Evaluating the Relationship between Cognitive Style and Pre-Service Teachers' Preconceived Notions about Adopting Console Video Games for Use in Future Classrooms

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ABSTRACT

This article explores the impact of perceptual cognitive styles on pre-service teachers' attitudes toward video games. Using a cognitive style continuum measuring field dependence and field independence, the authors conducted an exploratory study to measure the potential impact of cognitive style on pre-service teachers' dispositions towards the use of games in their future classrooms. Results showed that participants who planned on becoming teachers were generally found to be more field dependent than peers who elected other major fields of study. These participants also demonstrated a general reluctance towards using console games in their future classroom situations. After the brief experience playing the console game, however, these pre-service teachers' attitudes changed significantly with regards to their game playing attitudes and preferences.

Keywords: *Attitudes, Classrooms, Console, Education, Field Dependence, Field Independence, Group Embedded Figures Test (GEFT), Learning, Microsoft Xbox 360, Nintendo Wii, Teaching, Video Games*

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INTRODUCTION

In this article, we review the results of a study in which we investigate the relationship between future teachers' pattern recognition aptitudes and their preconceived notions about console video games. We hypothesized that these attitudes would correlate with whether or not teachers recognize console video games as being useful for teaching. For the purposes of this study, we elected to analyze a continuum measuring field dependence and field independence, a well-known perceptual concept articulated by cognitive psychologists in the 1960s. Using the Group Embedded Figures Test (GEFT) developed by Witkin et al. (1962), we explored the impact that field dependent-field independent cognitive style had on participants' preconceived impressions and eventual enjoyment of video games. We also investigated the connection between console choice type (Xbox 360 vs. the Nintendo Wii) and those attitudes.

The present study was inspired by previous work (Kenny & McDaniel, 2011) that explored teachers' general acceptance and use of serious games in the classroom. We extended that prior research by investigating whether or not a simpler gameplay mechanic would have any significant effect on teachers' attitudes towards games as useful instructional interventions. There has been some speculation in the literature that technological experiences leave a lasting impression that influences both cognition and affective response. For example, Salomon, Perkins, and Globerson (1991) describe a situation in which "the intellectual partnership with a computer tool can leave a transferable cognitive residue in the form of, for example, a generalized ability for self-regulation and guidance" (p. 6). Such residue would in turn "allow them to become involved in higher order activities in subsequent partnerships with intellectual tools" (p. 6).

In our prior study (Kenny & McDaniel, 2011), we also found that the encoding of internal knowledge structures may have been based on participants' exposure to gaming technologies, a theory initially proposed by Pillay, Brownlee, and Wilss (1999). They suggested that novice players initially encode surface structures that are later triggered by situations that convert these surface structures to organized knowledge. This work implies that exposure to gaming technologies has the potential to leave long lasting impressions of both the affective and cognitive variety if games are later encountered a subsequent time in the classroom as a potential teaching tool for adoption. The authors suggested in the earlier study that this theory would be an interesting avenue for later investigation; this current work furthers our understanding of these notions.

For the sake of this study, we chose to focus primarily on the attitudes of the participants towards console video games. We believe that console video games, although less likely to be used in the classroom than computerized educational games, are interesting because they often offer more usable control mechanisms, better graphical capabilities, and robust methods for socializing online. These are all characteristics that will likely emerge in next generation educational technologies. We hypothesized that individuals found to be field independent would at least initially demonstrate more positive attitudes towards console games than their field dependent counterparts and, correspondingly, would tend to play console games more often during leisure time hours. Conversely, we believed that field dependent individuals would find console games to be more complicated and difficult to learn unless they were provided instruction on game play mechanics prior to playing. We also knew from our own experiences as well as those expressed in the literature (most notably in Gee, 2003) that those who play video games tend not to require instructional manuals to learn how to play. Rather, most seem to acquire the process knowledge required to succeed in video games through emphatic trial and error, something we believe may be counterintuitive to the pedagogical methodologies embraced by those aspiring to the teaching profession.

Finally, we hypothesized that a correlation would exist between a field dependent/field independent (FD/FI) cognitive style and participants' general enjoyment of console video games, and further that teachers generally would lean more towards displaying field dependent tendencies than their peers who enter into other professions. These ideas about cognitive style have been previously explored in the literature (Altun & Cakan, 2006; Frank 1984, 1986; Garger & Guild, 1984; McKenna, 2006; Sadler-Smith & Riding, 1999). In our review of the literature, however, we found them to not be fully investigated in relation to video games. We also suspected, based on the descriptions of individual preferences and professional selections associated with each style, that teachers would be found to display field dependent tendencies. We believed that this would be especially true for those teaching in non-vocational fields and/or in the humanities. We felt that, if these suspicions could be confirmed, they might account at least partially for a generalized reluctance to use *any* type of video games in the classroom. The literature from cognitive differentiation offers some useful theoretical grounding for this study.

