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Learning from Myself: Avatars and Educational Video Games

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This research explores which conditions for video game play are more effective in producing outcomes such as knowledge retained, involvement, behavioral intention, enjoyment, and self-efficacy. Additionally, given that identification with a model increases positive learning results and given the history of avatar use showing that people tend to idealize themselves in avatar form, expectations are that an ideal-self avatar would yield the greatest learning outcomes, followed by real-self avatar (both conditions that offer extreme identification), and lastly the third-party avatar. Self-efficacy was higher in the enactive condition. The ideal self condition resulted in the highest levels of involvement and enjoyment of game, learning, and avatar, indicating that the ideal-self avatar may have the stronger relationship with these variables.

Keywords: avatars, learning, educational video games, social cognitive theory, observational learning, enactive learning, self-efficacy

The debate over how people learn best is constantly evolving. Do we learn best by diving in headfirst, a trial-by-fire approach? Or is it best to observe someone else first and then imitate that behavior? Researchers have differing opinions, and so we are left with two very different theoretical approaches to learning. Social Cognitive Theory (SCT) places the greater emphasis on observational learning, or learning by watching a model produce a behavior before doing it oneself (Bandura, 1977, 1989). Other researchers purport that experiential learning, or learning by doing, results in stronger learning (Kolb, 1984). Much research has been done regarding learning outcomes under both theories, but application of these theories to video games (a relatively new educational development) is scarce.

Translating SCT and experiential learning into the world of video games requires a look at how the two theories view models (or avatars, in video game terminology). According to SCT, learning will be optimized if the learner closely identifies with the model, while experiential learning does not include a model. In educational gaming, an experiential approach would take a first-person perspective, casting the player in the role of the main character, while a social cognitive approach would require players to watch a character on the screen and then reproduce the behavior themselves.

Two questions arise when considering observational and experiential learning in the context of educational video games: Is observational learning more effective than experiential learning when applied to video games? And if so, with what would we feel the most similarity: our actual self, our ideal self, or some third party character? This paper discusses an original experiment intended to provide preliminary answers to these questions. The experiment uses an electronic video game that manipulates both agency and similarity as the stimulus material.

Observational versus Experiential Learning

Every human being has at least some capacity for learning, but how that learning occurs can be explained in different ways. SCT, developed by Albert Bandura (1986), explains learning and behavior as a combination of behavioral, personal, and environmental interactions. Observation, according to Bandura, is the key to learning (Lerner & Steinberg, 2004). How well an individual learns depends on how carefully that person observes what some other person (the model) is doing (Ferrari, 1996). Visual demonstration is one of the most powerful ways to communicate behavioral and cognitive patterns (Wesch, Law, & Hall, 2007). Therefore, watching someone do something clarifies the expectations for the behavior to follow. Observational learning can also be more efficient than enactive learning (Adams, 1986; Ferrari, 1996; Lee & White, 1990; Pollock & Lee, 1992; Weeks & Anderson, 2000). Learners make fewer mistakes when there is a model for observation first. 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).

The effectiveness of modeling (in other words, observation) has been shown numerous times in research, especially with regard to children (Bennett, Farrington, & Huesmann, 2005; Farrington, 1998, 2001a, 2001b). 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). Similarity between the model and the individual, one of the aspects of observational learning, impacts learning outcomes (Schunk, 1987). As the perceived similarity between the individual and the model increases, the influence that the model has on the subject's behavior increases as well (Bandura, 1986). In plainer terms, the more similarity there is between learner and model, the better the potential for learning. 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, & van den Bergh, 2002). Subjects that are high in similarity to the model with regard to background produce more modeled behavior (Rosekrans, 1967; Schunk, 1987). Related to this, observational learning can also affect a number of other variables, including motivation to change, or to perform a behavior (Wesch et al., 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 or she can succeed, which can in turn influence 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 without prior observation of behavior. Kolb (1984) developed the experiential learning cycle, composed of four stages. First is the concrete experience stage (where the 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. Behaviorists like Skinner (1953) explain that behavior is reinforced by consequences, known as shaping. Experiential learning theory holds that learning is most effective when it is based on personal experience (Spencer, 2003). This type of learning is often used effectively for subjects such as marketing (Bobbitt, Inks, Kemp, & Mayo, 2000; Gremler, Hoffman, Keaveney, & Wright, 2000; Hoffman & Bateson, 1997; Lovelock & Wright, 1999; Wright, Bitner, & Zeithaml, 1994) and medicine (Maudsley & Strivens, 2000; Stanton & Grant, 1999). Indeed, experiential learning may allow people to form adequate skills, but not optimal skills (Bandura, 1986).

