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TITLE: THE EFFECT OF LEARNING TYPE AND AVATAR SIMILARITY ON LEARNING OUTCOMES IN EDUCATIONAL VIDEO GAMES

By

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ABSTRACT

THE EFFECT OF LEARNING TYPE AND AVATAR SIMILARITY ON LEARNING OUTCOMES IN EDUCATIONAL VIDEO GAMES

By

Melissa L. Lewis

Two theories guide two very different ideas about learning. Social cognitive theory (Bandura, 1977, 1989) places the greater emphasis on observational learning, or learning by watching a model produce a behavior before doing it oneself. Other researchers purport that experiential learning, or learning by doing, results in stronger learning (Kolb, 1984). Neither of these theoretical areas have been adequately explored with regard to video games, and they have never been compared before. As well, the entertainment-education paradigm (EEP), a third theoretical approach (Singhal & Rogers, 2002), uses many of the same constructs as SCT, and supports the idea that gaining attention and motivating learning by using intrinsically-motivating games will then increase learning. This research first explores which of these paradigms—SCT and the EEP, or experiential learning—is more effective in producing outcomes such as knowledge retained, involvement, intention to perform behaviors in the future, enjoyment, and self-efficacy.

Additionally, SCT posits that identification with the model one is observing increases positive learning results, and video games allow for the creation of an avatar with which one can adjust identification. People often create avatars to represent their ideal selves or their actual selves, but it is not yet known which of

these produces the more effective learning results. Because the player becomes the model when he or she creates an avatar based on self, there possibly exists a third condition—the self-as-model, or automodel—that is distinctly different from a third party observational learning perspective or an enactive perspective. Given the history of research on video games and avatar use showing that people tend to idealize themselves in avatar form, expectations are that the ideal self avatar would yield the greatest learning outcomes, followed by real self (both conditions that offer extreme identification with the model), and lastly the third-party avatar. This is the second major exploration this research undertakes.

Results indicate that enactive learning results in higher self-efficacy. Behavioral intentions and knowledge retained did not reach significance, but means were higher in the enactive condition. Ideal, real, or other observational conditions also did not reach significance in an analysis of variance, but again, means were highest for the ideal self avatar, and correlations showed relationships in the hypothesized direction for enjoyment of the game, enjoyment of learning, and enjoyment of the avatar.

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Chapter 1: Statement of the Problem

Bandura (1986) discussed in his seminal work on Social Cognitive Theory that there are two major types of learning: observational learning, and enactive learning. Enactive learning involves learning by doing it oneself, with a great deal of trial and error. Observational learning has learners watching the performance of a behavior and then modeling their own performances on that which they have watched. Which type of learning is the more effective, however, has not yet been adequately explored. According to Bandura (1986), observation is the key to learning (Lerner & Steinberg, 2004). However, other researchers who support experiential learning theories believe that enactive learning provides the more effective means of learning (Kolb, 1984). Until now, there has not been an adequate way to compose an experiment that could examine this issue while ensuring precise similarities between conditions, but with the advent of video games, we can create those similar conditions with different agencies: self (enactive) and other (observational). Thus, it is possible to begin to answer the question of which type of learning is the more effective type.

As well, Social Cognitive Theory states that learning will occur when there is a close identification between the model and the individual. But what happens when we *are* the model? In video games, "self" is almost always controlling the action to some degree, and when the self becomes the model, learning type moves from observational learning to enactive learning. Would the observation of a character (as opposed to an entirely enactive, first-person perspective) be more effective? And with what would we feel the most similarity: our actual self, or our ideal self? This new case—being able to see an external version of ourselves, as opposed to, for instance, a virtual reality simulation where we are immersed so deeply into the environment that we literally do not see our physical bodies anymore—should be explored and documented to determine what the use of avatars might mean for learning.

Moreover, if observational learning is, as Bandura posits, the better method for learning, then what type of agent works best as the model? A representation of oneself, or a representation of some external other? And should these representations be real, or idealized? Social cognitive theory is one of the most ubiquitous theories when it comes to education and learning, but researchers have most often focused on one or the other type of learning, and have not explored SCT with regard to avatars.

In order to begin to answer these questions, this research designs a study using an electronic video game that manipulates both agency and similarity. The enactive condition is where players are instructed that they are playing as themselves. The observational condition is where players are instructed that they are teaching some "other" being, the game character representing perhaps a friend of the player's. Then, conditions are assigned as real self, ideal self, and a third party.

Chapter 2: Review of Literature

Social Cognitive Theory

How do we learn? Every human being has at least some capacity for learning, but how that learning occurs can be explained in different ways. Social cognitive theory, developed by Albert Bandura, explains learning and behavior as a combination of behavioral, personal, and environmental interactions (Bandura, 1986). Personal factors include cognitive, affective, and biological events. Behavioral factors refer to behavioral patterns, and environmental events are what they sound like: things that occur outside of the individual but affect that individual's life.

Learning with social cognitive theory can be either observational or enactive (Bandura, 1986). Observational learning occurs when individuals watch someone else and then model the behavior that they have just observed. Enactive learning occurs when the individual performs the behavior herself, often through trial and error, without viewing the behavior first. Both types of learning are discussed in greater detail below.

Observational Learning

Observational learning, according to Bandura (1986), is the key to learning (Lerner & Steinberg, 2004). How well an individual learns depends on how carefully that person observes what the other person (the model) is doing (Ferrari, 1996). Observational learning is the first type of learning that we experience. As infants, we learn to mimic what we see our parents (or primary caregivers) doing, learning language, movement, and emotion simply by observing someone else (Bennett, Farrington, & Huesmann, 2005). Visual demonstration is one of the most powerful ways to communicate behavioral and cognitive patterns (Wesch, Law, & Hall, 2007).

Observational learning can be more efficient than enactive learning. By having a model whose behavior one can observe, one is left with a mental image of how something is to be done (Weeks & Anderson, 2000). Learners do not have to work through a trial-and-error process of learning but rather can access the cognitive representation formed by modeling and base their behavior on this preconceived mental model (Adams, 1986; Ferrari, 1996; Lee & White, 1990; Pollock & Lee, 1992). As well, learners have an idea of what the outcome of their behavior will be if they have observed a model (Bandura, 1986; Ferrari, 1996).

Research has determined that modeling is effective, especially with regard to children. Children learn values through modeling and social reproduction (Bennett, Farrington, & Huesmann, 2005). Children who associate with delinquent peers may develop anti-social, inappropriate cognitive scripts that are based on observations of these peers. Associating with delinquent peers is linked to an increase in criminal or violent potential (Farrington, 1998, 2001b), and parents who are criminals are more likely than those who are not to have delinquent and/or violent children (Farrington, 2001a).

Numerous subjects have been studied with regard to observational learning, particularly school subjects. Observational learning is effective for learning mathematics (Schunk & Hanson, 1985, 1989a, 1989b; Schunk, Hanson,

& Cox, 1987), writing (Graham & Harris, 1994; Graham, Harris, & Troia, 1998; Schriver, 1992), speaking and listening (Sonnenschein & Whitehurst, 1983, 1984), and reading and writing (Couzijn, 1999). Modeling works for physical activity, too, from swimming skills (Weiss, McCullagh, Smith, & Berlant, 1998) to strategy, form, and game plans (Cumming, Clark, Ste-Marie, McCullagh, & Hall, 2005; Wesch, Law, & Hall, 2007). Modeling prior to practice can also increase initial performance (Landers, 1975; Thomas, Pierce, & Ridsdale, 1977; Weeks & Anderson, 2000).

There are several mechanisms guiding observational learning that are important for this discussion: attention, retention, motor reproduction, and motivation (Bandura, 1986; Wesch, Law, & Hall, 2007). Attention processes determine to which things the individual pays attention. Retention processes explain what an individual remembers (or does not remember). To remember the information, it must be encoded into long-term memory. The individual must then be able to reproduce the behavior—motor reproduction. A person has to have the capability to coordinate thought and action to enact the behavior. Finally, the individual must be motivated to learn the behavior, which affects the other three processes. A person must be motivated first to pay attention, then to remember, and finally to practice the behavior. Motivation can be internal or external. A person might want to learn and practice a behavior because she is motivated to better herself, or because she has been promised a thousand dollars. Wherever motivation comes from, however, it must be strong enough to get the person to reproduce the behavior (Bandura, 1986).

Similarity between the model and the individual affects the modeling (Schunk, 1987). Modeling is a type of social comparison (Berger, 1977). When external standards are not readily accessible, people will compare themselves to others to evaluate themselves (Festinger, 1954). For instance, weak learners learn better when they have weak models on which to focus. Better learners learn more by focusing on stronger models (Braaksma, Rijlaarsdam, & vandenBergh, 2002). However, similarity does not *automatically* enhance learning from modeling (Schunk, 1987). Some variables do not make much of a difference. Past researchers assumed that gender would make a difference, but subjects did not learn more from members of their own gender (Leifer, Collins, Gross, Taylor, Andrews, & Blackmer, 1971). Gender *does* matter, however, with regard to gender roles. Children may categorize the behavior learned from a certain gender as being appropriate for that sex but not for the other (Schunk, 1987; Zimmerman & Koussa, 1975). Therefore, gender is important when it comes to task appropriateness. Age is important, in that models that are similar to children had beneficial effects compared to those who were dissimilar in age (Schunk, 1987).

Why do people learn from models? There are a number of variables that can affect the direction of attention. When people pay attention to models, they learn (Leifer et al., 1971). The closer the perceived similarity between the individual and the model, the greater the influence that the model has on the subject's behavior (Bandura, 1986). Subjects that are high in similarity to the model with regard to background produce more modeled behavior (Rosekrans, 1967; Schunk, 1987). Observational learning can affect motivation to change, or to perform a behavior (Wesch, Law, & Hall, 2007). It can also increase motivation, or involvement, with the activity (Clark & Ste-Marie, 2007). Additionally, observation can increase self-efficacy in observers (Bandura, 1986, 1977; Schunk & Hanson, 1985, 1989a). Watching others succeed can increase one's own belief that he can succeed, which can in turn influence learning. Self-efficacy will be discussed in more depth here later.

Enactive Learning

Whereas observational learning involves watching a model and then using that information to engage in a behavior, enactive learning refers to the process of attempting a behavior oneself using one's own abilities and skills. "Enactive mastery experiences refer to actual information a person has about their [*sic*] ability to execute a particular behavior gathered from their prior experience with that task" (Wesch, Law, & Hall, 2007, p. 221). Many of the experiences that individuals gain from observational learning are refined through enactive learning (Bandura, 1986; Carroll & Bandura, 1985). We hear this often as "practice makes perfect". First the behavior is observed; then it is enacted.

Individuals still experience outcome effects, but they are direct effects. Intrinsic response information is gained within the individual. If an individual punches another person, the individual will feel pain in his hand. Extrinsic response information is a socially arranged effect. These responses are socially mediated and occur usually after the behavior has been performed (Bandura, 1986). If an individual punches someone, he will be arrested. Individuals learn with enactive learning, then, by a trial-and-error process where they perform behaviors, examine the resultant consequences, and then adjust or continue the behavior based on this feedback.

Whereas Bandura and supporters are proponents of observational learning, another school of thought has developed regarding enactive experiences, referred to as experiential learning. In fact, David Kolb developed a theory of learning called the experiential learning cycle, composed of four stages (Kolb, 1984). First is the concrete experience stage, where individuals actively *do* something, then the reflective observation stage (the individual thinks about and reflects on what just happened), the abstract conceptualization stage, and finally, active experimentation.

Learning by doing is not a new idea, but the explanation behind it is unique. Behaviorists like Skinner (1953) explain that behavior is reinforced by consequences, known as shaping. However, social cognitive theory explains the consequences as sources of information and motivation. People learn behaviors that they believe will reward them (Zimmerman & Schunk, 2001). Experiential learning theory holds, however, that learning is most effective when it is based on personal experience (Spencer, 2003). This type of learning is often used effectively in classes such as marketing classes (Bobbitt, Inks, Kemp, & Mayo, 2000; Gremler, Hoffman, Keaveney, & Wright, 2000; Hoffman & Bateson, 1997; Lovelock & Wright, 1999; Wright, Bitner, & Zeithaml, 1994) and medical instruction (Maudsley & Strivens, 2000; Stanton & Grant, 1999).

However, a structured, guided approach was found to be more effective than a trial-and-error approach, at least in terms of learning to search for information electronically (Debowski, 2002). Indeed, enactive learning may allow people to form adequate skills, but not optimal skills (Bandura, 1986). So which is the more effective method of learning? Taking the SCT stance, we would expect observational learning to be the strongest method of instruction.

H1: Observational learning will lead to (a) more knowledge retained, (b) more enjoyment, and (c) more involvement with the topic than enactive learning.

The Role of Self-Efficacy in Learning

Self-efficacy is defined specifically by Bandura as the belief in one's capability to engage in a particular course of action to achieve important attainments (Bandura, 1997). Bandura (1977) describes four sources of efficacy expectations: verbal persuasion, emotional arousal, vicarious experience, and performance accomplishments.

Verbal persuasion is the first source of efficacy expectation defined by Bandura. Persuasion is one of the more commonly used means of getting people to do and think what is desired by the persuader. Persuasion is easy to do and readily available; a few well-chosen words over a matter of even a few seconds is all that is needed, as opposed to the previous sources involving either personal experience (time and effort are needed to actually work through the task) or vicarious experience (more time and effort are needed to watch someone *else* work through the task). However, persuasion is also a less effective efficacy source than the others listed so far because there is no authentic experience, either by oneself or by a third party.

Emotional arousal can also be a source of efficacy expectation. It is much the same as the "fight or flight" response, however, and can have negative repercussions as well (discussed later in this dissertation with regard to fear appeals). Thus, emotional arousal can instigate a "fight" response, where the individual processes the stressful situation and then responds accordingly, or it can cause a "flight" response instead, leading to avoidance and even more stress as the individual is not only upset at the initial arousal but increasingly upset at thoughts of his or her personal ineptitude (Bandura, 1977).

The two more effective sources of self-efficacy are vicarious experience and progressive mastery. Vicarious experience explains how we learn by watching others. If an individual observes someone else being successful at an endeavor, and observes that individual getting through the experience with no adverse effects, then that individual may feel as if s/he will also experience success with continued effort and improvement. Modeling behavior of others, however, tends to lead to weaker efficacy expectations that are more vulnerable to change and reduction than would the last kind of self-efficacy source: performance accomplishment.

Performance accomplishment, or progressive mastery of a task, is the best source of efficacy information, as it is individually tailored and tends to reduce future negative effects. Repeated successes emphasize an individual's mastery of tasks or experiences. If failure is experienced later, the negative effects are likely to be reduced because they are offset by the already-present self-efficacy felt due to the previous successes. Additionally, the positive feelings and increased self-efficacy associated with one particular task can transfer to increased self-efficacy with other experiences. With modeling behavior, individuals may see others succeed, but individual differences and the capacity for social comparison may impede the sense of self-efficacy. In other words, just because someone else was able to succeed at a task doesn't mean I will be; I'm not nearly as skilled at things as the other person might be.

Playing video games can be a type of enactive learning, and given what we know of the effectiveness of performance accomplishment as a means of gaining self-efficacy, we would expect that individuals who play a video game will have higher self-efficacy regarding the material than those who do not play a game. Indeed, health behavior is one prime example of successful entertainment education that can result in an increase in self-efficacy. Lieberman (2001) described the effectiveness of using video games to educate children on health behavior. Click Health, Inc., developed a number of games for children that provide players the ability to take on the role of the main character (with the same health condition as the child), and the ability to customize the game character's self-care regimens so that they might mirror (model) those of the child. Findings included an equal amount of knowledge gained from the video game condition and the non-interactive condition (a thirty-minute long video tape that participants viewed), but a higher level of enjoyment for those in the video game condition, and an *increase* in self-efficacy among those in the game condition. Those in the video tape condition experienced a *decrease* in self-efficacy. The opportunity to rehearse behavior is a strong predictor of self-efficacy (Thomas, Cahill, & Santilli, 1997) resulting as well in learning gains (Bandura, 1990). Video games offer these hands-on chances for behavior rehearsal.

Additionally, self-efficacy can predict future behavior better than past performance (Bandura, 1986). There are many examples of self-efficacy interventions that resulted in a change in future behavior, from improving patient follow-through regarding adherence to medication (Ludman, VonKorff, Katon, Lin, Walker, Bush & Wahab, 2000), to reducing caregiver burnout (Mackenzie & Peragine, 2003) and increasing regular physical activity among cancer survivors (Bennet, Lyons, Winters-Stone, Nail, & Scherer, 2007). Research suggests that increasing self-efficacy (essentially giving people the confidence to carry out the desired behaviors) increases the likelihood that people will actually enact these behaviors (Basen-Engquist, 1994; Fruin, Pratt, & Owen, 1992; Rippetoe & Rogers, 1987; Rimal & Real, 2003; Turner, Rimal, Morrison, & Kim, 2006).

To summarize, if enactive mastery is the better source of self-efficacy in previous research, we would expect this to be true for video games.

H2: Enactive learning will lead to higher levels of self-efficacy than observational learning.

Consequently, if self-efficacy increases the likelihood of engaging in a behavior, it would also be logical to assume that an increase in self-efficacy due to learning type would extend to intention to engage in behavior.

H3: Enactive learning will result in greater intentions to perform safe online behavior than observational learning.

SCT and the EEP

Using video games to teach is not a new idea, but using games to educate is not something that is readily accepted by all educators. In fact, one of the major barriers to using interactive games to teach is a lack of understanding of what makes educational games different from arcade-style games (Rice, 2007). Some researchers have recently called for integrating electronic games into learning after determining, through empirical study and reviews of prior research, that electronic games *are* effective for learning (Dipietro, Ferdig, Boyer, & Black, 2007; Gros, 2007; Mayo, 2007).