DIFFERENTIATION AS MEASURED BY COGNITIVE STYLE

People orient themselves differently visually according to their idiosyncratic psychologies of perception. One well-documented difference is found in the dichotomy between "field dependent" and "field independent" perceivers. The seminal test for these tendencies is described in Witkin et al. (1962). The original test involved a participant sitting in complete darkness, observing a luminous rod that is surrounded by a luminous frame. Both the rod and the frame can be tilted, and both are tilted by the researcher before the participant begins the test. The goal is to orient the rod vertically by providing instructions to the experimenter. In term of providing clues about spatial reasoning, Witkin et al. (1962) explain that (p. 1-2):

Some subjects tip the rod far towards the angle of tilt in the frame in order to perceive it as upright, thus determining its position mainly in relation to the visual field that immediately surrounds it. Here and in other perceptual situations these subjects find it difficult to overcome the influence of the surrounding field or to separate an item from its context. It is because of this characteristic that their perception has been designated field dependent.

The rod and frame test later evolved into the Group Embedded Figures Test (GEFT) in which participants reviewed a rather complicated set of figures in which other images were embedded. Participants were asked to locate/identify the embedded images within a certain time frame. Right and wrong answers and number of completed items are recorded and scaled based on the overall success they enjoyed.

The tests were intended to demonstrate that field dependent perceivers see objects and context as a single frame of reference and have trouble distinguishing an individual object from the context of its surroundings. In contrast, Witkin et al. (1962) noted (p. 2):

Other subjects, in contrast, are able to bring the rod close to the true upright, perceiving it independently of the surrounding field and determining its location with reference to body position. In perceptual situations generally, such people are able to distinguish an item from its context. Their perception is field independent.

The test also measures performance as related to psychological differentiation, which falls on a continuum between full field dependence and total field independence. In other words, some people are more likely to see context and an item as one, some will possess

the ability to see an item independently from its surrounding context, and still others will be slightly included toward one perceptual pole or the other.

While this perceptual difference among individuals is interesting, what is even more relevant to our inquiry is the impact these variations appear to have on other psychological dimensions, such as affect, cognition, top-down versus bottom-up thinking and perceiving, and spatial reasoning. The test has also been shown to measure relative independence of how much an individual depends on external support for decision making and understanding (Bloom-Feshbach, 1980; Witkin, Goodenough, & Oltman, 1979).

We also learned from a review of the literature that field dependent learners would more likely be distracted by dominant but irrelevant features and would less likely be able to organize their perceptions in less structured environments like those found in many video games (Ayersman, 1995; Burton, Moore & Holmes, 1995; Chen & Rada, 1996). This research also suggests that field dependent individuals may better orient themselves by way of top-down thinking, rather than the bottom up approach of case-by-case problem solving that is prevalent when players are working to overcome obstacles in video games. In fact, there seems to be some evidence that top-down thinking can actually impede successful gameplay (Lovrich, 2006).

Those most successful at modern video game play tasks can process visual information rapidly, are generally self-sufficient learners, are capable of complex reasoning, and prefer to learn through trial and error, rather than being instructed on how to do complete a task prior to attempting something new (Gee, 2003; Loh, 2009). However, there are suggestions in the literature that teachers, especially those who have been teaching for a while, are the opposite in that they may be prone to teach the way that they have been taught. This is more than likely to have occurred in linear fashion, through primarily printed materials and face-to-face interactions (Huebner, 2009; Putnam & Borko, 2000). As a result, these individuals may prefer to receive instruction prior to attempting new tasks.

This line of thinking suggests that those types of learners who are taught to teach using traditional methods are likely to learn best when material is presented to them in a logical, orderly progression, as one might organize materials when presenting them in print form or during a face-to-face lecture. In addition, the concept of removing the fear of being wrong and learning from mistakes like what is common during video gameplay can be off-putting to these individuals (Kenny & Wirth, 2009). This review of the literature prompted us to consider a possible correlation between perceptual differentiation and perceptions about their own abilities to successfully participate in video gameplay and their using games in their future classrooms.

COGNITIVE DIFFERENTIATION AND GAME PLAYING

Gee's (2003) widely cited book on video games, learning, and literacy opened the door for viewing video games in terms of their relationship to cognition and visual perception (i.e., they are a technology that aids in thinking and learning). Gee suggests that the best research being done in cognitive science is very similar to the learning theories that are being capitalized upon by well-designed video games. In particular, he notes that games are embedded in economic, historical, and political practice, just as learning is embedded in the real world, and that games afford opportunities for pattern recognition, an ability that humans excel at and that long has been studied under the label of connectionism. It was Gee's ideas on holistic learning and his enthusiastic support for how video games provide better means for knowledge acquisition that caused us to begin to wonder whether there might be differences between the way teachers think and learn and their video game-playing students.

