Jim said aloud, resolved. The data transfer was finished. He turned off his old desktop computer and began to work solely from his laptop on the Johnson project.

- Page 4
  - o The next morning, as Jim arrived to work, he stopped by the break room to grab some coffee before heading to his office. As Jim was pouring his coffee, his friend Anderson from the IT department walked in to the break room.
  - o "Good morning, Jim," Anderson said. "Did you catch the game last night?"
  - o The two sat down at the small table in the break room to chat for a few minutes before beginning work. Anderson noticed that Jim's laptop was sitting on the ground next to his chair. Being a member of the IT department, he could not help but point it out to Jim.
  - o "Say, Jim," he said. "You just got that laptop didn't you? Don't you remember what they taught you in training?"
  - o "What?" Jim replied, surprised that he had done something wrong.
  - o "Well, for one," Anderson began, "You should avoid putting your laptop on the floor, no matter where you are. If you must put it down, you should place it between your feet or at least up against your leg. That way, you're aware of it."
  - o "Oh," Jim replied, "I forgot about that."
  - o "In case you forgot anything else, let me remind you of a few things," said Anderson. "You should treat your laptop like cash. Always keep a careful eye on it."
  - o Jim nodded his head in agreement. "Okay, gotcha," he said.
  - o Anderson continued, "You should also come over to the IT department today and pick up a laptop security cable. When you leave your laptop sitting out somewhere, you should attach it to something immovable or to a heavy piece of furniture that's difficult to move, like a table or desk.
  - o "Cool," Jim said. "I'll pick one up before lunch today."
  - o "One last thing," said Anderson. "Do you memorize your passwords?"
  - o "I tried to for a while," Jim said, "But remembering strong passwords and access numbers can be difficult."
  - o "Well," said Anderson, "If you have to store passwords somewhere, make sure that you keep them in a different location than your laptop. Store them separately and encrypted if possible. Because you know, leaving a

password or access number in your laptop carrying case or on your laptop is like leaving the keys in your car, and you wouldn't do that, would you?" He finished speaking with a chuckle.

- o "Nope, that's for sure," Jim said. "Thanks for the reminders, Anderson."
- o "No problem, Jim," Anderson said. The two left the break room, and headed to their own offices.

- Page 5
  - o Three days into the Johnson project with his new company laptop, some suspicious activity began at the ABC Consulting Philadelphia office. Jim had just finished his morning cup of coffee at his office desk and decided to take a break from his work. Jim had been extra careful with protecting his work since beginning work on the Johnson project. Before leaving the room, he clicked "Ctrl-Alt-Del" and locked his computer. He used his laptop security cable to attach his laptop to his desk before sliding the computer out of sight under a small shelf on top of his desk. After all, Jim learned in his training that 40% of all laptop thefts occur at the office. After taking his precautions, Jim stepped out of the room, heading to the water cooler for a quick drink.
  - o As Jim opened the door to his office and stepped out, a newly hired intern at ABC Consulting watched him carefully. Jim walked away as the door automatically shut behind him. Before it had even closed, the intern slipped into Jim's office.
  - o The intern quickly found Jim's laptop, he had been watching Jim for the past two days and knew where he positioned it when he left it alone. The intern grabbed the laptop in his hands and turned away quickly to exit the office, holding the laptop closely to his ribs. The laptop lurched in his grip, stopping the thief dead in his tracks. He had forgotten about the security cable. He paused for a second, trying to figure out if he could break the cable somehow. Without any options, the intern placed the laptop back on the desk and darted out of the office. He had just rounded a corner wall as Jim returned to his office door.
  - o As Jim walked up to his desk, he noticed his laptop's change in position. "That's odd," he said as his face contorted in curiosity. He sat back down to continue his work.
  - o Throughout the day, Jim continued to dwell on the curious event that happened. "Maybe I'll work from home tomorrow," he thought. He typed a quick email to his supervisor letting him know of Jim's change in plans.
- Page 6
  - o The next day Jim worked from his home in the suburbs of Philadelphia. Jim felt very safe in his home. He had a home alarm system, although it had never been put to use. Jim lived in a pretty safe neighborhood. School children would play outside in his neighborhood on a daily basis.
  - o As Jim worked on the Johnson project from his company laptop at his kitchen table, his stomach began to growl. "Oh! I hardly noticed the time," Jim said as he looked at the clock on the wall. It was 2:45 PM and Jim hadn't eaten since breakfast. Jim decided that the fastest thing to do would

be to run to the drive-thru restaurant down the street from his neighborhood entrance. Jim almost left his laptop on the table in his hurry out the door. He paused, still weary of the odd occurrence the day before.