Different from traditional media such as books and television, video games are interactive. While players are in control of what happens in the game, video games adapt the challenges presented based on player performance and provide immediate reward and feedback. Further, video games are customizable and can "remember" a player's progress; they therefore personalize game play to each individual player. Enjoyment of video games is a result of (a) sensory delight; (b) feeling a sense of achievement, control, and self-efficacy; and (c) suspense, thrill, and relief (Vorderer, Klimmt, & Ritterfeld, 2004).

One of the major reasons why researchers posit that electronic games work can be explained using the entertainment education paradigm (EEP), which links the enjoyment of being entertained with the learning and processing of education, and is defined as "the intentional placement of educational content in entertainment messages" (Singhal & Rogers, 2002). There are three pathways for learning involved in the EEP: motivation, reinforcement, and blending.

The motivation pathway uses entertainment as a "door opener" for learning. Individuals might be playing a game for entertainment, but at the same time, this necessarily allocates attention to the educational content, which then leads to an interest in the content and finally processing *of* the content (Ritterfeld, Weber, Fernandes, & Vorderer, 2004; Vorderer & Ritterfeld, 2003). This parallels the attention stage of observational learning in social cognitive theory. The second pathway uses entertainment for the reinforcement of learning which enhances the motivation to process educational content. This is similar to the motivation stage in SCT. Game players also need to be able to remember the game behavior that is rewarded (memory in SCT) and reproduce the behavior that is reinforced in order to get rewarded (reproduction in SCT). Reinforcement is almost always integrated into interactive video games, through scores, feedback of progress in the game, adaption to skill levels, or rewards in the form of obtaining money, new objects, and other desirable goods. The EEP does not formally associate itself with social cognitive theory, although given the parallels between the two paradigms, researchers ought to begin integrating both of these when studying educational video games.

The sense of self-efficacy and the enjoyment of playing reinforce learning and enhance the potential for a person to seek out more of these entertaining and educational experiences, thus leading to more learning opportunities (Ritterfeld, Weber, Fernandes, & Vorderer, 2004). However, the greatest potential for entertainment education occurs when education becomes an essential part of the entertainment experience (Slater, 2002). Game design according to the EEP is not simply taking an educational game and adding entertaining elements; it is a game in which the entertaining experience is inseparable from the game's educational goal.

Research has demonstrated that turning learning into a game can encourage less interested individuals to take an active part in learning, as well as give the already motivated a new and exciting way to study the material (Kafai, 1994; Lieberman, 2006; Ritterfeld & Weber, 2006), and that the skills learned in computer games may transfer to other areas, lending themselves to increases in overall technological literacy (Gee, 2003; Lieberman, 2006; Prensky, 2005). Proponents of learning with computer games indicate that indeed, learning *does* occur and that use of games can even increase motivation, an integral part of observational learning (cf. Amory, Naicker, Vincent, & Adams, 1999; Bosworth, 1994; Egenfeldt-Nielsen, 2007; Egloff, 2004; Lieberman, 2001; Singhal, Cody, Rogers, & Sabido, 2004; Subrahmanyam & Greenfield, 1994; Thomas, Cahill, & Santilli, 1997; Walshe, Lewis, Kim, O'Sullivan, & Wiederhold, 2003; Yoon & Godwin, 2007). While some of these studies have methodological shortcomings, there are studies with fairly sound methodologies. Lieberman (2001) randomized in-patient participants in an experiment regarding self-care for children suffering from asthma. One group played a video game for thirty minutes while another group watched a thirty-minute video. The video game was an observational experience. The main character was not the child but rather a dinosaur who suffered from the same health issue as the child. The level of knowledge gained for both groups was the same, but enjoyment was greater in the video game condition, and while self-efficacy increased for the game players, it *decreased* for the video watchers.

The *i*-Safety project, in progress since 2005, has been funded by the National Science Foundation as well as Microsoft (Wirth, Rifon, LaRose, & Lewis, 2007). The purpose of the project, in part, was to develop a curriculum that will teach individuals of any age how to be safe online. The curriculum has been tested numerous times, using various subject populations, from teenagers through adults, and has been verified through experiments and data analysis to contain valuable, valid information that does indeed teach people how to protect themselves against online threats such as phishing attacks, spyware, identity theft, and more.

The *i*-Safety project was the impetus for creating the video game used in this project. Research is indicating a steady trend in adolescents of the lack of knowledge about online safety. A comparative study of adolescent females in the United States and New Zealand found that a significant percentage of girls were engaging in risky behavior online, including sharing personal information; results indicated a lack of education about safety online (Berson & Berson, 2005). The UK Children Go Online project determined that only two in five adolescents (40%) said they could fix a problem with their computer, and less than one in five (18%) can set up a filter on their computer or remove a virus (Livingstone, Bober, & Helsper, 2005). Four-fifths of those ages 10-17 are concerned about their privacy online, but most are also willing to yield sensitive information if sufficiently incented (Turow & Nir, 2000). In a sample of high school students over 60% failed to regularly look for privacy policies, 58% did not clear their browser history, 37.7% failed to check if online forms are secure and 50% did not set their browsers to reject cookies (Quilliam, Rifon, LaRose, & Carlson, 2006). Therefore, this research created the stimulus game *SafetyNet*, not only for the purposes of this research, but with the goal of educating children as well in an attempt to combat these statistics.

The Case of Avatars: Extending SCT

Al-Natour, Benbasat, and Cenfetelli (2006) (as well as from Reeves and Nass' media equation (1996)) have shown that technological entities can be perceived as being similar to ourselves, but the extent to which these similarities affect individuals' behavior is unknown and is recommended by these researchers as a future direction for study. Avatars in electronic environments give users the opportunity to have experiences they are not able to have in real life and to "try on" new identities (Allison, von Wahlde, Shockley, & Gabbard, 2006) . But how are learning variables affected when we can actually change ourselves?

SCT explains that people imitate characters they find attractive. This is part of the explanation for those that believe that violent video games cause increased aggression (Sherry, 2001). But what happens when the model is an electronic representation of one's self in a game? SCT has much to say about modeling, but the case of an avatar is a new horizon in SCT research: Avatars give individuals the opportunity to see themselves externally. While the experience is still enactive learning, because the individual is controlling the character, the individual also has the ability to view an external being and transfer the modeled game behavior into his life external to the game.

While literally any video game has the potential to deliver an educational message, this research is focused on avatar-based games. These games require players to take on the persona of a game character, and to create, customize, personalize, and play as the game character. Usually, an educational message is integrated in the game's narrative and learned by vicariously experiencing game outcomes as a result of a virtual character's actions.

As an example, the role-playing and simulation game "The Sims" (http://thesims.ea.com/) allows players to create virtual characters and manipulate those characters, like a virtual dollhouse. The goal of the game play is "survival" in a quotidian environment and rules similar to real life apply. Players (mainly children for this specific game) are responsible for telling their "Sim" (the virtual character) when to eat, when to sleep, when to go to work, how to have fun, and how to interact with other Sims. If rules are violated (e.g. a Sim does not go to work or does not eat), the virtual character has to suffer the negative consequences (i.e. runs out of money, becomes sick, etc.). If rules are not violated, the virtual characters prosper and become rewarded (i.e. make new friends, receive more money and resources, etc.). By observing rewards and punishments as a result of the virtual character's actions, children vicariously learn basic life skills by playing "The Sims". The learning experience is an essential part of the game design.

"Making History," a game developed by Muzzy Lane (http://www.making-history.com/), is a historical role-playing game that asks users to assume the role of world leaders during World War II ("Making History", 2007). Players can choose from the United Kingdom, France, Germany, Italy, Japan, the USSR, the United States, or China (though a new patch for the game now allows them to play as the leader of any nation of the time), and integrated into the role-playing are characteristics of each nation, including economic and military strengths, diplomatic relations, ideology, and technical advancement. In addition to teaching players about history, it also offers them the chance to "redo" history with six separate scenarios to play through. Players get to take on historic roles, experience new perspectives, and ultimately understand the critical thought processes behind decision-making as opposed to just learning the facts of World War II.

Most often, research on video games and avatars have studied the use of the avatar not as the individual learner but as an electronic instructor of sorts. However, Lee, Nass, Brave, Morishima, Nakajima, and Yamada (2007) studied the effect of a co-learner in an electronic environment. Many children's television programming such as Sesame Street and Blue's Clues present on-screen characters not only as instructors but as co-learners, learning the information along with the children while at the same time passing on the information. Kim, Wei, Xu, Ko, and Ilieva found that girls who learned with a pedagogical agent increased in self-efficacy and developed a more positive attitude about the subject matter (2007), and that pedagogical agents can effectively motivate children to learn (Kim & Baylor, 2007; Kim, Baylor, & Shen, 2007). Clearly, the co-learner is an external person. In the case of video game avatars, however, things change because the co-learner/instructor is the external representation of the player and is controlled by the player.

Of course, learning of a game's message is more likely if players care about their character; rewards and punishments that a virtual character has to experience are meaningful for a player as the player is ultimately rewarded or punished via the game outcome (winning or losing). Because a game with an avatar offers this secondary model, it is possible that individuals will retain more information playing an educational game with an avatar as opposed to playing a game without an avatar. As well, avatars have been studied with regard to persuasive communication in the advertising realm (Wood, Solomon, & Englis, 2005). Consumers preferred the idealized images of avatars to realistic ones. Additionally, if an individual disliked the avatar, that dislike extended to the product. We can relate this to the video game arena and hypothesize that if an individual dislikes the avatar, then that dislike extends to the game content. Conversely, if an individual likes the avatar, this like would extend to the game content and create an environment in the user's own mind more conducive to involvement and learning.

The avatar may not even have to physically resemble the individual. Just believing that the avatar is a representation of self may be enough to reach adequate levels for identification (Bailenson, Blascovich, and Guadagno, 2008). Research by Fox and Bailenson found that participants exercised more, regardless of whether feedback was positive (reward) or negative (punishment), when they used a virtual representation of self rather than a virtual representation of an other (2009). They also found that, when participants viewed a virtual self running on a treadmill, a virtual other running, or a virtual self loitering, those who viewed virtual selves running exercised significantly more 24 hours later than those who viewed themselves loitering, and those that viewed an other running. The use of self as a model in an electronic environment appears to motivate the individual more than the use of an other as a model. Reward and punishment had no differences in effect. All that mattered was that the avatar represented the self.

From here, the question then becomes in a virtual game setting, is it an idealized version or a realistic version of self that has the bigger effects? The more an individual perceives a model as being similar to himself, the more likely learning is to occur (Bandura, 1977, 2001).

The potential exists for self-efficacy and involvement (and subsequently learning) to increase when an individual sees his actual self being successful, or for these to decrease if an individual uses his ideal self, potentially viewed as an unattainable self and thus creating a gap that may lead the individual to think that although the ideal version of himself can be successful, the real version cannot. Prior research has determined that a match between a celebrity and a consumer's ideal self leads to a more positive response to persuasive messages

(Choi & Rifon, in press). However, even when people are not aware of it, seeing their actual selves to a degree in another's image increases positive response (Bailenson, Iyengar, Yee & Collins, 2009). But which is the better self, ideal or real? Even before examining this, the validity of the similarity assumption must be examined in this type of digital environment. Do individuals still respond most favorably to what they see as similar to themselves, or does playing as someone else still give the same results? How do people react to the external versions of themselves?

Wood, Solomon, and Englis (2005) studied the avatars given on an online shopping website that could be personalized to serve as models for the clothing. Participants in the research were instructed to measure their bodies and then create a representation of themselves using an online shopping website. However, participants did not feel that these models were important to their decision-making. Authors offer dissatisfaction with the projected image due to poor self-concept or dissatisfaction with one's own body as reasons for this result. Perhaps if, rather than instructed to make their real selves participants had been allowed to make idealized versions of themselves, results may have been different. In other words, being faced with their actual selves may have skewed the results negatively.

Part of the attraction of playing a game with a customizable avatar is that users can create idealized versions of themselves and act through that idealized version in the video game. Bessiere, Seay, and Kiesler (2007) found that people prefer to make idealized avatars, suggesting that despite their circumstances in their real lives, they can still experience success virtually.

If the use of an idealized avatar increases enjoyment (as opposed to the use of a real-self avatar), then it might also increase attention paid to the game which includes the information contained within the game (cf. Singhal & Rogers, 2002). Perceived similarity increases message effectiveness (Andsager, Bemker, Choi, & Torwel, 2006). But there has been no research to date on whether or not the perceived similarity must be between the actual self and some external other. Perhaps similarity between the ideal self and some external other is what makes the difference.

If enjoyment increases attention which can also potentially affect retention, then what is more enjoyable, playing as your ideal self, or playing as your real self? Do these conditions have an effect on self-efficacy, involvement, and retention as well? Does similarity to oneself still even hold in the digital world? Social cognitive theory posits that identification with a subject should lead to greater learning (Bandura, 2001; Weber, Ritterfeld, & Kostygina, 2006), but does not specify whether this refers to seeing similarity with your real self or your ideal self. Research suggests that the most effective models should be similar but slightly better, with intelligence, socioeconomic success, and competence (Bandura, 1969), similar social status (Miller & Dollard, 1941), and the power to reward (Bandura, Ross, & Ross, 1963). This seems to point to the creation of an idealized version of oneself: similar in status but with more power and intelligence.

Research on celebrity models indicates that relevance (how similar the individual sees the celebrity to himself or herself) of the external celebrity to the individual increases inspiration (Lockwood & Kunda, 1997), and people are most likely to compare themselves to another when that other resembles them in features, structure, and purpose (Holyoak & Thagard, 1995; Markman & Gentner, 1993). Inspiration may be thought of as motivation to succeed, and if we conceptualize it thusly, we can see again how drawing similarities between oneself and another can lead to greater motivation as well as greater enjoyment. If we prefer using idealized avatars that resemble our ideal selves, perhaps it is *this* similarity that matters.

It is possible that, for educational games regarding a topic about which the player is not very involved, if the player has a connection to the source (i.e. the game character), then the message (the educational portion of the game) may get through regardless of interest. Given the propensity of individuals to choose avatars reflecting idealized versions of themselves and SCT's propositions that similarity increases attention and modeling behavior, it is likely that the ideal self that will have the greatest impact on the outcome variables, followed by the real self, and finally, a third-party avatar that is *not* the individual will have the smallest impact, as identification with that avatar will be lower.

H4: The ideal-self avatar will be the most effective in terms of knowledge retained, involvement, enjoyment, and self-efficacy, followed by the real-self avatar and the third-party avatar.

Chapter 3: Methodology

Sample

For this research population, a total of 314 subjects was obtained through two waves of random sampling of students attending summer sessions I and II at a large Midwestern university. Email addresses were randomly selected by the Office of the Registrar and provided in an electronic spreadsheet. After the random samples were obtained, subjects were then contacted via email regarding participation. The first email notified subjects that they had been selected and provided them with a consent form as well as a link to a website that housed the game as well as the survey.

Of the total 314, 180 were female (57.3%), 124 were male (39.5%), and 10 did not indicate a response (3.2%). Ages ranged between 18 years and 48 years, with the greatest percentage being 21 years old (23.6%) and a median age of 22 years. Two hundred forty-three respondents indicated that they were white (77.4%), and 76 respondents indicated that they were of Hispanic descent (24.2%). One hundred forty-six respondents were in their senior year (46.5%), 76 were juniors (23.6%), and 59 were graduate students (18.8%). Eighty-two point two percent of respondents were PC users, and only 14.6% were Macintosh users.

Participants were also asked to indicate with which type of avatar they would most prefer to play a game. The majority of subjects responded that they would prefer to play with an avatar of their real selves (39.2%). Twenty-three point nine percent would prefer to play with a third-person character, and only

17.8% of respondents would prefer to play as a version of their ideal selves. The rest of the respondents selected "Other," chose more than one response, or did not answer.

Measures

Variables to be measured were behavioral intentions, self-efficacy, knowledge retained, involvement, enjoyment of the game, enjoyment of learning, enjoyment of the avatar, general demographic variables, and measures of the character and the players' real and ideal selves as well as the players' friends in the third-party condition in order to obtain the similarity measure.

Similarity (whether to ideal, actual, or other) was measured using a distance analysis. The method for measuring this congruence is based on Choi and Rifon's measure for estimating ideal congruence (in press) which was in turn based on other research using the absolute distance formula (Ericksen, 1996; Graeff, 1996; Sirgy, 1985).

The distance formula is as follows:

$$\sum_{i=1}^{n} | Aij - Iij |$$

Aij = avatar image (i) of individual (j)
Iij = ideal self-image (i) of individual (j)

For example, the similarity of ideal self to the avatar was measured by asking participants to rate how they viewed the avatar and how they viewed their ideal selves. The smaller the distance was, the greater the match. This also provides a manipulation check to ensure that representations are in fact participants' ideals. Using this formula, it is possible to determine congruence between ideal self and avatar, actual self and avatar, and friend and avatar. The fifteen semantic-differential items for rating avatar, ideal self, real self, and friend (on a seven-point scale) are as follows:

- Comfortable/Uncomfortable
- Pleasant/Unpleasant
- Sophisticated/Naïve
- Wise/Stupid
- Socially Responsible/Irresponsible
- Strong/Weak
- Confident/Apprehensive
- Enthusiastic/Not Enthusiastic
- Determined/Undetermined
- Rugged/Delicate
- Excitable/Calm
- Dominating/Submissive
- Masculine/Feminine
- Public/Private
- Bold/Shy

Knowledge retained was measured using ten objective questions based on the information contained in the game. Two incorrect answers and one correct answer were provided for options. Correct answers were later coded with a 1. Incorrect answers were coded with a 0. Questions were:

- What is phishing?
- Which URL is indicative of a phishing attempt?
- Which of the following is a type of phishing attack?
- What should you do if you get an email from a company requesting that you call them?
- What is a cookie?
- What does a third-party cookie do?
- What does ".exe" stand for?
- How should you close pop-up windows?
- Where do you go to set your system to update automatically?
- Turning on your pop-up blocker will do what?

Questions were pretested to determine difficulty.