But what happens when we can do both at once? Video games allow players to have both observational learning (through observing the character they are controlling) as well as experiential learning. Would the sheer presence of a model (the presence of an avatar) be enough to make a difference regarding learning? It is impossible to have a truly observational condition in a video game, as games need players, rules, and goals as indicated by Smed and Hakonen (2003). If player input is eliminated, it is no longer a game. However, just the appearance of a model might make a difference. Lee et al. (2007) discuss the effect of a co-learner in an electronic environment, citing that many children's television programs 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, and serving as a model for the target behavior. In the case of video game avatars, the avatar becomes a co-learner of sorts. So taking the SCT stance, it would be expected that the presence of a model (the co-learner, or avatar) would lead to more learning. Thus:

> H1: Learning with a model present will lead to (a) more knowledge retained, (b) more enjoyment, and (c) more involvement with the topic than experiential learning (without the model).

The Role of Self-Efficacy in Learning

Self-efficacy is defined specifically by Bandura (1997) as the belief in one's capability to engage in a particular course of action to achieve important attainments. Bandura (1977) describes four sources of efficacy expectations: verbal persuasion, emotional arousal, vicarious experience, and performance accomplishments. The two more effective sources of self-efficacy are vicarious experience and progressive mastery. Vicarious experience explains how we learn by watching others (linked with observational learning). 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 (linked with experiential learning).

The opportunity to rehearse behavior is a strong predictor of self-efficacy (Thomas, Cahill, & Santilli, 1997) resulting 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; Bennet, Lyons, Winters-Stone, Nail, & Scherer, 2007; Ludman et al., 2000; Mackenzie & Peragine, 2003). Self-efficacy 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). If experiential learning is the better source of self-efficacy in previous research, the same should be true for video games.

H2: Experiential learning will lead to higher levels of self-efficacy than learning with a model.

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: Experiential learning will result in greater intentions to perform safe online behavior than learning with a model.

The Case of Avatars

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). 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 (Amory, Naicker, Vincent, & Adams, 1999; Bosworth, 1994; Egenfeldt-Nielsen, 2007; Egloff, 2004; Kafai, 1994; Lieberman, 2001; Ritterfeld & Weber, 2006; Singhal, Cody, Rogers, & Sabido, 2004; Subrahmanyam & Greenfield, 1994; Thomas et al., 1997; Walshe, Lewis, Kim, O'Sullivan, & Wiederhold, 2003; Yoon & Godwin, 2007). 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).

One of the big attractions of video games is the ability to use avatars. Avatars are "digital models driven by real-time humans" that may either look like or behave like the humans controlling them (Bailenson, Yee, Merget, & Schroeder, 2006, p. 359). Avatars have been studied with regard to persuasive communication in the advertising realm (Wood, Solomon, & Englis, 2005). Consumers preferred idealized images of avatars to realistic ones, and 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 likes the avatar, then that extends to the game content. The avatar may not even have to physically resemble the individual for adequate levels for identification to be reached (Bailenson, Blascovich, & Guadagno, 2008). In other words, people might identify with an avatar that does not physically resemble them, just because they believe that avatar to be an extension of themselves.

SCT explains that people imitate characters they find attractive; they learn and reproduce the behavior of those to whom they are drawn. 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. Research is scarce, but one study by Fox and Bailenson reported 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 some other individual running (2009). The use of self as a model in an electronic environment appears to motivate the individual more than the use of another as a model. The idea of reproducing the behavior shown in a video game is also part of the explanation for those that believe that violent video games cause increased aggression (Sherry, 2001). Players identify with the model and then "learn" that behavior; they transfer the aggression to real life.