- o "Just to be safe," he said aloud as he picked up his laptop and moved it to a mid-size safe in his bedroom closet. He then proceeded to his car outside and drove away.
- o As Jim's car pulled away, the bushes outside his house rustled. Frustrated from his failure the day before, the intern from ABC Consulting climbed out from behind the greenery and hopped up to Jim's front porch carrying a tool bag. He wore black leather gloves on his hands as he quickly picked the lock to Jim's front door. He swung open the door and strolled inside.
- o Immediately, the alarm went off. "I wasn't expecting that!" exclaimed the thief as he rummaged around the house, the alarm blaring.
- o He did not see the laptop in plain sight. "I thought for sure that he would be more careless at home," the thief thought. "I don't have much time before the cops get here!"
- o Filled with frustration at his second at attempt to steal the laptop from Jim, the thief ran out the front door, leaving the door gaping wide open.
- o When Jim returned home, the police were already at the scene. After explaining what they had perceived to happen, Jim made a call to his supervisor and explained the situation. Given the importance of the data on Jim's computers and the two attempts now to steal it, Jim's supervisor told him to catch the next flight to the New York office.
- o "You have a very important job to do, Jim," his supervisor explained on the phone. "You should finish the Johnson project at our New York office, you and your laptop will be safer there. I don't have time to discuss it, just go," he said with authority.
- o Jim quickly packed a duffel bag, retrieved his laptop from the safe, and drove to the airport.
- Page 7
  - o Jim recognized that traveling would introduce new dangers for his laptop. So after the break-in at his home, Jim decided that he would carry his laptop in his backpack. A backpack wouldn't advertise what was inside of it like his computer case with a large ABC Consulting logo would. Jim kept his backpack with him in the check-in and security lines at the airport, holding onto it until the person in front of him had gone through the metal detector. He kept an eye out on the other side of the screening machine, eagerly awaiting his backpack and laptop.
  - o Jim boarded the plane to New York City. The plane was packed full of business people. Since Jim bought his ticket at the last minute, he was lucky to have gotten a seat at all. He finally reached it, finding that there was no remaining space in the storage bin above his row. He walked back up the aisle until he finally found space for his backpack near the front of the plane. It was a rather large bag that could not have fit under his seat. To keep his laptop safe, Jim decided to remove it from the backpack and took it back to his seat.

- o "After all of this, I'm not letting you out of my sight," Jim thought as he glanced down at the invaluable computer in his hands. Jim stored the laptop between his feet under the seat in from of him as the plane began to taxi.
  - o Unbeknownst to Jim, the thieving intern had followed Jim to the airport. He would stop at nothing to obtain the laptop from Jim. He too bought a ticket to New York and boarded the same plane, staying behind him at a distance. Watching. Waiting. Once the plane had landed in JFK airport, he struck.
  - o Jim had to wait for most of the other passengers to exit before he could retrieve his backpack from the overhead storage bin. As he finally arrived at the bin, he could not find his backpack.
  - o "Excuse me," he said to the nearest flight attendant. "I think my bag has been stolen!"
- Page 8
  - o Jim was stuck at the airport overnight, filing a police report and making yet another call to his supervisor. Afterward, Jim caught a cab and finally arrived at the New York office of ABC Consulting. The branch director greeted Jim warmly and showed him to the office space they had established for him during his stay.
  - o After so many theft attempts, Jim did not let his laptop leave his sight. He worked vigorously throughout the morning on the Johnson project, trying to finish his report. "I'm ready to be done with this project," he thought to himself as finished another section of the report.
  - o "Jim," said the branch director. "You've been working hard all morning. Let me take you out to lunch, it looks like you've had a rough couple of days."
  - o It was true. Jim was exhausted. He had not been able to sleep much the previous night. His mind had not stopped thinking about the attempted robberies on his laptop computer. Lunch sounded like a much needed relief.
  - o "Sure, but I think I'll bring my laptop with me if that's all right with you," Jim said. "I don't want to take any chances, especially after all that has happened so far."
  - o As Jim and the branch director drove away in the branch director's car, the thief emerged from his hiding spot in the parking lot. He entered the building with no difficulty – he had a company ID card after all. As he rifled through Jim's workspace, one of the New York branch employees saw the suspicious activity and spoke up.
  - o "Hey! What are you doing over there? I've never seen you before," said the employee.
  - o The intern ran away. "Hey! Come back here!" yelled the employee as he chased the thwarted thief down the stairwell to the parking lot. The chase did not last long before the thief managed to slip out of sight.
  - o Later that afternoon, Jim found out what had happened and called his supervisor in Philadelphia.