Self-efficacy was measured using items created based on Bandura's 2006 guide for constructing self-efficacy scales. Subjects are asked to rate how much they agree with each of the following statements. The scale is a 7-point Likert-type scale, with 1 being "Strongly Disagree" and 7 being "Strongly Agree". Items are as follows:

- I am confident that I can recognize a phishing attack.
- I am confident I can protect myself from phishing attacks.
- I am confident I can close pop-up windows the correct way.
- I am confident I can reject cookies based on my own preferences.
- I am confident I can set my browser to block pop-ups.
- I am confident I can set my computer to update automatically.

- I am confident I can keep myself safe from spyware.

Enjoyment is measured by asking participants to rate how much they enjoyed playing the game. Again, the scale is a seven-point Likert-type scale, with 1 being "not at all" and 7 being "a great deal". Items instruct players to rate how much they enjoyed playing the game overall, how much they enjoyed learning the information, and how much they enjoyed being able to play with the avatar.

Involvement is operationalized and measured using a measurement based on a scale developed by Ohanian (1989). The 5-item semantic differential scale items (on a 7-point scale) are listed below. Participants rated "online safety" using these 5 items.

- Matters to me/Doesn't matter to me
- Of concern to me/Of no concern to me
- Relevant/Irrelevant
- Important/Not important
- Interesting/Not interesting

Time on task was a simple measure of how long it took players to complete the game, measured using information recorded by the online survey application used, which tracked both the time of day that participants started the game and the time of day that they finished. Intention to enact behaviors was based on questions previously created for a separate research project (LaRose & Rifon, 2007) asking participants to rate, on a 7-point scale from Very Unlikely to

Very Likely, how likely it is that they will enact the behaviors learned in the game. The items are listed below.

- Set my computer to automatically update.
- Change the settings for cookies on my computer.
- Change the settings for popups on my computer.
- Discuss phishing with friends or family.
- Discuss cookies with friends or family.
- Discuss computer settings with friends or family.
- Check URLs in email for phishing attempts before clicking on them.
- Look up phone numbers given in emails to check for phishing attempts.
- Search Google to verify identities of email senders.

Demographic variables were also recorded from the subjects (age, race, SES, and gender) to determine if any of these variables had an impact on any of the predicted relationships.

Scale Reliabilities

Reliabilities were calculated where applicable for the scales used: character rating, ideal self rating, real self rating, friend rating, self-efficacy, behavioral intentions, and involvement. The character rating scale resulted in a Cronbach's *alpha* of .87 with a mean of 14.77 and a standard deviation of 11.44. The ideal self scale had an *alpha* of .80, mean of 24.59, standard deviation of 8.59. The real self scale had an *alpha* of .86, mean of 12.45 and standard deviation of 11.25. The friend scale yielded an *alpha* of .84 with a mean of 16.04 and a standard deviation of 10.82. Self-efficacy yielded an *alpha* of .95 with a mean of 42.60 and a standard deviation of 8.01, behavioral intentions resulted in an *alpha* of .88 with a mean of 41.90 and standard deviation of 12.43, and the alpha for involvement was .85 with a mean of 10.11 and standard deviation of 4.62. Individual items as well as correlation matrices are reported in Appendix A. The ten knowledge questions resulted in a mean of 7.92, SD = 1.38, and a Kuder-Richardson value of .50.

The Stimulus Instrument

To carry out this research, it was necessary to use a computer game that would teach and educate users on testable subject matter that they were not likely to know and would allow for some kind of identification with the avatar. Unfortunately, this type of game does not exist. Games that allow customization of avatars are typically not educational video games, and educational video games are usually targeted toward younger children (grade-school age) or do not contain the necessary components of avatar inclusion. It was necessary, then, to create a game from scratch. Because of the timeliness of the *i*-Safety project and the prior testing of the effectiveness of the information contained in the curriculum, the game was based on this information.

The game engine uses a simple combination of Adobe Flash interactions as well as ActionScript 2, a programming language specifically for Adobe Flash CS4 Professional, the program in which the entire video game was created (Adobe, 2008). All portions of the game were designed and implemented by the author, allowing for complete control over the game and the information contained within, as well as the ability to track game players' actions.

To use a game to instruct, the game must be compelling. Creating a compelling game can involve a number of different things, beginning with a storyline to draw users in (Green, Brock, & Kaufman, 2004). Allowing users to put themselves in the game character's shoes (a first-person perspective) also makes a game more compelling because it brings the game closer to home for a player (Dickey, 2005; Riddle, 2002). Therefore, *SafetyNet* begins by informing players that they have just been given a new job: a security guard for their family's computer. However, before they officially earn their job title of Online Security Expert and become qualified to protect the family computer from outside attacks, they must complete several levels of training in the Cyber Security Training Course to earn their badge. Players are informed that they must pass each level (of which there are a total of three) in order to receive their official security badge. They are told that there will be hints along the way.

The game environment is a 2D representation of the computer desktop. Entering and exiting various portions of the computer, using a browser, accessing the Internet, and other navigational activities are done by pointing and clicking the mouse in much the same way that a user would interact with his or her computer. Each level of the game corresponds to a different "threat zone". Players begin with the more simple tasks and move on to more difficult tasks. External threats to safety in the form of spyware, phishing attacks, cookies, etc., are represented with avatars as well. In order to battle these threats, players must have knowledge of how to be safe online.

The first level deals solely with email safety, specifically phishing attacks. A phishing attack occurs when an outside source attempts to infiltrate an individual's private information by impersonating an official source in an email and requesting that an individual give out information. As an example, the email might appear to come from a bank, requesting that the individual click on a link in the email and, once at the new URL, input information such as names, addresses, passwords, and financial information to "update records," "verify information," or other phony (though reasonable-sounding) reasons. However, this new URL is not affiliated with the bank, but has been set up by identity thieves, and each person who fills out the information has now left themselves at risk for identity theft.

Players are taught to recognize phishing attempts using several different methods of verification. They are also advised about the actions they should take if they do receive a phishing email. Four sample emails are given, and players must determine if they are phishing attempts.

The second level deals with browser safety. Once they have mastered email safety, they are then instructed to launch their browser. This level contains potential threats such as pop-up windows (that may contain spyware when clicked on), cookies, and instant messages. Players learn how to be suspicious of blindly accepting things, and how to spot problems before they occur.

The final level deals with system settings. Setting a pop-up blocker, determining how their browser will handle those cookies, and setting their system to automatically update are taught in this level. Although operating systems and browsers differ, the game is set up in as generic a way as possible so that information gained from the game may be transferable, regardless of browser or OS in use at the player's home.

When a decision is made and action taken in the game, either a dialogue box or the game character will appear on the screen to explain either (a) why what the player did was the safe thing to do, or (b) why what the player did was the unsafe thing to do and, more importantly, what the appropriate course of action would be. Thus, players might experience a set-back, but they are not left without the proper safety information. Once players have successfully completed all three levels, they are awarded their Security Expert badge and have won the game.

The Avatar Manipulation

The avatar manipulation was a textual manipulation shown to players prior to entering the video game site. The players were asked to imagine that the avatar they were presented with was one of three things: their ideal self, their real self, or a friend of theirs. The avatar used was a simple two-dimensional figure with human body and limbs and the head of a dog. Six different avatar heads were pretested to determine which was most effective. An animal was used to eliminate cultural biases as well as the potential for closer matching in appearance to some players and not to others that use of a human avatar would have meant. The author was responsible for all graphics, programming, etc. in order to keep the project at a reasonable cost as well as to ensure that the game could be created to very exact specifications, and if changes needed to be made, those changes could be easily implemented. *SafetyNet* was hosted on the *i*-Safety server, located in the Communication Arts and Sciences building at Michigan State University. Mean distances and reliabilities are reported in Table 1.

Procedure

Subjects were randomly assigned to one of the four treatment conditions. An email containing a link to the website housing the game as well as the survey was provided to subjects in an email. Subjects were asked to provide an assigned log-in name for tracking purposes. After entering the log-in

Table 1: *Mean Distance Scores and Scale Reliabilities*

	Ideal Self	Real Self	Friend	Avatar	Scale Reliability
Ideal Self	.00	16.27	18.10	19.30	.80
Real Self	16.27	.00	17.68	18.92	.86
Friend	18.10	17.68	.00	17.40	.84
Avatar	19.30	18.92	17.40	.00	.87

name, the survey application, through basic PHP programming, randomly sent each subject to a webpage for one of the four conditions that contained instructions regarding how the individual was to play the game. Those in the enactive condition were not asked to imagine that they were playing as anyone but rather were presented with an avatar-free game. Those in the observational condition were playing as a character and were instructed to either imagine that this character was their ideal self, their real self, or a friend of theirs. After completing the game, players were then asked to fill out an online questionnaire during which the dependent measures as well as the measures for similarity ratings were taken. Random assignment of individuals accounted for a number of confounds that might otherwise be present, such as base knowledge, general educational ability, maturation, and so forth, as well as self-efficacy and involvement to participate prior to beginning the project. Using the subject area of online safety education not only taught subjects useful material, but the subject matter lent itself well to using electronic teaching methods, being electronically-based itself.

Effect sizes in video game studies regarding video games as educational tools have yielded effect sizes of small to medium. Meta-analysis of high-quality studies of the efficacy of education software resulted in an effect size of .38 (Gentile & Anderson, 2006). Power calculation using the G*Power software program (G*Power, 2008) suggested for an alpha of .05 (power of .95), an effect size of .25, and four treatment conditions, 280 subjects should be used. This research resulted in a total of 314 subjects across the four treatment conditions.

Chapter 4: Results

Manipulation Check

The manipulation check instituted in this project was to determine that the textual manipulation for assigning conditions of real self, ideal self, and friend (the third-person condition) functioned properly. To check that the manipulation functioned correctly, respondents were asked to respond to items about how they viewed the avatar, and then to respond to those same items regarding how they view their real selves and their ideal selves. Respondents in the friend condition were also asked to rate the friend they chose. The distance formula below (which uses the ideal condition as an example) was used to calculate a measure for each category.

$$\sum_{i=1}^{n} | A_{ij} - I_{ij} |$$

Aij = avatar image (i) of individual (j)
Iij = ideal self-image (i) of individual (j)

By taking the sum of the absolute values of the differences between each item for two conditions, a measure may be calculated. In this case, the difference between each item for the individual's ideal self image, as well as the avatar image (the way the individual viewed the avatar), is taken and added together. Next, a measure would be calculated for the avatar image and the individual's real self image, and in conditions where respondents were assigned to imagine the avatar as a friend of theirs, a measure would be calculated for avatar image and friend image as well. These numbers may then be compared to each other. The smallest distance should be the distance between avatar image and the image to which the respondent was assigned. For example, if respondent A were asked to imagine that the avatar was respondent A's friend, then the sum of distances between A's friend image measure and avatar image measure would be smaller than the sum between A's ideal self image measure and avatar image measure, as well as A's real self image measure and avatar image measure. As would be expected, the distance was the smallest between real and ideal selves.

The textual manipulation was successful in 184 cases (41 cases of the 80 in the ideal group, 41 of 77 in the real group, and 28 of 77 in the friend group, as well as the 74 cases in the enactive group which did not contain an avatar). Success was determined by examining distance measures between standardized scores (calculated by subtracting the overall mean score from each individual's score and dividing by the standard deviation) for ideal self and character, real self and character, and friend and character. If the standardized distance was smallest in the pair that was the assigned condition, the manipulation was deemed successful.

A correlation of successful versus unsuccessful manipulations with the various dependent variables yielded no significant results, indicating that success of manipulation was not the cause for results found.

Statistical Analysis

All statistical analyses were conducted with SPSS Statistics 17 (SPSS, 2009). The four main hypotheses to be tested were:

- H1: Observational learning will lead to more knowledge retained, more enjoyment, and more involvement with the topic than enactive learning.
- H2: Enactive learning will lead to higher levels of self-efficacy than observational learning.
- H3: Enactive learning will result in greater intentions to perform safe online behavior than observational learning.
- H4: The ideal-self avatar will be the most effective in terms of knowledge retained, involvement, enjoyment, and self-efficacy, followed by the real-self avatar and the third-party avatar.

Hypothesis 1. To compare the two groups, enactive and observational learning, a multivariate analysis of variance using planned contrasts was conducted to check for differences between each group. Means, standard deviations, and cell numbers are reported in Table 2. Between-subjects effects are reported in Table 3, and planned contrasts are reported in Table 4.

Table 2: ***Means, Standard Deviations, and Cell Sizes for Enactive Learning, Ideal Self, Real Self, and Friend***

Dependent Variable	Condition	N	Mean	Standard Deviation
Knowledge (total correct, 10-item scale)	Enactive	74	8.30	1.28
	Ideal	80	7.81	1.35
	Real	75	7.75	1.44
	Friend	77	7.84	1.40
Self-Efficacy (scale of 1 to 7, 7-item scale, transformed)	Enactive	73	.80	.07
	Ideal	77	.77	.15
	Real	75	.76	.18
	Friend	77	.75	.17
Behavioral Intentions	Enactive	73	4.81	1.30

Table 2 (cont'd)

(scale of 1 to 7, 9-item Scale)	Ideal	79	4.66	1.45
	Real	75	4.60	1.26
	Friend	77	4.57	1.50
Involvement (scale from -3 to +3, 5-item scale)	Enactive	71	2.15	.83
	Ideal	79	2.07	.86
	Real	75	1.88	.97
	Friend	77	1.99	1.02
Enjoyment of Game (from -3 to +3)	Enactive	73	1.33	1.31
	Ideal	79	1.13	1.23
	Real	75	1.05	1.47
	Friend	77	1.18	1.47
Enjoyment of Learning (from -3 to +3)	Enactive	73	1.51	1.19
	Ideal	79	1.37	1.13
	Real	75	1.27	1.36
	Friend	77	1.17	1.47
Enjoyment of the Avatar (from -3 to +3)	Enactive	n/a	n/a	n/a
	Ideal	79	.62	1.47
	Real	75	.68	1.69
	Friend	77	1.08	1.65

A multivariate analysis of variance was conducted using the General Linear Model menu in SPSS with dependent variables of enjoyment of learning, enjoyment of game, behavioral intentions, total number of correct answers, and self-efficacy, involvement as a covariate (as involvement is likely to remain constant), and condition as the independent variable. Results are reported in Table 3.

Table 3: *F-Tests for Dependent Variables and Condition*

Source	Dependent Variable	Type III Sum of Squares	df	F	Sig.	Partial Eta Squared	Observed Power
Corrected Model	Behavioral Intentions	25.60	3	4.64	.00	.06	.89

Table 3 (cont'd)

	Knowledge Gained	7.76	3	1.34	.26	.02	.36
	Enjoyment of Game	93.02	3	20.10	.00	.21	1.00
	Enjoyment of Learning	79.16	3	18.36	.00	.20	1.00
	Self-Efficacy	.06	3	.75	.00	.01	.21
Intercept	Behavioral Intentions	657.92	1	357.44	.00	.62	1.00
	Knowledge Gained	2352.90	1	1222.48	.00	.85	1.00
	Enjoyment of Game	1.59	1	1.03	.31	.01	.17
	Enjoyment of Learning	.13	1	.09	.77	.00	.06
	Self-Efficacy	26.56	1	977.81	.00	.81	1.00
Involvement	Behavioral Intentions	24.83	1	13.49	.00	.06	.96
	Knowledge Gained	7.62	1	4.00	.05	.02	.51
	Enjoyment of Game	92.48	1	59.92	.00	.21	1.00
	Enjoyment of Learning	77.68	1	54.04	.00	.19	1.00
	Self-Efficacy	.05	1	1.71	.19	.01	.26
Group	Behavioral Intentions	.42	2	.12	.89	.00	.07
	Knowledge Gained	.11	2	.03	.97	.00	.05
	Enjoyment of Game	.20	2	.06	.94	.00	.06
	Enjoyment of Learning	1.46	2	.51	.60	.00	.13
	Self-Efficacy	.02	2	.33	.72	.00	.10
Error	Behavioral Intentions	412.31	224				
	Knowledge Gained	431.13	224				

Table 3 (cont'd)

	Enjoyment of Game	345.76	224
	Enjoyment of Learning	321.98	224
	Self-Efficacy	6.08	224
Total	Behavioral Intentions	5299.05	228
	Knowledge Gained	14351.0 0	228
	Enjoyment of Game	733.00	228
	Enjoyment of Learning	770.00	228
	Self-Efficacy	137.72	228
Corrected Total	Behavioral Intentions	437.90	227
	Knowledge Gained	438.89	227
	Enjoyment of Game	438.79	227
	Enjoyment of Learning	401.14	227
	Self-Efficacy	6.15	227

Although type of condition did not result in any significant findings (though involvement had a significant effect on all dependent variables except self-efficacy), a planned contrast between observational learning and enactive learning was still examined. According to Kwon (1996), planned comparisons can offer more power than traditional MANOVA followed by post hoc tests, guarding against Type II error, and planned comparisons force the researcher to think more critically about research design. Planned comparisons can also detect significant differences between groups of interest that a classical omnibus test would not. Therefore, a planned comparison between the enactive condition and the observational conditions was examined. The planned comparison involved assigning the enactive condition a contrast coefficient of 3, and the three observational conditions a -1 for a total of 0 when all conditions were examined together. Because this research had predetermined directional hypotheses, one-tailed test results for the contrasts were use. Consideration was given to the exploratory nature of this research, and in an effort to reduce Type II error (failure to reject the null hypothesis when the null hypothesis is false), the acceptable alpha level was raised to .10.

All significance values for the planned comparison are reported in Table 4, whether or not they reached significance in the expected direction.

Table 4: *Significance Values for Planned Comparisons Between Enactive and Observational Conditions*

Dependent Variable	Value of Contrast	t	df	Significance (one-way)
Knowledge Gained	1.49	2.72	302	1.00
Self-Efficacy	.10	1.64	298	.05
Involvement	.51	1.35	298	.91
Future Behavior	.59	1.06	300	.15
Enjoyment of Game	.62	1.13	300	.86
Enjoyment of Learning	.72	1.38	300	.92

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Although it was hypothesized that knowledge, enjoyment, and involvement would be higher in the observational condition, none of these reached significance. Therefore, hypothesis 1 was not supported.