The potential exists for self-efficacy and involvement (and subsequently learning) to increase when an individual sees himself being successful. 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 themselves to a degree in another's image increases positive response (Bailenson, Iyengar, Yee, & Collins, 2008). But which is the more effective self—ideal or real?

Part of the attraction of playing a game with a customizable avatar is that users can create idealized versions of themselves and act through those idealized versions in the video game. Bessiere, Seay, and Kiesler (2007) found that people prefer to make idealized avatars. 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, including the information contained within the game (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. As indicated earlier regarding SCT, as the perceived similarity between the individual and the model increases, the greater the influence of the model on the subject (Bandura, 1986). Again, the more similarity there is between model and learner, the more learning there will be.

Thus, identification with a subject should lead to greater learning (Bandura, 2001; Weber, Ritterfeld, & Kostygina, 2006). Research suggests that the most effective models should be similar but slightly better than the learner in intelligence, socioeconomic success, and competence (Bandura, 1969), similar to the learner in social status (Miller & Dollard, 1941), and in possession of 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.

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 avatar, defined here as the self that one wants to be but currently is not, will have the greatest impact on the outcome variables, followed by the real-self avatar. 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.

Method

Sample

A sample of 314 subjects was obtained through two waves of random sampling of students attending a large Midwestern university. 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.

The Stimulus Instrument

The current experiment uses an educational video game created specifically for this project that is based on the curriculum developed through the i-Safety project. 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.

Research indicates a steady trend that adolescents lack 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 said they could fix a problem with their computer; less than one in five reported that they 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).

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. The game, SafetyNet, begins by informing players that they have just been given a new job: a security guard for their family's computer.

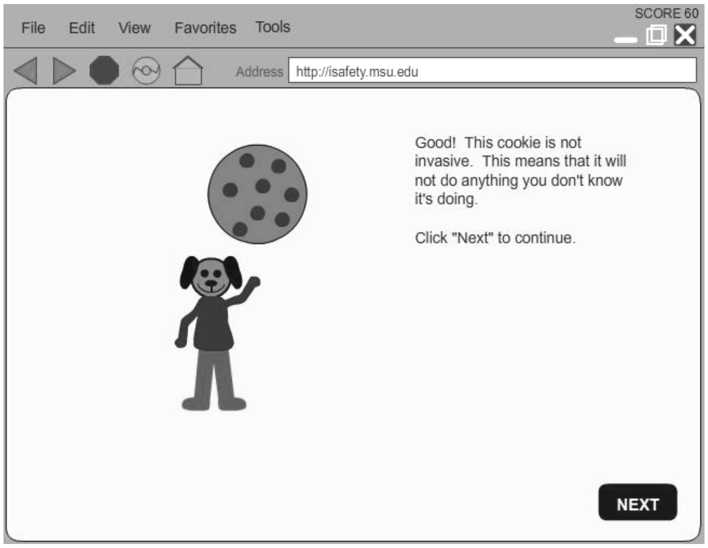

Figure 1. Accepting a non-invasive cookie in the video game with an avatar.