- o "It seems New York isn't safe either," his supervisor said over the phone. "If not, there's no reason to pay for you to be in New York. Come back to Philly. But don't take a plane. It'll be safer to rent a car this time."
- Page 9
  - o That afternoon, after sitting in traffic for several hours, Jim was feeling anxious. By the time he had rented a car, he was stuck in rush hour traffic leaving the city. He was ready to get out. He took the next exit he came to and decided to grab some food. It was past his usual time for dinner.
  - o He pulled into his favorite chain restaurant. He moved his laptop from the front seat to the trunk of the car. He had been keeping it close to him the entire drive. The sight of it added to his anxiety. For a few minutes, he would be rid of it, enjoying his favorite meal at his favorite restaurant. He locked the trunk and proceeded inside the restaurant.
  - o The thief was close behind. He had followed Jim's car all the way to the restaurant. He got out of his car and looked through the windows of Jim's rental car. He did not see the laptop. "He must have it with him inside," said the thief aloud. "I won't be able to get it there." He got back into his car and waited for Jim to return.
  - o As Jim walked out of the restaurant, the thief saw that Jim did not have the laptop with him. "Ah! It must have been in the car!" he said to himself. "The next time he stops, that computer is mine."
- Page 10
  - o After several more hours on the road, Jim began to think that this trip was taking longer than it should have. He thought that the route from New York to Philadelphia was straightforward enough that he would not have needed his GPS. However, some construction work had re-routed traffic to side roads off of the highway.
  - o Jim pulled over to the side of the road to check the GPS on his mobile phone.
  - o "What?!" Jim yelled, exasperated. "I took a wrong turn? Could this day be any worse?" Jim had somehow ended up heading north, away from Philadelphia. He was still several hours away from home and the events from the past few days were taking his toll on him. "I can't do this anymore tonight. I need to sleep."
  - o Jim found a hotel nearby and resolved to wake up early the next day to finish the drive back to Philadelphia. He was so tired that he decided to just grab the laptop and head up to his hotel room. He didn't bother to grab his backpack out of the back seat of the car. He arrived at his room, locked the laptop in the room safe, and fell to sleep immediately still dressed in his business attire.
  - o Around midnight, the thief pulled into the hotel parking lot. He snuck over to Jim's rental car and peered through the window. He saw the backpack lying in the backseat of the car. "Perfect," he said.
  - o The thief was well prepared this time. He withdrew several tools from his bag, effortlessly popping the door lock. To his dismay, the laptop was not

in the bag. This time, he searched the trunk, but it wasn't there either. After scouring the entire car, the thief decided to take drastic measures.

- Page 11
    - The next morning, Jim was feeling refreshed. Even though he was only a few hours away from home, he still had a bit of work remaining to do on the Johnson project before he could be free of this laptop. Again, Jim contemplated all that had happened to him since receiving his new laptop computer for the Johnson project.
    - "I've been really lucky that I haven't lost my laptop with all of these burglary attempts," he thought. "I should take extra precautions in case of the worst possible scenario – that my laptop actually is stolen."
    - So before leaving the hotel, Jim made a backup of all of his files to the company's online secure drive. By saving his files to a secure location, he would be able to rebuild his work environment if need be. Next, Jim jotted down the laptop's make, model, serial number, and asset number for ABC Consulting, along with the emergency contact information for IT Security at the company that he found on the company website. He folded the sheet of paper and placed it in his pocket.
    - Jim wouldn't normally save ABC Consulting confidential, proprietary, or client identifiable information on his laptop, but he needed those files on his own laptop for the Johnson project. All the same, he had a plan for what he would do if his laptop were stolen.
- Page 12
    - Jim checked out of the hotel and proceeded outside to his car. Halfway to his car, Jim was struck. The thief swung at the back of Jim's head with his fist, knocking him off balance. Stunned, Jim felt the laptop leaving his hands. He saw a hooded figure in a black sweatshirt wrap his arms around the laptop as he turned away and ran. Jim was shocked. He had been mugged! Before he could think to react, the thief jumped into a car and speeded away. Jim hadn't gotten a good look at the figure or the license plate for the car. The client information for the Johnson project was gone. Even though he had backed up the data just minutes before, the personal information of several thousand clients was now stolen.
    - Jim reported the incident to local authorities immediately. He did what he could to describe the thief and getaway car, and gave the police the identifying information he had jotted down that morning for his laptop computer in case it turned up somewhere.
    - Jim knew that his company needed to know about the robbery as soon as possible in order to prevent any further damage by the thief. Jim used a computer in the hotel lobby to submit a formal report to the IT Service Desk at ithelp@abcconsulting.com. He provided his name, phone number, the location, date, time, and a description of what had happened. He relayed his make, model, serial number, and asset numbers for his laptop. Finally, he identified the data type involved with the incident. A service desk ticket was generated with assignment to the IT Security team.