Hypothesis 2. Hypothesis 2 indicated that self-efficacy would be higher for individuals in the enactive condition than for those in the observational condition. Again, to compare the two groups, a planned contrast was utilized. The self-efficacy scale was not normally distributed and a transformation of log10 was made to the data. Self-efficacy was found to be higher in the enactive condition than in the observational condition. Effect size for self-efficacy using Cohen's *d* was .24, a small effect size using the standard convention for Cohen's *d* where .2 is a small effect size, .5 is a medium effect size, and .8 is a large effect size.

Hypothesis 2, that those in the enactive learning condition would have higher levels of self-efficacy regarding online safety behaviors than those in the observational learning condition, was therefore supported.

Hypothesis 3. Hypothesis 3 posited that individuals in the enactive learning condition would report greater intentions of performing safe online behaviors that they had learned in the video game than would those in the observational condition. The multivariate analysis of variance did not result in a significant difference between groups on the behaviors overall, although the means were in the hypothesized direction. The mean for behavioral intentions of the enactive condition was 4.81 (SD = 1.30) and the means of the observational conditions were 4.66 (SD = 1.45) for ideal, 4.60 (SD = 1.26) for real, and 4.57 (SD = 1.50) for friend.

Hypothesis 4. Hypothesis 4 stated that the ideal-self avatar will be the most effective in terms of knowledge retained, involvement, enjoyment, and self-efficacy, followed by the real-self avatar and the third-party avatar. Again, planned comparisons were used to detect specific group differences between ideal, real, and friend conditions. For each possible pair of comparisons, the two conditions being examined were assigned contrast coefficients of 1 and -1, while the condition that was not being included in the comparison was assigned a 0.

Despite the numerous opportunities for significant results, the planned contrasts did not show significant differences between the three groups for any of the outcome variables.

Table 5: *Planned Comparisons for Ideal, Real, and Friend Conditions*

Dependent Variable	Contrast	Value of Contrast	t	df	Sig.
Knowledge Gained	Ideal-Real	.07	.29	229	.77
	Ideal-Friend	-.03	-.14	229	.89
	Real-Friend	-.10	-.43	229	.67
Self-Efficacy	Ideal-Real	.01	.53	226	.60
	Ideal-Friend	.02	.69	226	.49
	Real-Friend	.00	.16	226	.88
Involvement	Ideal-Real	.18	1.19	228	.23
	Ideal-Friend	.07	.48	228	.62
	Real-Friend	-.11	-.71	228	.48
Future Behavior	Ideal-Real	.05	.24	228	.81
	Ideal-Friend	.09	.38	228	.72
	Real-Friend	.03	.14	228	.89
Enjoyment of Game	Ideal-Real	.07	.33	228	.74
	Ideal-Friend	-.06	-.25	228	.81
	Real-Friend	-.13	-.60	228	.57

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Table 5 (cont'd)

Enjoyment of Learning	Ideal-Real	.10	.47	228	.64
	Ideal-Friend	.20	.93	228	.35
	Real-Friend	.10	.45	228	.65
Enjoyment of Avatar	Ideal-Real	-.06	-.23	228	.82
	Ideal-Friend	-.46	-1.78	228	.08
	Real-Friend	-.40	-1.53	228	.13

Again, though, the means on several variables were heading in the proper direction. For enjoyment of learning, involvement, and behavioral intentions, means were all highest in the ideal condition.

To further examine this hypothesis, the standardized distance measures between avatar and other (ideal self, real self, and friend) were used as continuous variables and were then correlated with the dependent variables in a post hoc analysis. Correlations and Steiger's Z values, based on the test designed by Meng, Rosenthal, and Rubin (1992) for testing the significance of correlations between correlated variables, are reported below in Table 6 between the ideal and real conditions, as standardized scores for real and friend conditions were nearly identical and resulted in the same correlation values.

Table 6: *Correlations Between Distances and Dependent Variables*

	Ideal-Avatar	Real-Avatar	Friend-Avatar	***Steiger's Z value (Ideal-Real)
Enjoyment of game	**-.41 ($p < .01$)	**-.33 ($p < .01$)	**-.33 ($p < .01$)	1.39

Table 6 (cont'd)

Enjoyment of learning	**-.31 ($p < .01$)	**-.24 ($p < .01$)	**-.24 ($p < .01$)	1.11
Enjoyment of avatar	**-.34 ($p < .01$)	*-.15 ($p = .02$)	*-.15 ($p = .02$)	3.08
Involvement	**-.28 ($p < .01$)	**-.20 ($p < .01$)	**-.20 ($p < .01$)	1.28
Knowledge retained	.12 ($p = .06$)	.10 ($p = .14$)	.10 ($p = .14$)	Both correlations not significant
Self-efficacy (transformed)	.13 ($p = .64$)	*.03 ($p = .64$)	*.03 ($p = .06$)	One correlation not significant
Behavioral intentions	**-.17 ($p = .01$)	*-.16 ($p = .02$)	*-.16 ($p = .02$)	.29

*p is significant at the .05 level
** p is significant at the .01 level
***One-tailed Z-critical is 1.28 for $p < .10$ and 1.65 for $p < .05$

Examining all of these results, hypothesis 4 is therefore partially supported. Enjoyment of the game, enjoyment of learning, enjoyment of the avatar, and involvement were all significantly higher in the ideal condition than in the real or friend conditions. However, knowledge retained and self-efficacy were not significantly correlated with condition, and there was no difference between friend and real conditions

Time spent playing was not significantly different between any of the groups. As well, demographic factors did not have any significant influences on results.

Chapter 5: Discussion

In summary, enactive learning was related to higher levels of self-efficacy than observational learning, and avatar type (ideal self, real self, or friend) showed the strongest correlations between ideal self and the learning outcomes. Although significant differences were not found between involvement, behavioral intentions, and enjoyment between observational and enactive learning, the means were higher for enactive learning than for observational learning, indicating that there may be some support for these, as well. These results are in line with Kolb's Experiential Learning Theory while on the surface contradicting Bandura's Social Cognitive Theory.

Enactive Versus Observational Learning

Social Cognitive Theory posits that observational learning should be the stronger form of learning. However, this research did not find significant differences in knowledge gained. Generalizations cannot be broad, given that this project only tested one learning area, but it is possible that in the case of video games, enactive learning (learning without a model) is the better way to instruct. This is also contradictory to the idea of video game design in which including customizable avatars, particularly in massively multiplayer online role-playing games (or MMORPG's), is one of the more important aspects of game play (Yee, 2004). Respondents indicated that they most enjoyed the game play using their ideal selves, but enjoyment means were highest in the enactive condition without an avatar at all.

Perhaps, though observational learning may be more effective in certain cases (Bennett, Farrington, & Huesmann, 2005; Farrington, 1998; Farrington, 2001a; Farrington, 2001b; Wesch, Law, & Hall, 2007), when learning activities that do not have immediate, real-world, negative consequences (for instance, when playing a video game about online safety, a mistake or error does not result in a loss of privacy or data—an immediate negative consequence likely to happen in real like—but instead, simply a loss of points in the game), method of learning does not matter. More likely, though, the lack of findings may be a case of a one-shot experimental design lacking not statistical power but the power of connection with a character. It is difficult for gamers to form an instant bond with a video game character; the relationship between player and connection to a character strengthens as the player spends more time with the character (Lewis, Weber, & Bowman, 2007). Given this, repeated game play or even extending the game from a 15-minute version to a lengthier version with more levels may allow connections to develop more significantly between the individual and the assigned condition.

The results of this research, however, could also be due to discrepancies between Social Cognitive Theory's assumptions and the necessary environment of the video game. Though some of the aspects of SCT remained intact (self-efficacy being higher in the enactive condition which led to greater, though not significant, intentions to enact the behaviors learned), some did not. These discrepancies must be examined in detail.

First, the results indicate that it did not matter whether the model was the self or the other; it was still seen as being something other than the self. Even in cases where participants were playing the game as their manipulated selves (ideal or real) there were no differences between either of these conditions with the friend condition. Social Cognitive Theory states that learning is most likely to occur if, first, there is a close identification between the learner and the model. In this research, the learner *was* the model, which would necessarily indicate an extreme identification. The manipulation check indicated the participants were indeed playing as the type of individual they were instructed to use, ideal or real. But modeling one's self (with what can be assumed to be a very high level of identification) was not more effective than modeling an external other (where identification would be lower).

Secondly, Social Cognitive Theory posits that there are four steps in the modeling process, beginning with attention, then retention (remembering what has been seen), reproduction (being able to do the behavior that has just been seen), and motivation (past, promised, and vicarious reinforcements or punishments). The Entertainment-Education paradigm has a similar basis, stating that entertainment (the video game) can serve as a door-opener to the learning (education) that will follow. Here, however, it appears that several of these premises and steps do not hold true. Entertainment and attention should be garnered by putting the information in a true game format, complete with avatar. Motivation in the form of vicarious reinforcement or punishment should have an effect on learning, as well. But presenting the information about online safety in a video game format with an avatar present to display vicarious reinforcement/punishment was the less effective method. Presenting a more traditional training simulation (the only difference being the absence of the avatar as all other aspects of the game remained exactly the same) resulted in greater self-efficacy and more information learned. Perhaps the presence of the avatar again distracted participants and unintentionally placed more focus on the fact that it is the game players who control the character and form its intelligence, leading to a feeling of non-transferable skills from avatar in a game to individual in real life.

Furthermore, the mean of involvement was still higher in the enactive condition than in the observational condition even though the difference did not reach significance. This means that the identification between the player and the avatar, while it was present, did not make the expected difference. Motivation (involvement) should have been higher when there was identification with the avatar (the ideal and real selves) and lower in the friend and the avatar-free condition, but it was not significantly different. It could be argued that players felt more identification with no avatar than with any avatar at all, leading to higher involvement. Perhaps this is because the outcomes in the game appeared to more directly affect the game player. Participants were not watching a model of themselves or a friend, but rather were engaged in a first-person view of the game environment. In the avatar condition, even though the only difference was the presence of an avatar moving about the screen and "talking" to players (in the no-avatar condition, the text merely appeared on the screen outside of a speech bubble), the avatar still gave the impression that the consequences would happen to someone other than the player. Regardless of the reason, involvement was higher in the enactive condition, another surprising finding. Research exists supporting the idea that enactive exploration increases intrinsic motivation (Wood, Kakebeeke, Debowski & Freese, 2000) but both groups compared in this study were exposed to an observational learning component prior to the experimental differences: exposure to an enactive exploration (participants were encouraged to practice and explore a computer task on their own prior to doing it) versus no exposure to an enactive condition.

This research supposes that there may be a third kind of learning, something between pure enactive and pure observational: the learning that occurred when the self was the model. However, the conditions in which there was a self model were not as successful in any of the learning outcomes as the enactive condition. Social Cognitive Theory states that observing a model with which the individual identifies will result in greater learning, and individuals with a great deal of self-efficacy will learn more. If observing behaviors is the stronger way to learn them, then the avatar conditions (ideal, real, and other) should have provided the better results.

To explain why the assumptions of Social Cognitive Theory about observational and enactive learning may not hold here, the nature of video games must be examined. Because of the natural set-up of the video game, observational learning is simply too enmeshed with enactive learning. Enactive learning and observational learning were, in fact, both present in the avatar conditions, because subjects were viewing the avatar engaging in behavior (observational) as well as learning how to do the behavior themselves (enactive). The new type of model, the self-model, was present in all conditions in this research. Observational and enactive learning were occurring at the same time, regardless of avatar condition.

The difference between purely observational learning and self-observational learning is the inherent, possibly even subconscious knowledge that the character is in fact the individual. A game player knows that he is the one that is ultimately guiding the character and forming the resultant actions. It does not matter whether an avatar is present or not; it is always going to be enactive learning because the player is in control. True observational learning would require the absence of control of any kind over the avatar.

This leads to an argument of what may, at least at first, appear to be the reverse of the discussion that all game-playing is enactive, because it may be argued that all game-playing is observational. Enactive learning is learning by doing, learning that takes place directly with reinforcements of rewards or punishments. But a game player is still playing a role when interacting with a video game, and necessarily experiencing those rewards or punishments indirectly. For instance, when watching a character in a video game, the character experiences the losses and gains of rewards (points, lives, artifacts pertaining to the game) as well as the success of completing the mission. The game player experiences these vicariously. When playing a game about World War II, the player himself is not directly responsible for the outcome. He does not directly injure or kill opponents. The game is a simulation. Similarly, when playing a game about online safety, the player himself does not experience direct gains or losses. His computer is not at greater risk should he not make the correct choices in the game. This removal from direct consequences defines observational learning.

Enactive learning means that there is not this removal from reality. A player cannot put the blame on the avatar and must accept responsibility directly for the results, which likely results in increased involvement. Video game playing takes, essentially, the best of both words. Individuals are directly responsible but the safety factor is still in place. Observational learning may occur in a game if the individual observes an opponent, either real (as in an MMORPG) or computer-generated, facing consequences of decisions. But video games cannot be purely enactive, either, because there is no one-to-one connection. What one does in the game does not translate into real-world consequences.

Therefore, avatars in video games, whether visible as in a third-person perspective or invisible as in the first-person perspective comprise a new type of model—tentatively labeled the automodel—combine elements of both. Although this research attempted to separate the automodel from the other conditions in video game research, it appears theoretically and practically impossible to create a video game that excludes one or the other types of learning. The game created satisfied all the conditions for a video game—players, rules, and goals (Smed & Hakonen, 2003) with interactive capabilities wherein the player's input has an effect on the game and even a brief opportunity for customization.

Consumers of more traditional media, such as film, are passive consumers, but video game players become a part of the narrative (Grodal, 2000). Eliminating this input to create observational learning, or eliminating indirect rewards, punishments, rules, and goals to create enactive learning both take the video game and change it into something that is by definition no longer a video game.

Though it makes intuitive sense that experiencing two means of gaining self-efficacy would create the highest levels of self-efficacy, even in cases where the avatar is a third-party avatar, it is still controlled by the game player. If players go into a game to learn, they are learning as they go, but in modeling, the model is expected to have more expertise than the learners do. In a video game, this isn't true: the model (avatar) has whatever information the players bring to it. In fact, Fox and Bailenson (2009) discuss this very issue: self models are limited by player skill. Using a self model would mean that self-efficacy is not as high because individuals do not put as much faith into the observations. They know the model's level of expertise is equal to their own, even if it is only on a subconscious level. Therefore, perhaps this dual source of self-efficacy, progressive mastery and observation of the avatar together, is the less effective means of increasing self-efficacy in video game instruction, because although the mastery increases self-efficacy, it is offset by the knowledge that the model and the knowledge of the model is limited by the individual controlling the model. Although players can observe consequences as they happen to other characters in the game (either controlled by other individuals such as in an MMORPG or controlled by the game drivers—a nonplayer character or NPC), purely observational learning regarding one's own avatar is not possible and again, this is what makes video games an auto-modeled experience.

As for the lack of significant differences in behavioral intentions, there was the possibility that the game did a better job of covering some behaviors than others, which might have masked true differences. More likely, however, is that the study did not contain enough participants to reach significance. Although the intentions as a whole were not significant, means for each item in the scale were higher in the enactive condition than the observational conditions, so perhaps additional subjects might have revealed differences.

Ideal, Real, or Other Avatar

This research next attempted to answer the question of whether it is idealized versions or realistic versions of self that have the bigger effects. The correlation analysis showed that enjoyment of the game, enjoyment of learning the material, enjoyment of the avatar, and involvement were all higher when players were playing as their ideal selves. There was not, however, the expected differentiation between real self and the third party condition. In fact, the correlations between the real self scores and the friend scores with the dependent variables yielded the same values. This is likely a limitation of the study design and will be discussed in Limitations below. However, the ideal condition consistently indicated more enjoyment and greater involvement with the material. Thus, even though observational learning did not differ from enactive learning as defined in this project, when considering only the avatar conditions, Social Cognitive Theory was supported. Research on modeling in Social

Cognitive Theory suggests that for models to be the most effective, they should first be similar to the individual, but they should also be slightly improved versions of the individual. They should be intelligent, have symbols of socioeconomic success, and possess a high level of competence (Bandura, 1969). At the same time, individuals are more likely to imitate models that are in adjacent positions in the social hierarchy rather than positions that are far beyond the individual's position (Miller & Dollard, 1941). Children identify more with models who have the power to reward behavior rather than models who are competing for rewards (Bandura, Ross, & Ross, 1971). Thus, the model that has the greatest effect on an observer is the model that is like the observer, with positive characteristics, but also accessible. In essence, the ideal self forms this better model. When individuals create an idealized version of themselves, the ideal version tends to be smarter, have a higher status, be more competent, and so forth.

However, when models are too far above what is attainable by the individual, outcomes may suffer. Although results of the correlation were consistent with hypothesized relationships for enjoyment and involvement, knowledge and self-efficacy in the correlation, as well as the analyses of variance, were not. This may have been caused by a lack of true similarity between avatar and player. Similarity in Social Cognitive Theory is usually physical similarity (Bandura, 1989, 2001; Wood, Solomon, & Englis, 2005). This research used a verbal manipulation of psychological similarity. Although physical similarity may lead to a belief that psychological similarity exists as well, it is likely that physical similarity is what makes the difference in terms of identification. This study used the verbal manipulation to attempt to avoid confounds by using various aspects of physical customization, but perhaps, in line with similarity research, physical similarity would have yielded different results. The Uncanny Valley (Mori, 1970) provides an extension to this explanation. When non-human things come closer to seeming human, there comes a point where similarity is almost (but not quite) achieved, and the non-human aspects stand out, causing a negative response from humans. The avatar used in this experiment was a dog. Although the avatar pretested better than human-looking avatars and was used to eliminate cultural biases, perhaps that dog was not similar enough to a human being and thus failed to elicit the empathy needed for identification.