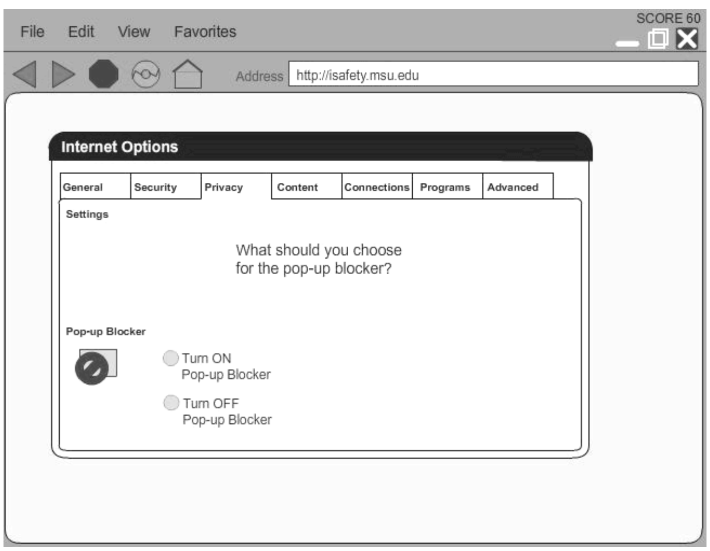

Figure 2. Changing the pop-up blocker status in the video game without an avatar.

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 the game to earn their badge.

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 (the cookies actually appear as chocolate-chip cookies, for instance). In order to battle these threats, players must have knowledge of how to be safe online.

When a decision is made and action taken in the game, 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. Two representative screenshots are shown in Figure 1 and Figure 2.

The Avatar Manipulation

While most games give players the opportunity to physically manipulate their avatar to make it look like what the player wants, the physical appearance of the avatar in this research remained constant. While this might seem counterintuitive, the major reason for not allowing physical customization of the avatar was to avoid confounding any results with the various customization options. For example, hairstyle might have been the defining physical characteristic that allowed one player to identify with an avatar, but eye color might have been the defining physical characteristic for another game player. However, there would be no way of knowing which piece was the key. In order to eliminate these confounds, all players playing with the avatar were given the same avatar. Indeed, research even suggests that just believing the avatar is a representation of self can allow identification to take place between avatar and individual, even if the avatar doesn't physically resemble the individual (Bailenson et al., 2008).

However, rather than allowing physical customization, players were shown a block of text prior to entering the game where they were asked to imagine that the avatar they were presented with (a two-dimensional figure with human body and limbs and the head of a dog) was one of three things: their ideal self, their real self, or a friend of theirs. (Six different avatar heads were pretested to determine which was most effective.) An animal head 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. For instance, if six types of hairstyles were given as options, they may have matched certain players' real or ideal hairstyle more closely than other players', creating less of a match between what players wanted and what was available. Only giving players one option for an avatar attempted to eliminate matching the avatar to some participants more closely than others.

As well, textual priming has been used in numerous studies to great effect. Typically, these priming activities involve giving participants tasks to groom them to respond in certain ways. As an example, one strain of research demonstrates that people can be primed to think of themselves as individuals (independent selves) or as group members (interdependent selves) (Gardner, Gabriel, & Lee, 1999; Kühnen & Oyserman, 2002). Thus, it is possible to prime people to think of themselves in different ways. However, priming research is usually concerned with doing this in a way that masks the true intent; participants don't know how they're being primed to think, but the text is enough to get them to think it. Research by Hess, Henson, and Statham (2004) deals with priming regarding aging and stereotypes, but also discusses explicit priming—priming where the individual is aware of the prime. Guiding participants with words or tasks can cause them to respond in different ways according to aspects of their personality.

In sum, the literature suggests first, that individuals may identify with an avatar that is physically different from them, and second, that it is possible to prime individuals to think of themselves in certain ways. Therefore, this experiment utilized explicit priming, asking participants before they began the game to think of their real selves (who they are right now), their ideal selves (the kind of person they wish they could be), or a third party (a friend of theirs). Then they were asked to attribute those characteristics to the avatar with which they would be presented and play the game.

Procedure

Subjects were randomly assigned to one of four treatment conditions. After entering their log-in name to the online application, participants were randomly sent to a webpage for one of the four conditions (ideal self, real self, friend, or the no-avatar enactive condition) 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.