- o Jim called his supervisor to make sure that the report made it to their office.
- o "Jim," his supervisor said, "I don't blame you. Someone's been after that laptop for days now. You did all that you could do. It's up to the authorities now."
- o Only a few days later, the thief was caught. The ABC Consulting IT Security team had been working with the police, waiting for the thief to try to steal a Johnson project client's identity. When the thief used the stolen information, the police caught him. The laptop was retrieved from the thief's home by the local police. The authorities notified Jim that all had ended well. He could finally rest at ease.

APPENDIX E

MEASURES

Reactions to Training

Please rate the following items on a scale of 1 (*strongly disagree*) to 5 (*strongly agree*).

Technology Satisfaction

1. The technology interface was easy to use.

2. The technology allowed for easy review.

3. I am satisfied with the technology interface.

Enjoyment

4. I enjoyed this training.

5. Learning this material was fun.

Relevance

6. The training was relevant to laptop security practices.

7. The training provided useful examples and illustrations.

Attitude toward Game-based Learning

Please rate the following items on a scale of 1 (*strongly disagree*) to 5 (*strongly agree*).

1. If I had the choice, I would choose to complete work training in which games were used.

2. If I had to vote, I would vote in favor of using games in work training.

3. I am enthusiastic about using games in work training.

Experience with Games

Please rate the following items on a scale of 1 (*strongly disagree*) to 5 (*strongly agree*).

1. I like playing games.

2. I often play games.

3. Compared to people of my age, I play a lot of games.

4. I would describe myself as a gamer.

5. I play different types of games.

Demographic Information

1. How old are you?

   • [dropdown menu ranging "Under 18, 18-64, 65+"]

2. Which of the following best describes your gender?

   • Male

   • Female

   • Other

3. Which of the following best describes your race?

   • African American

   • Arab American

   • Asian American

   • Caucasian

   • Hispanic or Latino/a

   • Indian American

   • Mixed 2 or more races

   • Native American or Native Alaskan

   • Pacific Islander or Native Hawaiian

4. Which of the following best describes your level of education?

   • Some high school

- High school diploma/GED

- Some college

- Two-year associate's degree

- Four-year bachelor's degree

- Master's degree

- Doctoral degree

5. Are you currently employed?

- Yes, full-time

- Yes, part-time

- No

6. If yes, in what type of business are you employed?

- Business Services

- Education

- Finance

- Health Care

- Insurance

- Manufacturing

- Retail

- Wholesale

- Other [enter business type manually]

7. If yes, how long have you held this job?

- Less than 1 month

- Less than 6 months

- Less than 1 year

- Less than 5 years

- More than 5 years

VITA

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Education

Bachelor of Arts, Psychology, Western Kentucky University, May 2013
> Thesis: "Regressions on Personalities and Political Preference of Collegiate Greek Letter Social Organizations"
> Undergraduate Leadership Certificate Program

Selected Publications

Landers, R. N., & **Armstrong, M. B.** (*in press*). Enhancing instructional outcomes with gamification. An empirical test of the Technology-Enhanced Training Effectiveness Model. *Computers in Human Behavior,* 1-9.

Armstrong, M. B., Landers, R. N., & Collmus, A. B. (2015). Gamifying recruitment, selection, training, and performance management: Game-thinking in human resource management. In D. Davis & H. Gangadharbatla (Eds.), *Emerging Research and Trends in Gamification* (pp. 140-165). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-8651-9

Landers, R. N., Bauer, K. N., Callan, R. C., & **Armstrong, M. B.** (2015). Psychological theory and the gamification of learning. In T. Reiners & L. Wood (Eds.), *Gamification in Education and Business* (pp. 165-186). Cham, Switzerland: Springer.

Selected Presentations

Armstrong, M. B. & Landers, R. N. (2015, April). *Game-thinking in assessment: Applications of gamification and serious games.* Symposium presented at the 30th Annual Conference of the Society for Industrial and Organizational Psychology, Philadelphia, PA.

Armstrong, M. B. & Landers, R. N. (2015, April). *Enhancing training outcomes with gamification.* Poster presented at the 30th Annual Conference of the Society for Industrial and Organizational Psychology, Philadelphia, PA.

Armstrong, M. B., Landers, R. N., & Collmus, A. B. (2015, April). *Game-thinking in human resource management.* Poster presented at the 30th Annual Conference of the Society for Industrial and Organizational Psychology, Philadelphia, PA.

Callan, R. C., Bauer, K. N., **Armstrong, M. B.**, & Landers, R. N. (2014, May). *Gamification in psychology: A review of theory and potential pitfalls.* Poster presented at the 29th Annual Conference of the Society for Industrial and Organizational Psychology, Honolulu, HI. doi:10.13140/2.1.3536.1928