Different results have been obtained using virtual reality-based observational learning, although there was no apparent enactive condition. There are several reasons that observational learning might work in virtual reality settings but fail in video game settings. First of all, virtual reality has the ability to make far better representations of ourselves, leading to a greater degree of visual similarity which, according to various studies (Bandura, 1977; Jose & Brewer, 1984), leads to a greater degree of identification. Because of this potential for greater identification (the model that subjects see is more representative of the subjects' views of self), observational learning may be more effective.

Additionally, virtual reality has subjects performing the behavior in real time. While the video game in this project offered participants the ability to practice doing behaviors that they would then perform for real, subjects were not learning movement and motion, but rather information and instruction about where to go and what to click to remain safe. Virtual reality studies have primarily utilized the teaching of movement (such as, for instance, Tai Chi motions (Bailenson, Patel, Nielsen, Bajcsy, Jung, & Kurillo, 2008)) rather than the teaching of more cognitive information. Learning how to be safe online still requires movement and recall of the steps learned, but rather than "muscle memory," the learning relies on more in-depth cognitive function. Although it is tempting to say that observational learning works only in cases where the modeling is physical, there are instances where observational learning was used to learn mathematics rather than large muscle movements (Schunk, Hanson, & Cox, 1987).

Bailenson, Blascovich, and Guadagno (2008) found that people responded more positively regarding intimacy-consistent behaviors to representations of themselves than others. There were no differences between those who interacted with physically similar representations of themselves and those who interacted with physically dissimilar representations, although the authors were hesitant to draw conclusions from this. They note that perhaps "the belief that an embodied agent is a representation of the self is more important than whether this embodied agent is photographically similar to an individual" (p. 2685). It is possible in the research reported in this paper that participants viewed any condition as being a representation of a third party, due to the physical dissimilarity between participants and the dog, and this is why there were not significant differences in the planned contrasts.

Although differences in information retained, involvement, behavioral intentions, and self-efficacy were not noted between conditions, enjoyment of the game, enjoyment of learning, and enjoyment of the avatar between ideal, real, and other were correlated in the proper direction, with the ideal self condition resulting in the highest levels of enjoyment, indicating that ideal self has the stronger relationship with these variables. Even if game players using their ideal self avatar do not experience more learning and higher levels of self-efficacy, the fact that they enjoy the experience more suggests that they will return to the material (Ritterfeld, Weber, Fernandes, & Vorderer, 2004; Vorderer & Ritterfeld, 2003). If two participants score equally well, but one had a more enjoyable time, this individual will, at least in terms of the game contained in this research, have a better chance of keeping his computer safe than the individual who viewed the experience as less enjoyable.

In summary, this research explored which type of learning is the more effective in educational video games, and whether or not avatar type has any effect on learning outcomes. Results indicated that the enactive learning condition resulted in higher self-efficacy, and that, in the case of textually-manipulated avatar type, the ideal self avatar type had the more successful results than an avatar representing one's real self or a third party.

Chapter 6: Limitations

Manipulation Check

The manipulation itself for establishing real, ideal, and friend (or other) worked in approximately 60% of the total cases. These results indicate that the manipulation did not have the desired effect on as many participants as would have been ideal. Most successful were the manipulations for real and ideal selves, as would be expected. Asking participants to view an avatar as a representation of how they actually see themselves would be the easiest leap to make. Asking participants to view the avatar as their ideal selves would be slightly more difficult, but still, the only knowledge necessary is knowledge that is present inside the minds of the participants. They know their real selves, and they know their ideal selves. Indeed, results show that when using the standardized scores for the distance analysis, correlations between real self and friend with the dependent variables yielded the same results. Therefore, use of a friend condition rather than a neutral third party may have negatively affected results. Most individuals choose friends based on attraction to that which is similar to themselves (Byrne, 1971), so any differences between one's real self and the chosen friend would likely be minimal (as the data show) compared to potential differences if a third party unknown to the player prior to game play was used. However, the use of a friend was chosen to attempt to balance the limitation created by only having players play the game once, creating a situation that would be relatively equivalent across the three avatar conditions. People know who they are and who they would like to be, as well as knowing what their friends are like. Because it takes time to form a connection with a game character, using a friend that the game player already has a connection with would have allowed players to more adequately have an impression of the character. Rather than risking random answers to the questions for the similarity distance measure due to the player not having a strong connection to the character, participants were asked to think about a friend and rate the friend with the assumption that they would have a better grasp of the friend's personality.

The manipulation with the lowest success rate was that for the friend condition. Instead of one connection to be made (putting one's own self concept inside the body of a digital character), two were required: imagining what the friend they chose is like (essentially putting themselves in the minds of their friends), and then putting that concept into the avatar. Part of the reason that the verbal manipulation may have been so weak was simply that physical similarity is far more important than mental similarity. Without the physical cues, participants could not connect with the avatar. However, it may also be a case for the necessity of repeat game play.

There were no significant correlations between whether or not the manipulation check worked and the dependent variables of the study. This means that the success or failure of the manipulation did not somehow influence the results, but that the manipulation itself was more probably the cause for differences found. In other words, were there to be significant correlations between success and the dependent variables, differences found may be attributed to the type of individual—perhaps participants for whom the manipulation was successful are more conscientious individuals in general, will read more carefully, pay more attention, and be more involved with the material. This would lead to significant correlations between success and the dependent variables, and would lead to erroneous conclusions. However, success or failure of manipulation did not have an effect, and thus, this does not create a confound for results.

Text was used to manipulate ideal, real, and friend for several reasons. The major reason for not using avatar characteristics was to avoid confounding any results with the various customization options. For instance, if participants were told to make their ideal selves, with choices for hair color, hair style, eye color, clothing, gender, and age, this leaves six variables to contend with. It is entirely possible that one of these would be responsible for the adequate manipulation in one case (say, hair style), and the other characteristics were not at all important in determining whether or not the participant thought of the character as an ideal self. For other participants, the defining variable may be gender, or age, or any combination of variables. By eliminating confounds, this research examined whether avatar type made a difference; future research can determine which visual characteristics make the largest differences.

Secondly, the important variable for this research was avatar type: real self, ideal self, or third party. If participants had been allowed to choose the look of their avatar, using any of the above options, customization choice would have created confounds. Choice boosts confidence in one's ability to perform a task (Tafarodi, Mehranvar, Panton, & Milne, 2002) which would have likely had an effect on self-efficacy, and customization would result in a great many choices (skin color, hair style, eye color, and so on) that would make it exceedingly difficult to determine which characteristic(s) made the difference in participants' imagining of the avatar as the proper type.

Thirdly, individuals from a variety of cultures and races were included in the research. To remain culturally neutral, six different non-human avatars were pretested. The dog avatar resulted in a greater number of successful manipulations than did the other five. Unfortunately, the use of the dog avatar might have created a confounding variable in an attempt to eliminate other confounds. For those who like other animals better, or who do not like dogs at all, these individuals may have had a more difficult time identifying with the dog character. As well, the dog's fur was brown, which may have been a race confound.

However, in other research studying avatars and learning, there are inevitably confounds and this research attempted to eliminate as many confounds as possible. As previously discussed, by using a non-human avatar that remained consistent and only altering the textual information cues, cultural biases were reduced, as were gender biases. By using a consistent avatar, the potential for one characteristic (eye color, hair style, etc.) to affect one participant in terms of belief that the avatar was the participant's ideal self and to not affect another was also eliminated. Even in studies where actual representations of participants were used, the possibility for experimenter and observer effects, particularly in studies where participants needed to spend time having their virtual selves created, exists.

The game also needed to be comparable in the avatar and the no-avatar (observational and enactive) conditions so that observations could be made regarding the effectiveness of the conditions. Keeping the avatar simple and constant across conditions and merely changing the text prompts to reflect either the presence or absence of an avatar allowed for consistency that might otherwise have been absent. (See Appendix B for a collection of screenshots both with and without the avatar.)

Hypothesis 1

It was hypothesized that the observational condition would result in greater learning than the enactive condition, as modeling is theorized to be the strongest method of learning. However, significant differences in learning outcomes between the two conditions were not found. Although discussion offered several explanations for these results, of course they may also be due to design and experimental limitations.

It is possible that participants knew the material prior to playing the game. However, pretesting eliminated questions and responses that were too easy or too difficult and random assignment of participants would have ensured that regardless of prior knowledge, differences found between conditions would still be valid. Each participant was asked ten questions about what they had just learned in the video game during the posttest, but perhaps ten questions were not enough to adequately determine a difference in knowledge.

This research did not include a control condition because it would have been impossible to ensure precise similarity between the control group and the rest of the groups and because this research was done entirely online. Future research, however, should include a non-interactive presentation of the information. However, this had the potential to confound results because time on task can vary widely. Those individuals playing the game would likely spend more time with the material than those reading the copy because first of all, people read faster on paper than they do online. People also skim material online (Nielsen, 2006). Secondly, it takes more time for users to click the mouse and move about the screen than it does for individuals to read a printed page. Because of the potential for a time confound, a printed-material control group was not used. Perhaps one consideration would have been to put the material on a webpage and randomly assign participants. Those in the control condition would simply visit the website, scroll through the material, and move on. However, the time discrepancy still stands. The research as it is now shows that the groups all spent the same amount of time interacting with the material and that time was not affected by the random group assignment.

Because time remained comparable among all groups (analysis of variance showed no significant differences), one of the typical explanations for differences between groups with regard to video games can be discarded. It might be tempting to say that the reason for any difference, whether it is a positive or negative (in the sense of positive effects that we would like to see, and negative effects that we wish we did not see), can be attributed to time. The more time an individual spends with any material, let alone a video game, the more likely he or she is to remember the information (Ebbinghaus, 1913).

Hypothesis 2

This research showed that the enactive condition resulted in higher levels of self-efficacy than did the observational condition for cases that passed the manipulation check. Rather than watching someone else succeed, individuals in the enactive condition were themselves experiencing the consequences. Therefore, self-efficacy levels should be higher for individuals in that condition, but this was only true when analyzing only those who passed the manipulation check. Perhaps the individuals who passed the manipulation check were more careful readers and took the experiment more seriously, resulting in greater self-efficacy gains than those who were not able to suspend disbelief, who did not read the instructions carefully enough, and who ultimately did not take the game as seriously.

Hypothesis 3

Although means were in the correct direction, intentions to perform behaviors in the future were not affected by the enactive versus observational conditions. Two of the behavioral intention items exhibited extremely significant differences between the groups as individual items rather than taking the items as a whole. These were two things related to phishing emails, which many people do not know about. These future behaviors were likely things that participants did not know about prior to playing the video game and were behaviors that the game covered repeatedly, more so than the other behaviors.

It might have been that the game spent more time with these, and therefore, they showed significant differences while the other behaviors that received less time did not.

As well, these behaviors were extremely easy to do. They required no real additional effort (no downloading, etc.) and could be accomplished in a matter of seconds. Participants in the observational condition were exposed to consequences through vicarious learning, but they may have also had things happen to them related to breaches of online safety, meaning they may have had personal (enactive) experience. This may have interfered.

Changing settings and the inner workings of a computer may be daunting. However, the two significant behaviors were things that did not require any settings be changed. There was no potential for error with these two behaviors, as they involved checking links and searching using Google.

Finally, perhaps the number of participants in each cell was not high enough to find effects that are actually there (Type II error). Although alpha was raised to assist in elimination of Type II error, when taking the entire sample and using the distance measure as the independent variable, relationships start to develop in predicted directions. It is possible that the N for this experiment was simply not high enough to detect significant differences. The effects that may be present might be larger than the effect size originally used to estimate cell size.

Hypothesis 4

Although the planned comparisons did not show any significant differences between groups, the correlation analysis found the strongest significant correlations in the ideal self condition. Again, this could be due to the smaller cell sizes (Type II error). Although power analysis showed that 70 subjects per condition should be adequate for finding a medium effect size, it is possible that the effect in question is a smaller effect size of approximately .2 (instead of the medium effect size of .3) and a larger N would make a difference.

Participants responded that they would most prefer to play as their real selves, followed by a third party (a friend or other external individual), and lastly their ideal selves. This is incredibly surprising, given that much of what is written about the appeal of video games is the ability of individuals to try on new personas, to do things they could not (or would not normally) do in real life. The means for enjoyment of the game, of learning, and of the avatar were higher in the ideal condition than in the other two, and although they did not reach significance, perhaps this is indicative that people *like* to pretend to be something they aren't, but when it comes down to doing something more than just enjoying themselves, such as learning new material, the type of avatar isn't important. Indeed, it would appear that the avatar is not necessary at all.

The lack of significant planned contrast differences may have been due to a smaller subject sample (approximately 75 individuals in each group). When N increased using the continuous variable of distance as the independent variable, the correlation matrix showed significant results. It is also possible that the subject sample was too old to benefit from any manipulation of sense of self or other. Although the sample falls within the range of the typical video and computer game player—the average age of game players is 35, according to the

Entertainment Software Association (2008) with about 49% of gamers falling between the ages of 18 and 49, individuals who use a video game to learn are likely younger, so the age of the game players may have skewed the results.

Moreover, many times, respondents do not carefully read text presented to them online (Nielsen, 1997). Rather than carefully reading the instructions to imagine that the avatar was a certain type (real self, ideal self, or friend), the participants for whom the manipulation was not effective may have simply skimmed this instruction page (or even skipped it entirely) and clicked next. To play a video game, suspension of disbelief is necessary so that players can become immersed in the game world (Green, Brock, & Kaufman, 2004; Oatley, 1994). For some of the participants, suspending disbelief and being able to imagine that they were a two-dimensional canine character on the screen may have been too difficult to overcome at all, let alone to imagine that the character possessed traits of some version of themselves or a friend, even if they did read the instruction page.

Perhaps, however, avatars are not necessary when using games as a learning tool. Though avatars can make the experience more enjoyable (Chan & Vorderer, 2006; May, 1994), it is possible that their presence detracts from the game material. An item on the questionnaire asking respondents if they would rather play as their ideal self, real self, friend/other person, or something else resulted in a number of responses indicating "something else," and of those, several reported that they would prefer no avatar at all. Those who selected "other" (the fourth response) were provided space in which to explain their preference. One respondent wrote, "it [the avatar] takes away from the fact that computer useage (*sic*) isn't some cute little game. Most 'avatars' are associated with annoyance and hindering useability (*sic*), not helpful guides. IE: Clippy". Again, this could also be an issue of age; adults do not typically play games to learn and have been exposed to previously-created avatars with negative experiences regarding those avatars (as the respondent noted, the Microsoft Office assistant).

As indicated in the results, involvement was lowest in the real condition, whereas behavioral intentions were lowest in the friend condition, but both were highest in the ideal condition, though no significant differences were found between the three groups. An analysis of involvement examining only differences between ideal and real self, however, found a significant difference. If participants were imagining their ideal selves while playing, it would stand to reason that they were still imagining their ideal selves while answering the questionnaire. Socially desirable behaviors, then, such as considering online safety to be important, could be attributed to idealized versions of self, because if respondents could be their ideal selves, they would consider online safety important. In the real condition, however, respondents answered honestly, and this resulted in a lower level of involvement. The desire to make your actual self reflect the goals and beliefs of your ideal self is known as the social desirability bias, and even though the only recipient of each individual's answers was the researcher, this tendency appears to hold true, regardless of the "social" aspect.

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Though learning with electronic environments is just beginning to be explored, research in press by Bailenson et al. indicates that participants learning physical actions learn better in virtual reality than through a video condition because of the ability to see themselves represented on-screen (2008). Perhaps the lack of significant findings between conditions in this research is related to the type of avatar used. Had this experiment been able to place exact versions of individuals in a three-dimensional game space for the real self condition, allowed participants to adjust their image for their ideal self, and put the exact version of the subject's friend in the friend condition (rather than using a previously-created, fixed avatar), results could have been different. Part of the appeal of an avatar is the feeling of connection (Allison, von Wahlde, Shockley, & Gabbard, 2006; Chan & Vorderer, 2006; May, 1994). In an attempt to remain neutral and consistent, this research utilized one constant avatar, but it is unlikely that this connection would exist strongly in every participant.

Because the content of the game revolved around online safety, a topic that can have very serious consequences and that is, in and of itself, serious, the addition of the avatar may have detracted and distracted participants from the actual material. Although only one respondent made a comment about this, it is quite possible that many individuals felt the same way. In fact, game players may have been enjoying the avatar and enjoying the ability to imagine their ideal selves, but the enjoyment of the novelty may have overshadowed the content. The simplistic avatar and graphics may have made the topic seem less serious, so respondents were not as motivated to take the lesson seriously, which was then reflected in the lack of significance for various results. When it comes to enjoyment of a game, clearly, people enjoy pretending to be something they are not. But when adults are learning with a video game, this makes no difference. As summarized by the respondent above, perhaps there is no room for pretending, because learning is serious business.

Chapter 7: Directions for Future Study

The first and most obvious step to take next in order to further examine this line of research would be to design a study that contained observational learning as well as the new potential type discovered here: auto-observational learning. The conditions could still be tested using a video game, but in the pure observational learning condition, participants would simply watch the game play itself, as if watching a video. The auto-observational condition participants would play the game. This could be compared to a third condition of purely enactive learning, although this could not be integrated into a video game due to the enmeshing of enactive and observational learning in a game. Instead, enactive learning would require participants to be on a computer with instructions to change settings, etc.

Putting in this external observational condition (where participants observe the game without interacting with it) would test in more depth differences between observational and auto-observational learning. This concept of self-modeling or auto-observational learning needs further exploration as well. To test whether or not the appearance of the avatar (physical similarity) affects the effectiveness of learning using self-modeling could be accomplished by putting images of game players directly onto avatars and assigning players their self-modeled avatars, or by putting images of individuals that are not the game players onto avatars and assigning those to players as well. As discussed previously, similarity deals more with physical characteristics rather than cognitive ones, and it is possible that simply manipulating participants' cognitive images of the avatar was not enough to elicit strong identification due to similarity. Perhaps the physical characteristics must match as well.