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:

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

A_{ij} = *avatar image (i) of individual (*j)

I_{ij} = *ideal self-image (i) of individual (j)*

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. Self-efficacy was measured using items created based on Bandura's (2006) guide for constructing self-efficacy scales. Subjects were asked to rate how much they agreed, on a 7-point Likert-type scale (1 being "Strongly Disagree" and 7 being "Strongly Agree") with statements such as "I am confident that I can recognize a phishing attack". Enjoyment was measured by asking participants to rate how much they enjoyed playing the game, learning the information, and playing with the avatar on a seven-point Likert-type scale (1 being "not at all" and 7 being "a great deal"). Involvement was operationalized and measured using a five-item semantic differential scale based on a scale developed by Ohanian (1989). 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 created for the i-Safety project. Intention to enact behaviors was based on questions previously created for a separate research project regarding the i-Safety project asking participants to rate, on a 7-point scale from Very Unlikely to Very Likely, how likely it was that they would enact the behaviors learned in the game (LaRose & Rifon, 2007).

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. Alpha values greater than .8 typically indicate a high level of reliability. The ten knowledge questions resulted in a mean of 7.92, SD = 1.38, and a Kuder-Richardson Formula 20 value of .50. A KR-20 value of greater than .9 indicates high homogeneity.

Results

The textual manipulation (the prime) 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.

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.

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, as planned comparisons can offer more power than traditional MANOVA followed by post hoc tests (Kwon, 1996). Results are reported in Table 1.

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

Hypothesis 2 indicated that self-efficacy would be higher for individuals in the enactive condition than for those in the model-present condition. 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 experiential condition than in the model-present condition. Effect size for self-efficacy using Cohen's *d* was .24. Hypothesis 2 was therefore supported.

Hypothesis 3 posited that individuals in the experiential learning condition would report greater intentions of performing safe online behaviors that they had learned in the video game than would those in the model-present condition. The multivariate analysis of variance did not result in a significant difference between groups on the behaviors.

Hypothesis 4 stated that the ideal-self avatar would 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. The planned contrasts did not show significant differences (though the means on enjoyment of learning, involvement, and behavioral intentions were all highest in the ideal condition). However, when the standardized distance measures between avatar and other (ideal self, real self, and friend) were used as continuous variables and correlated with the dependent variables in a post hoc analysis, significant correlations were found. 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 2 between the conditions. Examining all of these results, hypothesis 4

Table 1
Significance Values for Planned Comparisons Between Enactive and Avatar 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

Table 2
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
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 $p < .05$

is therefore partially supported.

Discussion

While several of the hypotheses were not supported (though the results are promising and merit further investigation), the results that were significant, in particular the results of hypothesis 4, could have important implications pertaining to education. Specifically they give educators and game designers a preliminary picture of what could be important in designing video games intended to teach. Hypothesis 1 showed that the simple presence of a model, or avatar, was not significant enough to create differences in knowledge gained, enjoyment, and involvement. Thus, these outcomes were similar regardless of category. The same was true of behavioral intentions, and self-efficacy was higher in the no-avatar condition, so it may be tempting to say that the presence or absence of an avatar doesn't matter, or even that we might be better off without an avatar.

However, when hypothesis 4 was examined, 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 the expected differentiation between the real-self and the third-party conditions (the correlations between the real-self scores and the friend scores with the dependent variables yielded the same values). But the ideal-self condition consistently indicated more enjoyment and greater involvement with the material, indicating that the ideal-self avatar may have the stronger relationship with these variables. Even if game players using their ideal-self avatar do not experience more learning or higher levels of self-efficacy, the fact that they enjoy the experience more and are more involved suggests that they will return to the material (Ritterfeld, Weber, Fernandes, & Vorderer, 2004; Vorderer & Ritterfeld, 2003). The point is not that learning and self-efficacy are not of primary importance; indeed, they are. But if we can design a learning experience where there is more enjoyment of the learning process and more involvement with the material, then we may ultimately produce learners who are eager to return and learn more.