Because participants only had one opportunity to play the relatively short video game, exploring results when individuals are allowed repeat exposure to the avatar in the game is needed. Adding three more conditions, still with the three types of avatar, but allowing the first triad to play once and instructing the second triad to play for a certain length of time or to play through a certain number of times would allow comparison between the connection with type of self (or third party) and avatar gained in a short time versus a longer time. Related to this, if the use of a longer exposure to the stimulus is utilized, it is also possible to use a neutral third party avatar with which the players are not familiar. Extended time would allow for a stronger connection to develop and would allow players to develop their own ideas about what this third party character is like.

Future research should also better explore the use of various types of avatars, especially using technology that allows for better quality avatars that are personalized for each respondent. It would be particularly useful to have access to technology that allows for an exacting image of the individual to be placed within the game, such as using virtual reality. Subjects in the ideal self condition could then alter their images to look like what they would like to look like and pick personality traits that would represent their ideal selves.

As discussed earlier, it is possible that the use of text rather than image did not create a strong enough link between avatar and player. A stronger priming effect might make a greater impact on results. Rather than simply telling players how to view the avatar, participants could be asked a series of questions about how they (as either their ideal self or real self) would respond in various situations and then shown the generic avatar with instructions to imagine the avatar as having all the characteristics and qualities they just described in their answers. Those in the third party condition may be shown an image of an avatar and asked a series of questions about how they believe that avatar might respond in the same situations described in the two self conditions. If order of exposure is problematic, participants in the third party condition could be asked how they think someone well-known but unlikely to be similar to either their real or ideal self (the governor of the state, for instance), or even someone they actively dislike, would respond prior to showing them the avatar and giving them the instructions.

Using a dog as an avatar rather than a human being likely limited identification with the avatar, so designing research studies to replicate this one but utilizing humans as the avatars could lead to more significant results in line with the theoretical grounds. In order to determine which characteristics ought to be included or offered as choices for avatar customization to maximize similarity between ideal and real selves, exploratory research needs to be conducted first. One potential method could involve using an existing avatar creation system, such as the concept behind the Nintendo Wii's "Mii". Individuals could be assigned to create their real or ideal selves using the system, and then rate or rank which of the characteristics were most important to them in determining what made the avatar representative: hair style, hair color, gender, skin tone, age, height, weight, and so forth. Limiting options (as this existing system does) would eliminate some of the confounds that might be found in something like Second Life or The Sims, where customization and hacks lead to almost innumerable and difficult-to-classify characteristics.

The less involved method of creating a system to offer human cues for avatar similarity may be done by simply interviewing game players in open interview sessions. From there, avatars can be designed that manipulate only one of the common cues, and each manipulated characteristic forms its own study of differences. For instance, a female and a male avatar can be offered in the game with the same outcome variables measured to determine the significance of gender, although investigation of each particular characteristic in this manner would require numerous studies and participants. Thus, the former method is preferable.

Wood, Solomon, and Englis (2005) conducted a study regarding avatars and online shopping clothing models. Subjects preferred photographic, rather than characterized, avatars (realistic) but they also preferred idealized avatars (the equivalent of a supermodel in real life). In essence, then, people prefer realistic-looking avatars, but avatars that are idealized. The realistic qualities might assist in the video game world of being able to make the connection between the game and real life, but the idealization of an avatar could provide the inherent "expertise" that players don't have. In the Wood, Solomon, and Englis study, perhaps it was the fact that the models used *looked* as if they were, in fact, knowledgeable about fashion. Participants were more familiar with some of the images than others (for instance, Meg Ryan's image was used) and perhaps that familiarity caused participants in their study to prefer the images with which they were familiar. This, combined with the fact that the models were those that were typically related to fashion and clothing, could have led subjects to prefer them because they would have seen these individuals as having expertise. It would be interesting to conduct this video game study with avatars utilizing the images of Bill Gates and Steve Jobs to investigate familiarity and expertise further in terms of avatars and learning using video game environments.

Finally, and perhaps most importantly, if self-efficacy was significantly higher in the enactive (no avatar) condition, but enjoyment of the game, enjoyment of learning, enjoyment of the avatar, and involvement were correlated most strongly with distance in the ideal self condition as compared to real self and other, maybe this means that there is no need for an avatar at all, but for merely the *suggestion* of an avatar. Perhaps players do not need to be physically convinced about the similarity of their avatars to themselves, since any attempts to use physical similarity elicit numerous confounds, but instead, players need to be psychologically linked to their avatar in order to experience the greatest positive learning outcomes, and linked using their ideal selves. Suggesting to players that their ideal self is the main character in the game and simply providing textual cues to this end could potentially result in a combination of the positive effects from both conditions, and better encompass the reasons for creating educational video games in the first place. Further exploration of this comparing ideal, real, and other manipulations using text only without an avatar is necessary to better understand the psychology behind avatar use, but perhaps the Entertainment-Education Paradigm is not a lost cause after all, but needed only to be placed on the shoulders of Social Cognitive Theory in order to better see the future for educational video games.

APPENDICES

Appendix A

Table 7: *Correlation Matrix for Involvement Scale Items*

Item	Item 1	Item 2	Item 3	Item 4	Item 5
1. Matters to me ... Doesn't matter to me	1.00	.79	.69	.85	.42
2. Of concern to me ... Of no concern to me	.79	1.00	.70	.75	.45
3. Relevant ... Irrelevant	.69	.70	1.00	.82	.40
4. Important ... Not important	.85	.75	.82	1.00	.41
5. Interesting ... Not interesting	.42	.45	.40	.41	1.00

Table 8: *Correlation Matrix for Self-Efficacy Scale Items*

Item	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7
1. I am confident that I can recognize a phishing attack.	1.00	.94	.80	.66	.81	.76	.69
2. I am confident I can protect myself from phishing attacks.	.94	1.00	.80	.68	.81	.76	.72
3. I am confident I can close pop-up windows the correct way.	.80	.80	1.00	.66	.88	.83	.65
4. I am confident I can reject invasive cookies.	.66	.68	.66	1.00	.70	.65	.75
5. I am confident I can set my browser to block pop-ups.	.81	.81	.88	.70	1.00	.90	.70
6. I am confident I can set my computer to update automatically.	.78	.76	.83	.65	.90	1.00	.67
7. I am confident I can keep myself safe from spyware.	.69	.72	.65	.75	.70	.67	1.00

Table 9: *Correlation Matrix for Behavioral Intentions Scale Items*

Item	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7	Item 8	Item 9
1. Set my computer to automatically update.	1.00	.66	.61	.34	.35	.25	.34	.35	.33
2. Change the settings for cookies on my computer.	.66	1.00	.85	.52	.53	.42	.31	.40	.33
3. Change the settings for popups on my computer.	.61	.85	1.00	.44	.45	.37	.24	.37	.30
4. Discuss phishing with friends or family.	.34	.52	.44	1.00	.94	.81	.24	.44	.42
5. Discuss cookies with friends or family.	.35	.53	.45	.94	1.00	.83	.24	.41	.41
6. Discuss computer settings with friends or family.	.25	.42	.37	.81	.83	1.00	.21	.37	.41
7. Check URLs in email for phishing attempts before clicking on them.	.34	.31	.24	.24	.24	.21	1.00	.48	.47
8. Look up phone numbers given in emails to check for phishing attempts.	.35	.40	.37	.44	.41	.37	.48	1.00	.71
9. Search Google to verify identities of email senders.	.33	.33	.30	.42	.41	.41	.47	.71	1.00

Appendix B

Figure 1: *Opening Screen (with Avatar)*

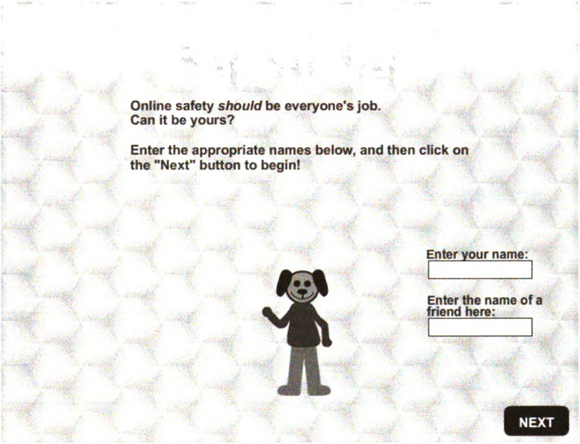


Figure 2: *Phishing Email Example*

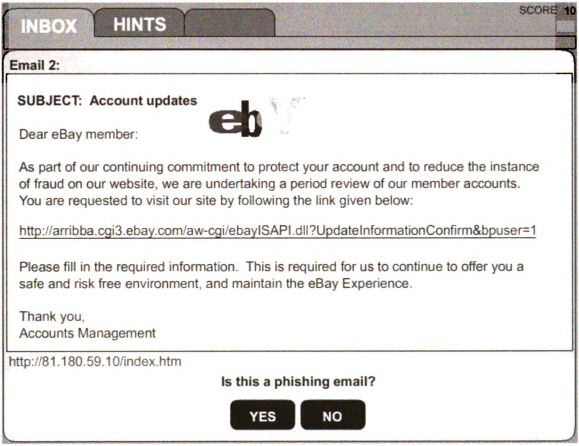


Figure 3: *Phishing Completion Screen (without Avatar)*

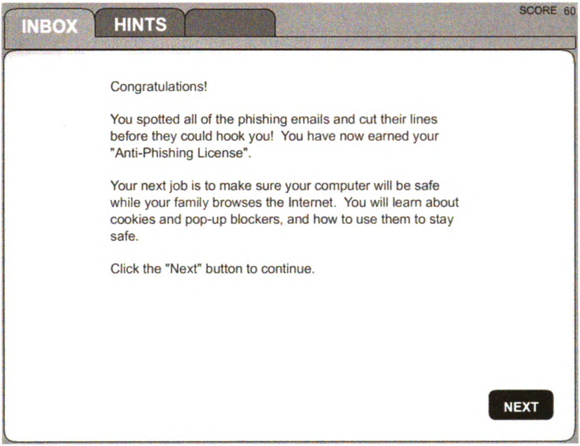


Figure 4: *Accepting Non-Invasive Cookie (with Avatar)*

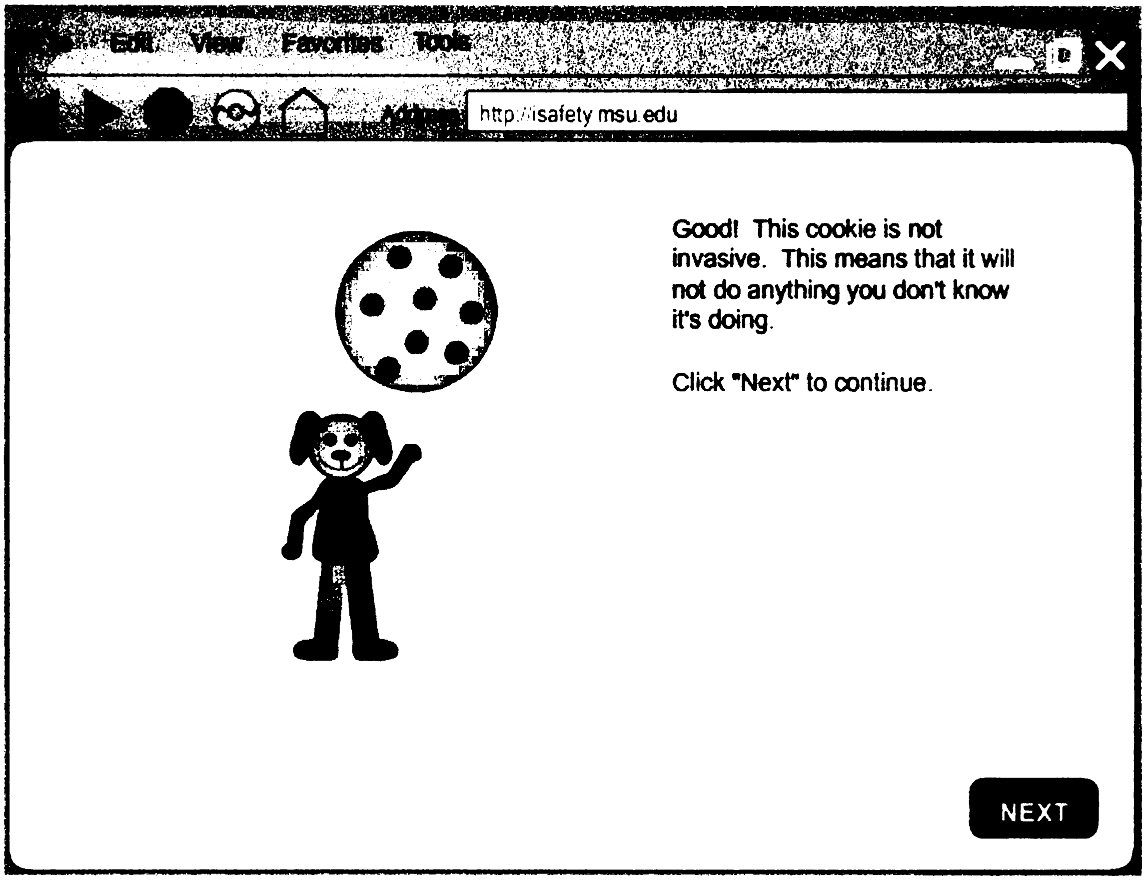


Figure 5: *Instant Message Level (with Avatar)*

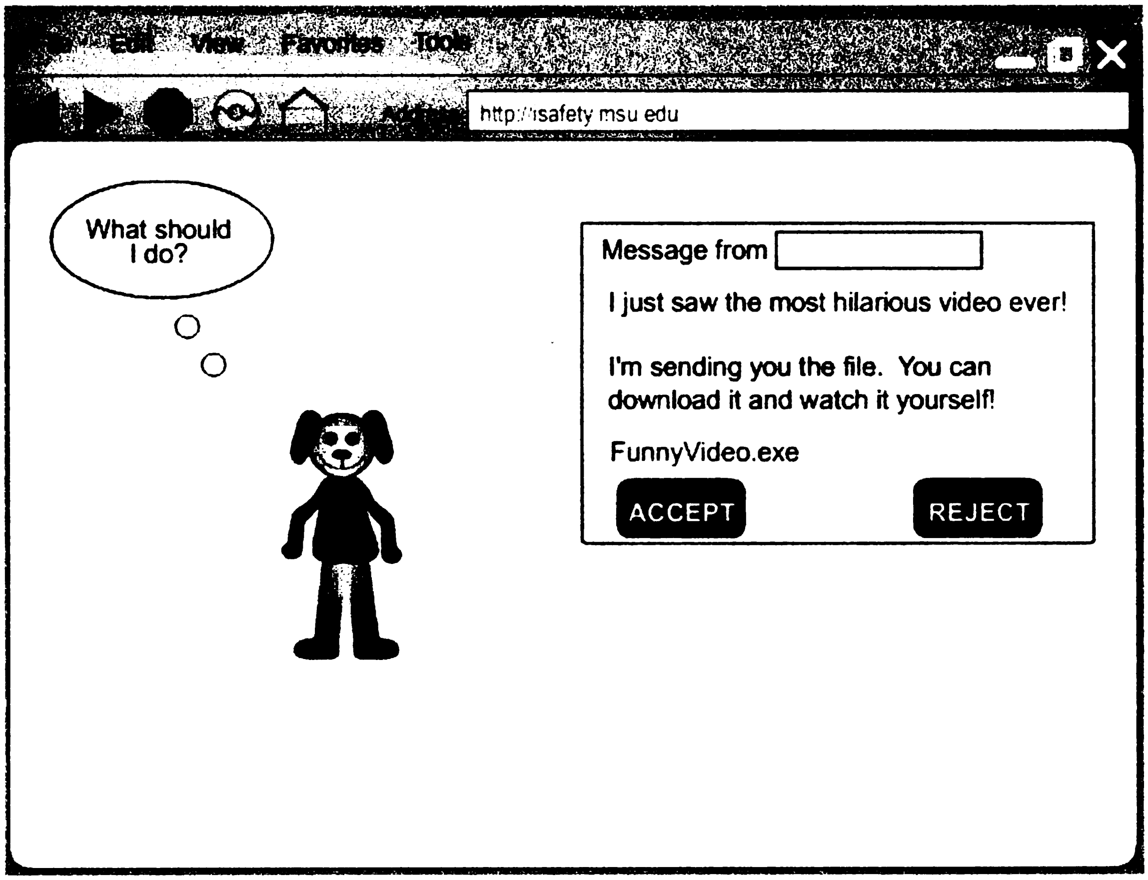


Figure 6: *Moving On To Final Level (with Avatar)*

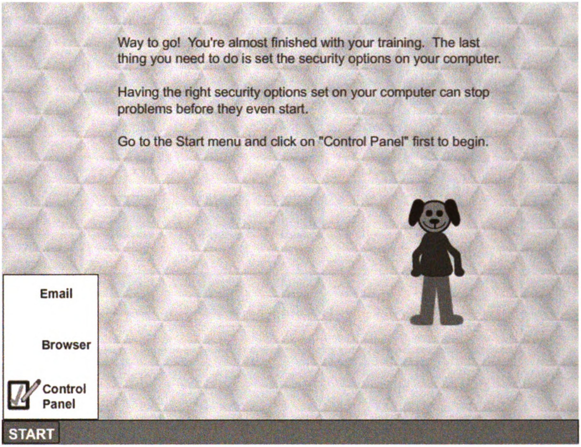


Figure 7: *Setting Automatic Updates (with Avatar)*

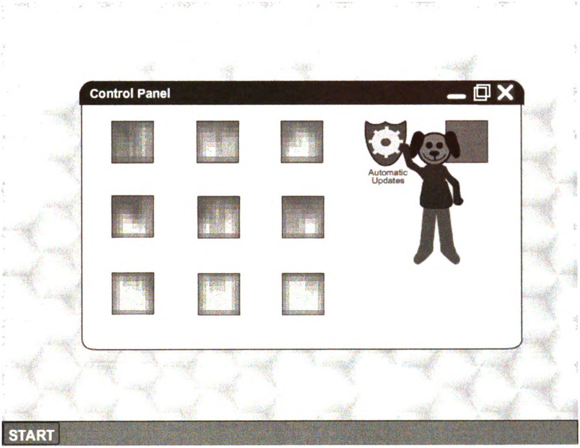


Figure 8: *Pop-Up Blocker (with Avatar)*

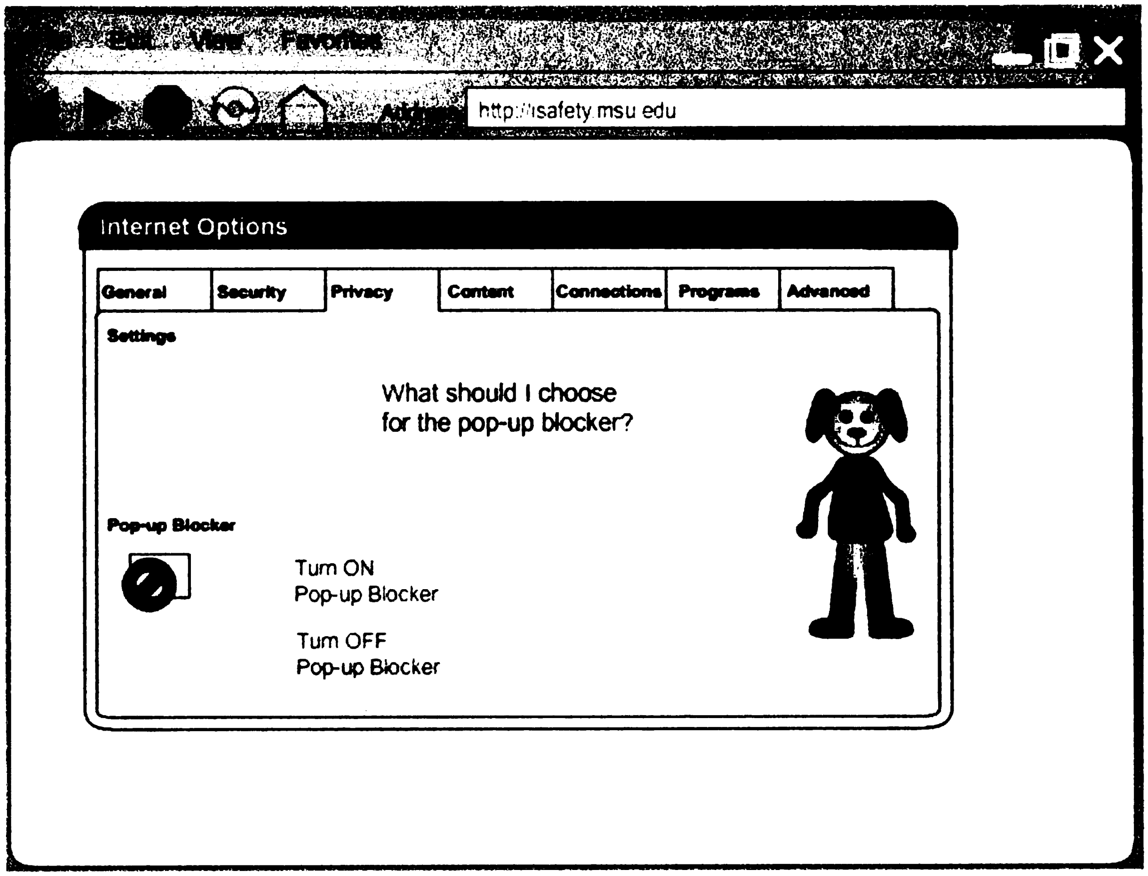


Figure 9: *Pop-Up Blocker (without Avatar)*

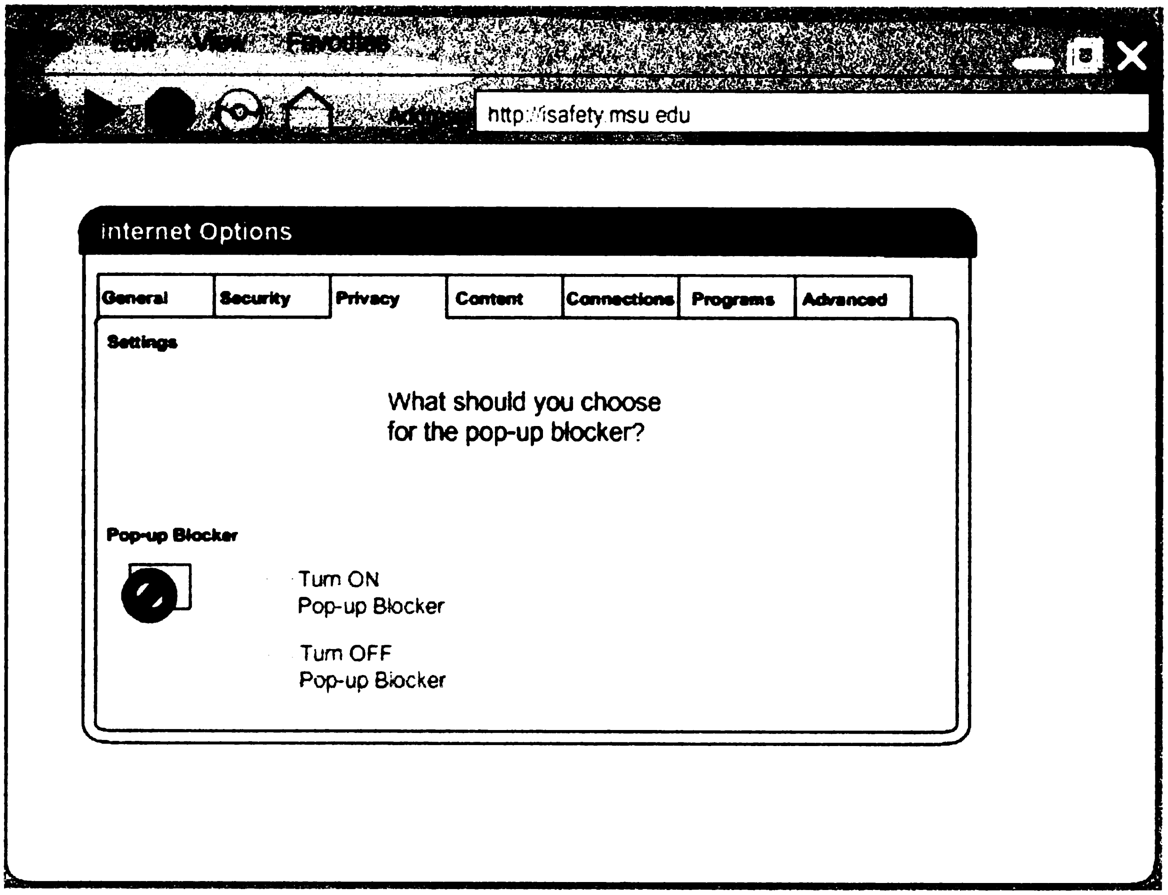
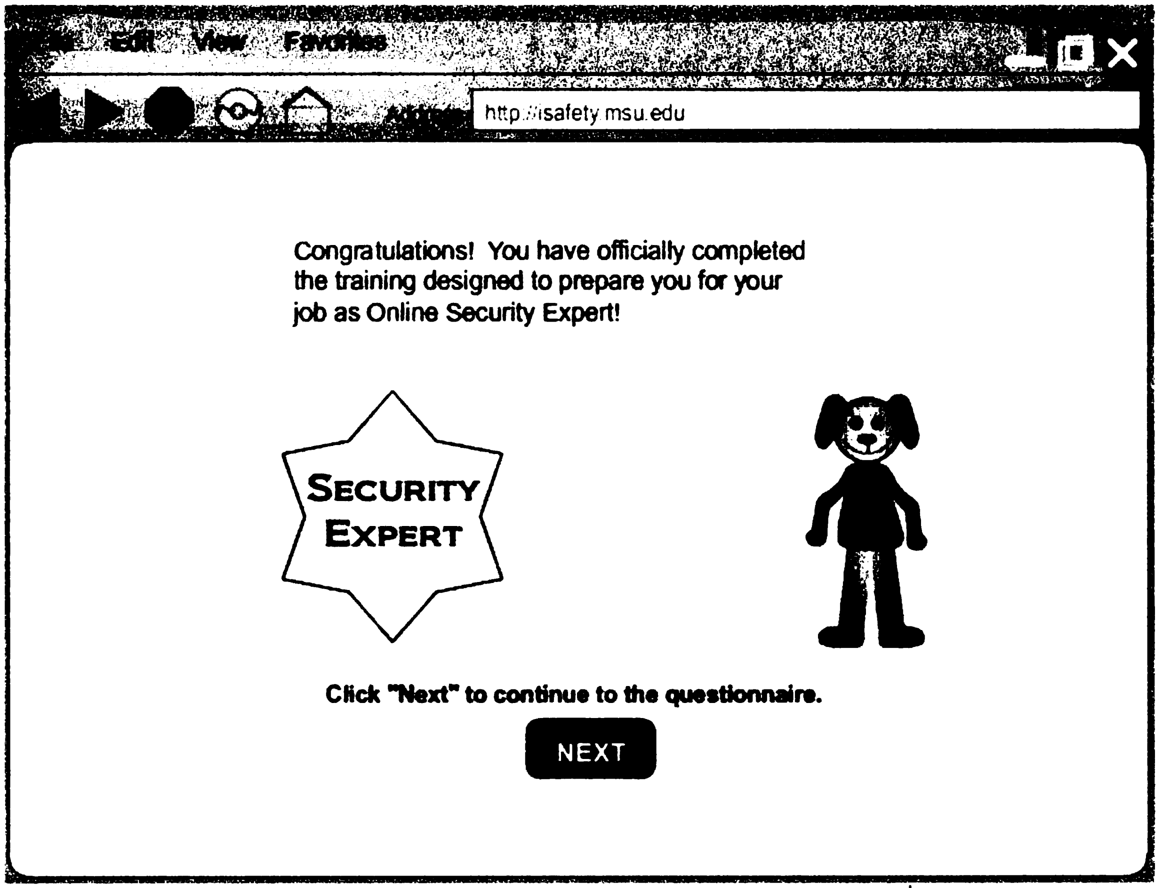


Figure 10: *Final Screen (with Avatar)*



REFERENCES

References

Adams, J. A. (1986). Use of the model's knowledge of results to increase the observer's performance. *Journal of Human Movement Studies,* 12, 89–98.

Adobe Flash CS4 Professional. (2008), for Windows. [Computer Software]. San Jose, CA: Adobe Systems Inc.

Allison, S. E., von Wahlde, L., Shockley, T., & Gabbard, G. O. (2006). The development of the self in the era of the internet and role-playing fantasy games. *The American Journal of Psychiatry, 163*(3), 381-385.

Al-Natour, S., Benbasat, I., & Cenfetelli, R. T. (2006). The Role of Design Characteristics in Shaping Perceptions of Similarity: The Case of Online Shopping Assistants. *Journal of the Association for Information Systems, 7*(12), 821.

Amory, A., Naicker, K., Vincent, J., & Adams, C. (1999). The use of computer games as an educational tool: Identification of appropriate game types and game elements. *British Journal of Education Technology, 30*(4), 311-321.

Andsager, J.L., Bemker, V., Choi, H.L., & Torwel, V. (2006). Perceived similarity of exemplar traits and behavior: Effects on message evaluation. *Communication Research, 33*(3), 3-18.

Bailenson, J.N., Blascovich, J., & Guadagno, R.E. (2008). Self representations in immersive virtual environments. *Journal of Applied Social Psychology, 38*(11), 2673-2690.

Bailenson, J.N., Iyengar, S., Yee, N., & Collins, N. (2007, in press). Facial similarity as a voting heuristic. *Public Opinion Quarterly.*

Bailenson, J.N., Patel, K., Nielsen, A., Bajcsy, R., Jung, S., & Kurillo, G. (2008). The effect of interactivity on learning physical actions in virtual reality. *Media Psychology, 11*(3), 354–376.

Bandura, A. (1969). *Principles of behavior modification.* New York: Holt, Rinehart, & Winston.

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review, 84*(2), 191-215.

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory.* New Jersey: Prentice-Hall.

Bandura, A. (1989). Human agency in social cognitive theory. *American Psychologist, 44*(9), 1175-1184.

Bandura, A. (1990). Perceived self-efficacy in the exercise of personal agency. *Journal of Applied Sport Psychology, 2*, 128-163.

Bandura, A. (1997). *Self-efficacy: the exercise of control.* New York: W.H. Freeman.

Bandura, A. (2001). Social cognitive theory of mass communication. *Media Psychology, 3*, 265-299.

Bandura, A. (2006). Guide for constructing self-efficacy scales. In T. Urdan & F. Pajares (Eds.), *Self-efficacy beliefs of adolescents* (pp. 307-337). Charlotte, NC: Information Age Publishing.

Bandura, A., Ross, D., & Ross, S.A. (1963). A comparative test of the status envy, social power, and secondary reinforcement theories of identificatory learning. *Journal of Abnormal and Social Psychology, 67*, 527-534.

Basen-Engquist, K. (1994). Evaluation of a theory-based HIV prevention intervention for college students. *AIDS Education and Prevention, 6*(5), 412-424.

Bennett, S., Farrington, D.P., & Huesmann, L.R. (2005). Explaining gender differences in crime and violence: The importance of social cognitive skills. *Aggression and Violent Behavior, 10*, 263-288.

Bennet, J., Lyons, K.S., Winters-Stone, K., Nail, L.M., Scherer, J. (2007). Motivational interviewing to increase physical activity in long-term cancer survivors: A randomized controlled trial. *Nursing Research, 56*(1), 18-27.

Berger, S.M. (1977). Social comparison, modeling, and perseverance. In J.M. Suls & R.L. Miller (Eds.), *Social comparison processes: Theoretical and empirical perspectives* (pp. 209-234). Washington, DC: Hemisphere.

Berson, I.R., & Berson, M.J. (2005). Challenging online behaviors of youth: Findings from a comparative analysis of young people in the United States and New Zealand. *Social Science Computer Review, 23*(1), 29-38.

Bessiere, K., Seay, A.F., & Kiesler, S. (2007). The ideal elf: Identity exploration in World of Warcraft. *CyberPsychology & Behavior, 10*(4), 530-535.

Bobbitt, L.M., Inks, S.A., Kemp, K.J., & Mayo, D.T. (2000) Integrating marketing courses to enhance team-based experiential learning. *Journal of Marketing Education, 22*(1), 15-24.

Bosworth, K. (1994). Computer games and simulations as tools to reach and engage adolescents in health promotion activities. *Computers in Human Services, 11*(2), 109-119.

Braaksma, M.A.H., Rijlaarsdam, G., & van den Bergh, H. (2002). Observational learning and the effects of model-observer similarity. *Journal of Educational Psychology, 94*(2), 405-415.

Byrne, D. (1971). *The attraction paradigm.* New York: Academic Press.

Carroll, W. R., & Bandura, A. (1985). Role of timing of visual monitoring and motor rehearsal in observational learning of action patterns. *Journal of Motor Behavior, 17*(3), 269–281.

Chan, E., & Vorderer, P. (2006). Massively multiplayer online games. In P. Vorderer & J. Bryant (Eds.), *Playing computer games: motives, responses, and consequences.* Mahwah, NJ: Lawrence Erlbaum Associates.

Choi, S.M., & Rifon, N.J. (in press). It's a match: The impact of congruence between celebrity image and consumer ideal self on endorsement effectiveness. *Psychology & Marketing.*

Clark, S.E., & Ste-Marie, D.M. (2007). The impact of self-as-a-model interventions on children's self-regulation of learning and swimming performance. *Journal of Sports Sciences, 25*(5), 577-586.

Couzijn, M. (1999). Learning to write by observation of writing and reading processes: Effects on learning and transfer. *Learning and Instruction, 2*, 109-142.

Cumming, J., Clark, S., Ste-Marie, D., McCullagh, P., & Hall, C. (2005). The functions of observational learning questionnaire (FOLQ). *Psychology of Sport and Exercise, 6*, 517-537.

Debowski, S. (2002). Developing effective electronic information seekers. *Australian Journal of Management, 27*, 21-29.

Dickey, M.D. (2005). Engaging by design: How engagement strategies in popular computer and video games can inform instructional design. *Educational Technology Research and Development, 53*(2), 67-83.

Dipietro, M., Ferdig, R. E., Boyer, J., & Black, E. W. (2007). Towards a Framework for Understanding Electronic Educational Gaming. *Journal of Educational Multimedia and Hypermedia, 16*(3), 225.

Ebbinghaus, H. (1913). *Memory: A contribution to experimental psychology* (H.A. Ruger & C.E. Bussenius, Trans.) New York: Columbia University. (Original work published in 1885).

Egenfeldt-Nielsen, S. (2007). Third Generation Educational Use of Computer Games. *Journal of Educational Multimedia and Hypermedia, 16*(3), 263.

Egloff, T. H. (2004). Edutainment: A case study of interactive cd-rom playsets. *Computers in Entertainment, 2*(1), 13-13.

Entertainment Software Association. (2008). *Essential facts about the computer and video game industry.* Retrieved March 13, 2009, from http://www.theesa.com/facts/pdfs/ESA_EF_2008.pdf

Ericksen, M. K. (1996). Using self-congruity and ideal congruity to predict purchase intention: A European perspective. *Journal of Euromarketing, 6*(1), 41-56.

Farrington, D. P. (1998). Predictors, causes, and correlates of male youth violence. In M. Tonry, & M. Moore (Eds.), *Youth violence* (pp. 421–475). Chicago: University of Chicago Press.

Farrington, D. P. (2001a). Predicting adult official and self-reported violence. In G. F. Pinard, & L. Pagani (Eds.), *Clinical assessment of dangerousness: Empirical contributions* (pp. 66–88). Cambridge, England: Cambridge University Press.

Farrington, D. P. (2001b). The causes and prevention of violence. In J. P. Shepherd (Ed.), *Violence in health care* (2nd ed.) (pp. 1–27). Oxford, England: Oxford University Press.

Ferrari, M. (1996). Observering the observer: Self-regulation in the observational learning of motor skills. *Developmental Review, 16*(2), 203-240.