Making learning into a game makes the learning intrinsically motivating (Lepper & Cordova, 1992). According to Deci and Ryan (1985), intrinsic motivation means doing something for its own sake. Conversely, extrinsic motivation means doing something to get some separate goal met. Numerous studies have cited the positive effects of intrinsic motivation (Ferrer-Caja & Weiss, 2000). If we can increase enjoyment and involvement with a video game through the simple act of asking learners to imagine the avatar as their ideal selves, then we have created intrinsic motivation by turning learning into something fun, enjoyable, and rewarding. Lepper and Cordova (1992) conducted several studies and found that intrinsic motivation "can include increased learning and retention of the material, greater generalization of that learning, heightened subsequent interest in the subject matter, enhanced confidence in the learner, and improvements in the actual process of learning" (p. 203). It may not be the ultimate goal to turn every learning experience into a game, nor should it, but knowing what could influence unmotivated learners may help educators reach that population with more success.

In sum, this research has begun to paint a picture of what can be done to have a better educational experience with video games designed to teach. Educators struggle to reach students who do not want to learn. If the avatar conditions result in a similar amount of learning across them, but greater enjoyment and involvement with the material in the ideal-self condition, this may be one way to entice unengaged students to learn. One way educators might approach this when using electronic games as teaching tools is to help students identify with the game character, regardless of personalization options. If the educator simply instructs learners to imagine that the game character is an ideal representation of themselves, as this research indicates, the suggestion is enough to create the connection between character and ideal self. Enjoyment increases, encouraging reluctant learners to engage as well as encouraging them to continue with learning and return to the game. As well, involvement with the material increases, too, strengthening the connection between the learner and the material. In simpler terms, students will care more about the material and feel it is more important to them when they make this connection with the game character.

From a technical perspective, game designers of educational video games may use this information to strengthen the connection between player and character. One method might be to ask game players to describe their ideal selves using their own words (including a name) and then plugging those specific words into dialogue throughout the game. Being able to plug in the player's name and attributes may make the connection stronger as players progress. A second, more complicated option is to allow players to personalize the physical appearance of the character. Even an interface as simple as Nintendo's Wii, which allows players to create versions of themselves, known as Miis, to be used in various games, has options for gender, skin tone, height, weight, hair color and style, eye color and shape, nose shape, mouth color and shape, clothing color, and name. Asking players to create a physically ideal version of themselves may strengthen the connection, because most research regarding similarity and identification has been done using physical similarity to make the connection (Bandura, 1989, 2001; Wood et al., 2005).

The final technical option to be offered here is a combination of the two above suggestions coupled with an advanced form of computer programming that can take the descriptive words and physical choices and create a very specific character that behaves according to the descriptive adjectives and looks like the physical creation. The stronger the connection between the player and the character in the form of the player's ideal self, the more the learner will enjoy and, even more importantly, feel involved with the material. This research cannot indicate which of these possibilities is the strongest option for maximizing the connection between the character and the player, but it does give designers a starting point to optimize the learning experience in terms of enjoyment and engagement.

Limitations and Future Directions

It is difficult for gamers to form an instant bond with a video game character; the connection between player and character strengthens as the player spends more time with the character (Lewis, Weber, & Bowman, 2008). 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. Another study might employ two lengths of exposure, but still with the three types of avatar. Individuals in the first set of conditions (ideal-self avatar, real-self avatar, other avatar) could be instructed to play the game only once while the second triad of conditions could be instructed to play for a certain length of time, to play through a certain number of times, or even to offer them a chance to play other games in between time with the educational game. This would allow comparisons between the connection with type of self (or third party) and avatar gained in a short time versus a longer time. As well, extended time would allow for a stronger connection to develop between the player and a neutral third party character.

Related to the above, use of a friend condition rather than a totally 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. Because it takes time to form a connection with a game character, using a friend that the game player already has a connection with allowed players to more adequately have an impression of the character. Rather than risking random answers 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.

Finally, research on modeling in SCT 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. 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, the relationships for knowledge and self-efficacy 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 et al., 2005). In line with similarity research, physical similarity may have yielded different results. Future research should better explore the use of technology that allows for better quality avatars that are personalized for each respondent, potentially utilizing 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.

But perhaps players do not need to be physically convinced about the similarity of their avatars to themselves. Perhaps players need to be psychologically linked to their avatar in order to experience the greatest positive learning outcomes, and linked using their ideal selves. If self-efficacy was 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. 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.

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