Festinger, L. (1954). A theory of social comparison processes. *Human Relations, 7*(2), 117-140.

Fox, J., & Bailenson, J.N. (2009). Virtual self-modeling: The effects of vicarious reinforcement and identification on exercise behaviors. *Media Psychology, 12*(1), 1-25.

Fruin, D. J., Pratt, C., & Owen, N. (1992). Protection motivation theory and adolescents' perceptions of exercise. *Journal of Applied Social Psychology, 22*(1), 55-69.

Gee, J.P. (2003). *What video games have to teach us about learning and literacy*. New York: Palgrave Macmillan.

Gentile, D.A., & Anderson, C.A. (2006). Video games. In N.J. Salkind (Ed.), *Encyclopedia of Human Development* (pp. 1303-1307). Thousand Oaks, CA: Sage Publications.

G*Power. (2008), for Windows (Version 2) [Computer Software]. Duesseldorf, Germany: Heinrich Heine University. Available from http://www.psycho.uni-duesseldorf.de/aap/projects/gpower/

Graeff, T. R. (1996). Using promotional messages to manage the effects of brand and self-image on brand evaluations. *Journal of Consumer Marketing, 13*(3), 4-18.

Graham S., & Harris, K. R. (1994). The role and development of self-regulation in the writing process. In D. H. Schunk & B. J. Zimmerman (Eds.), *Self-regulation of learning and performance: Issues and educational applications* (pp. 203-228). Hillsdale, N.J.: Erlbaum.

Graham, S., Harris, K. A., & Troia, G. A. (1998). Writing and self-regulation: Cases from the self regulated strategy development model. In D.H. Schunk & B.J. Zimmerman (Eds.), *Self-regulated learning, from teaching to self-reflective practice* (pp. 20-41). New York: The Guilford Press.

Green, M. C., Brock, T. C., & Kaufman, G. F. (2004). Understanding media enjoyment: The role of transportation into narrative worlds. *Communication Theory, 14*(4), 311-327.

Gremler, D.D., Hoffman, K.D., Keaveney, S.M., & Wright, L.K. (2000) Experiential learning exercises in services marketing courses. *Journal of Marketing Education, 22*(1), 35-44.

Grodal, T. (2000). Video games and the pleasures of control. In Zillmann, D., & Vorderer, P. (Eds.), *Media entertainment: The psychology of its appeal* (pp.197-214). Mahwah, NJ: Lawrence Erlbaum.

Gros, B. (2007). Digital Games in Education: The Design of Games-Based Learning Environments. *Journal of Research on Technology in Education, 40*(1), 23.

Hoffman, K.D., & Bateson, J.E.G. (1997). *Essentials of services marketing*. Fort Worth, TX: Dryden.

Holyoak, K.J., & Thagard, P. (1995). *Mental leaps: Analogy in creative thought*. Cambridge, MA: MIT Press/Bradford Books.

Jose, P. E., & Brewer, W. F. (1984). Development of story liking: Character identification, suspense, and outcome resolution. *Developmental Psychology, 20*(5), 911-924.

Kafai, Y.B. (1994). *Minds in play: Computer game design as a context for children's learning.* Mahwah, NJ: Lawrence Erlbaum.

Kim, Y., & Baylor, A. L. (2007). Pedagogical agents as social models to influence learner attitudes. *Educational Technology, 47*(1), 23-28.

Kim, Y., Baylor, A. L., Shen, E., & PALS Group (2007). Pedagogical agents as learning companions: The impact of agent affect and gender. *Journal of Computer-Assisted Learning, 23*(3), 220-234.

Kim, Y., Wei, Q., Xu, B., Ko, Y., & Ilieva, V. (2007, July). *MathGirls: Increasing Girls' Positive Attitudes and Self-Efficacy through Pedagogical Agents.* Paper presented at the 13th International Conference on Artificial Intelligence in Education (AIED 2007): Los Angeles, CA. July 9-13, 2007.

Kolb, D. A. (1984). *Experiential learning: Experience the source of learning and development.* Englewood Cliffs, NJ: Prentice Hall.

Kwon, M. (1996, January). *The use of planned comparisons in analysis of variance research.* Paper presented at the Annual Meeting of the Southwest Educational Research Association: New Orleans, LA. January, 1996.

Landers, D. M. (1975). Observational learning of a motor skill: temporal spacing of demonstration and audience presence. *Journal of Motor Behavior, 7*, 281-287.

LaRose, R., & Rifon, N.J. (2007). *Online safety begins with you and me: Getting Internet users to protect themselves.* Paper presented at the 57th Annual Conference of the International Communication Association: Montreal, Quebec, Canada. May, 2007.

Lee, J.E.R., Nass, C., Brave, S.B., Morishima, Y., Nakajima, H., & Yamada, R. (2007). The case for caring colearners: The effects of a computer-mediated colearner agent on trust and learning. *Journal of Communication, 57*, 183-204.

Lee, T. D., & White, M. A. (1990). Influence of an unskilled model's practice schedule on observational motor learning. *Human Movement Science, 9*, 349–367.

Leifer, A.D., Collins, W.A., Gross, B.M., Taylor, P.H., Andrews, L., & Blackmer, E.R. (1971). Developmental aspects of variables relevant to observational learning. *Child Development, 42*(5), 1509-1516.

Lerner, R.M., & Steinberg, L.D. (2004). *Handbook of Adolescent Psychology*. New Jersey: John Wiley and Sons.

Lewis, M. L., Weber, R., & Bowman, N. D. (2008). They may be pixels, but they're MY Pixels: Developing a metric of character attachment in role-playing video games. *CyberPsychology and Behavior, 11*(4), 515-518.

Lieberman, D. (2001). Management of chronic pediatric diseases with interactive health games: Theory and research findings. *Journal of Ambulatory Care Management, 24*(1), 26-38.

Lieberman, D. (2006). What can we learn from playing interactive games? In P. Vorderer & J. Bryant (Eds.), *Playing computer games: Motives, responses, and consequences*. Mahwah, NJ: Lawrence Erlbaum Associates.

Livingstone, S., Bober, M., & Helsper, E. (2005). Internet literacy among children and young people: findings from the UK Children Go Online Project [online]. London: LSE Research Online. Available at: http://eprints.lse.ac.uk/archive/00000397.

Lockwood, P., & Kunda, Z. (1997). Superstars and me: Predicting the impact of role models on the self. *Journal of Personality and Social Psychology, 73*(1), 91-103.

Lovelock, C.H., & Wright, L.K. (1999). *Principles of service marketing and management*. Upper Saddle River, NJ: Prentice Hall.

Ludman, E., VonKorff, V., Katon, W., Lin, E., Walker, E., Bush, T. & Wahab, S. (2000). The design, implementation, and acceptance of a primary care-based intervention to prevent depression relapse. *International Journal of Psychiatry in Medicine, 30*(9), 229-245.

Mackenzie, C.S., & Peragine, G. (2003). Measuring and enhancing self-efficacy among professional caregivers of individuals with dementia. *American Journal of Alzheimer's Disease and Other Dementias, 18*(5), 291-299.

Making History. (2007). Retrieved July 14, 2007, from http://www.making-history.com/edu/index.php

Markman, A.B., & Gentner, D. (1993). Structural alignment during similarity comparisons. *Cognitive Psychology, 25*, 431-467.

Maudsley, G., & Strivens, J. (2000). Promoting professional knowledge, experiential learning and critical thinking for medical students. *Medical Education, 34*, 535-544.

May, S. A. (1994). The best in role-playing games. *Compute, 16*(1), S10-S11.

Mayo, M. J. (2007). Games for Science and Engineering Education. *Association for Computing Machinery. Communications of the ACM, 50*(7), 30.

Meng, X.L., Rosenthal, R., & Rubin D.B. (1992). Comparing correlated correlation coefficients. *Psychological Bulletin, 111*(1), 172-175.

Miller, N.E., & Dollard, J. (1941). *Social learning and imitation*. New Haven: Yale University.

Mori, M. (1970). The uncanny valley (K. F. MacDorman & T. Minato, Trans.). *Energy, 7*(4), 33-35.

Nielsen, J. (1997, October 1). How users read on the web. *Alertbox*. Retrieved March 2, 2009, from http://www.useit.com/alertbox/9710a.html

Nielsen, J. (2006, April 17). F-Shaped pattern for reading web content. *Alertbox*. Retrieved March 2, 2009, from http://www.useit.com/alertbox/reading_pattern.html

Oatley, K. (1994). A taxonomy of the emotions of literary response and a theory of identification in fictional narrative. *Poetics, 23*, 53-74.

Ohanian, R. (1989). Ego centrality as an indicator of enduring product involvement. *Journal of Social Behavior and Personality, 4*(3), 443–455.

Pollock, B. J., & Lee, T. D. (1992). Effects of the model's skill level on observational motor learning. *Research Quarterly for Exercise and Sport, 63*, 25–29.

Prensky, M. (2005). Computer games and learning: Digital game- based learning. In J. Raessens & J. Goldstein (Eds.), *Handbook of Computer Game Studies* (pp. 97-122). Cambridge, MA: The MIT Press.

Quilliam, E. T., Rifon, N. J., LaRose, R. J., & Carlson, L. (2006). Losing my good name: Teens, online privacy, and identity theft, *Marketing & Public Policy Conference*. Washington, D.C.

Reeves, B., & Nass, C. (1996). *The Media Equation – How People Treat Computers, Television and New Media Like Real People and Places*. Cambridge: Cambridge University Press.

Rice, J. W. (2007). New Media Resistance: Barriers to Implementation of Computer Video Games in the Classroom. *Journal of Educational Multimedia and Hypermedia, 16*(3), 249.

Riddle, J. (2002). Cameras and Point-of-view in the gamespace. In *SIGGRAPH2002 Proceedings, ACM,* 155. San Antonio, TX.

Rimal, R. N., & Real, K. (2003). Perceived risk and efficacy beliefs as motivators of change: Use of the risk perception attitude (RPA) framework to understand health behaviors. *Human Communication Research, 29*(3), 370-399.

Rippetoe, P. A., & Rogers, R. W. (1987). Effects of components of protection-motivation theory on adaptive and maladaptive coping with a health threat. *Journal of Personality and Social Psychology, 52*(3), 596-604.

Ritterfeld, U., & Weber, R. (2006). Video games for entertainment and education. In P. Vorderer & J. Bryant (Eds.), *Playing computer games: Motives, responses, and consequences* (pp. 399-413). Mahwah, NJ: Lawrence Erlbaum.

Ritterfeld, U., Weber, R., Fernandes, S., & Vorderer, P. (2004). Think science!: Entertainment education in interactive theaters. *Computers in Entertainment, 2*(1), 11-11.

Rosekrans, M.A. (1967). Imitation in children as a function of perceived similarity to a social model and vicarious reinforcement. *Journal of Personality and Social Psychology, 7*(3), 307-315.

Schriver, K. A. (1992). Teaching writers to anticipate readers' needs: A classroom-evaluated pedagogy. *Written Communication, 9* (2), 179-208.

Schunk, D. H. (1987). Peer models and children's behavioral change. *Review of Educational Research, 57,* 149-174.

Schunk, D.H., & Hanson, A.R. (1985). Peer models: Influence on children's self-efficacy and achievement. *Journal of Educational Psychology, 77*(3), 313-322.

Schunk, D. H., & Hanson, A.R. (1989a). Influence of peer-model attributes on children's beliefs and learning. *Journal of Educational Psychology, 81*, 431-434.

Schunk, D. H., & Hanson, A.R. (1989b). Self-modeling and children's cognitive skill learning. *Journal of Educational Psychology, 81*, 155-163.

Schunk, D.H., Hanson, A.R., & Cox, P.D. (1987). Peer model attributes and children's achievement behaviors. *Journal of Educational Psychology, 79*(3), 54-61.

Sherry, J.L. (2001). The effects of violent video games on aggression. *Human Communication Research, 27*(3), 409-431.

Singhal, A.S., Cody, M. J., Rogers, E. M. and Sabido, M. (2004). *Entertainment education worldwide: History, research, and practice*. Mahwah, NJ: Lawrence Erlbaum.

Singhal, A.S., & Rogers, E.M. (2002). A theoretical agenda for entertainment-education. *Communication Theory, 12*(2), 117-135.

Sirgy, M.J. (1985). Using self-congruity and ideal congruity to predict purchase motivation. *Journal of Business Research, 13*(3), 195-206.

Skinner, B.F. (1953). *Science and human behavior.* New York: Macmillan.

Slater, M. D. (2002). Entertainment Education and the persuasive impact of narratives. In M. C. Green (Ed.), *Narrative Impact: Social and Cognitive Foundations*. Mahwah, NJ: Lawrence Erlbaum Associates.

Smed, J., & Hakonen, H. (2003). *Towards a definition of a computer game*. TUCS Technical Report No. 553). Turku Centre for Computer Science.

Sonnenschein, S., & Whitehurst, G. J. (1983). Training referential communication skills: The limits of success. *Journal of Experimental Child Psychology, 35,* 426-436.

Sonnenschein, S., & Whitehurst, G. J. (1984). Developing referential communication: A hierarchy of skills. *Child Development, 55,* 1936-1945.

Spencer, J. (2003). Learning and teaching in the clinical environment. *British Medical Journal, 326*(7389), 591-594.

SPSS, Inc. (2009), for Windows (Version 17.0) [Computer Software]. Chicago, IL: SPSS, Inc.

Stanton, F., & Grant, J. (1999). Approaches to experiential learning, course delivery and validation in medicine: A background document. *Medical Education, 33*, 282-297.

Subrahmanyam, K., & Greenfield, P.M. (1994). Effect of video game practice on spatial skills in girls and boys. *Journal of Applied Developmental Psychology, 15*, 13-32.

Tafarodi, R. W., Mehranvar, S., Panton, R. L., & Milne, A. B. (2002). Putting oneself in the task: Choice, personalization, and confidence. *Personality & Social Psychology Bulletin, 28*(5), 648-658.

Thomas, R., Cahill, J., & Santilli, L. (1997). Using an interactive computer game to increase skill and self-efficacy regarding safer sex negotiation: Field test result. *Health Education and Behavior, 24*(1), 71-86.

Thomas, J.R., Pierce, C., & Ridsdale, S. (1977). Age differences in children's ability to model motor behavior. *Research Quarterly, 48*, 592-597.

Turner, M. M., Rimal, R. N., Morrison, D., & Kim, H. (2006). The role of anxiety in seeking and retaining risk information: Testing the risk perception attitude framework in two studies. *Human Communication Research, 32*(2), 130-156.

Turow, J., & Nir, L. (2000). *The internet and the family 2000: The view from parents, the view from kids*. Philadelphia: The Annenberg Public Policy Center.

Vorderer, P., Klimmt, C., & Ritterfeld, U. (2004). Enjoyment: At the heart of media entertainment. *Communication Theory, 14*(4), 388-408.

Vorderer, P., & Ritterfeld, U. (2003). Children's future programming and media use between entertainment and education. In E.L. Palmer & B. Young (Eds.), *The faces of televisual media: Teaching, violence, selling to children* (2nd ed., pp. 241-262). Mahwah, NJ: Lawrence Erlbaum Associates.

Walshe, D.G., Lewis, E.J., Kim, S.I., O'Sullivan, K., & Wiederhold, B.K. (2003). Exploring the use of computer games and virtual reality in exposure therapy for fear of driving following a motor vehicle accident. *CyberPsychology & Behavior, 6*(3), 329-334.

Weber, R., Ritterfeld, U., & Kostygina, A. (2006). Aggression and violence as effects of playing violent video games? In P. Vorderer & J. Bryant (Eds.), *Playing computer games: Motives, responses, and consequences*. Mahwah, NJ: Lawrence Erlbaum.

Weeks, D.L., & Anderson, L.P. (2000). The interaction of observational learning with overt practice: Effects on motor skill learning. *Acta Pscyhologica, 104*, 259-271.

Weiss, M.R., McCullagh, P., Smith, A., & Berlant, A. (1998). Observational learning and the fearful child: Influence of peer models on swimming skill performance and psychological responses. *Research Quarterly for Exercise and Sport, 69*, 380-394.

Wesch, N.N., Law, B., & Hall, C.R. (2007). The use of observational learning by athletes. *The Journal of Sport Behavior, 30*(2), 219-231.

Wirth, C.B., Rifon, N.J., LaRose, R., and Lewis, M.L. (2007). Promoting teenage online safety with an i-Safety intervention: Enhancing self-efficacy and protective behaviors. Paper presented at the Annual Meeting of the International Communication Association: Montreal, Quebec, Canada. May, 2007.

Wood, N.T., Solomon, M.R., & Englis, B.G. (2005). Personalisation of online avatars: Is the messenger as important as the message? *International Journal of Internet Marketing and Advertising, 2*(1/2), 143-161.

Wood, R.E., Kakebeeke, B.M., Debowski, S., & Frese, M. (2000). The Impact of enactive exploration on intrinsic motivation, strategy, and performance in electronic search. *Applied Psychology, 49*(2), 263-283.

Wright, L.K., Bitner, M.J., & Zeithaml, V.A. (1994). Paradigm shifts in business education: Using active learning to deliver services marketing content. *Journal of Marketing Education, 16*(fall), 5-19.

Yee, N. (2004). Unmasking the Avatar: The Demographics of MMO Player Motivations, In-Game Preferences, and Attrition. *Gamasutra*. Retrieved March 1, 2009, from http://www.gamasutra.com/view/feature/2139/unmasking_the_avatar_the_.php

Yoon, S. L., & Godwin, A. (2007). Enhancing Self-Management in Children with Sickle Cell Disease Through Playing a CD-ROM Educational Game: A Pilot Study. *Pediatric Nursing, 33*(1), 60.

Zimmerman, B.J., & Koussa, R. (1975). Sex factors in children's observational learning of value judgments of toys. *Sex Roles, 1*(2), 121-132.

Zimmerman, B.J., & Schunk, D.H. (2001). *Self-regulated learning and academic achievement: Theoretical perspectives.* New Jersey: Lawrence Erlbaum Associates.