Connectionism is a view of learning that argues that humans learn best through specific experience rather than through abstract principles and logic. As Gee (2003) explains, "they think best when they reason on the basis of patterns they have picked up through their actual experiences in the world, patterns that, over time, can become generalized but that are still rooted in specific areas of experience." In general, logic suggests that excellent pattern recognizers are more positively situated to appreciate and enjoy the various features of video games. Puzzles that require pattern recognition skills of players are important features of games that are well documented in numerous game design texts (Juul, 2005; Koster, 2004; Rouse III, 2005; Salen & Zimmerman, 2004; Schell, 2008). However, it is natural that some types of players will be more adept at solving puzzles than others. For instance, we might speculate that those gamers found to be field dependent require more extensive external help functions and aids (such as cheats, for example) when learning how to solve puzzles. This is because games often require that the player be able to see game objects (tokens, widgets, characters, interactive objects, etc.) distinctly from game environments (backgrounds and non-interactive objects). There are also various types of puzzles, each with their own unique gameplay scenarios. These range from abstract puzzle games like *Tetris* to more sophisticated adventure games requiring complex interactions with characters and environments.

The challenge for this study was for us to find games that offered opportunities for participants to explore a variety of potential solutions to sharply defined problems without requiring advanced subject knowledge. While adventure games or first person shooter contain puzzles, they are often embedded within larger gameplay experiences that are time consuming or difficult to find for novice players. On the other hand, sports games are more familiar and simulate real world activities novice players may already be familiar with. In this sense, they present players with the opportunity to optimize a system while still offering the unique affordances of games. When playing a sports game, a player must decipher and adapt to their chosen character's particular skills and abilities, respond and react to particular environmental events (such as the wind blowing or icy or rainy precipitation), understanding scoring conditions, and be willing to play the game with what Salen and Zimmerman (2004) following Suits (2005; originally published in 1978) referred to as the "lusory attitude," or a willingness to solve problems using non-straightforward methods. A parallel comparison might be drawn between attitudes towards problem solving and being confronted with mini 'epic moments' as game elements in sports games (McGonigal, 2011). For instance, instead of merely picking up a golf ball and placing it in the hole, the player is willing to play by the rules in which she attempts to drive the ball down a field toward the hole using a golf club. Similarly, in sports video games, the additional challenge presented by complex variables is not only accepted, but appreciated. The lusory attitude is certainly important for gaming, but are some individuals more predisposed to adopt the lusory attitude than others?

In terms of correlating specific cognitive styles with gameplay success, we believe that field dependent learners may have more trouble with learning gameplay mechanics than their field independent counterparts. For example, one issue might be that the task of separating disparate elements of a game from another, specifically those that appear to be superfluous elements (such as the heads up display, scoring mechanism, and/or graphical user interface), may prove overwhelming to dependent learners. This, in turn, can lead to difficulty in adopting the required lusory attitude (earlier defined as one that allows players to accept the arbitrary rules of a game in order to facilitate the resulting experience of play). The game is, therefore, perceived as being too difficult and frustrating, causing that player to be unwilling to attempt to solve the game's puzzles.

Further, we suspect that most seasoned gamers do not want or need to read instructional manuals prior to playing. Rather, they prefer to learn how to play games through trial and error.

As a result, and perhaps also in no small part due to game development companies wanting to save money on production costs, instructional manuals are frequently nonexistent, underdeveloped, or minimally written. This can prove- to be frustrating for non-traditional or occasional gamers.

These same preferences for learning gameplay mechanics seem to parallel one's preferences to knowledge acquisition in general. It would seem that those who are accustomed to and have an affinity for traditional teaching methods that emphasize a 'first teach about, then do' approach to learning would also find it difficult to adopt the "the voluntarily attempt to overcome unnecessary obstacles" (Suits, 2005) attitudes that are necessary to function in the video game ecosystem. Game play learning is based on player-learners successfully progressing through the game's levels by recognizing its patterns. Learning through pattern recognition is a recognized preference on the part of field independent learners and is based, in part on adaptive resonance theory, which suggests a need to remain plastic, or adaptive, in response to significant events but still remaining stable in response to those events found to be irrelevant (Carpenter, 1988; Fahle, 1994). It is this ability to recognize and classify the differences that appears to deter field independent learners from successfully acquiring necessary knowledge in given situations. Successful gameplay requires that the player-learners adapt and refine those patterns throughout the duration. Contrary to general classroom learning situations in which one correct answer is sought after, many games often have no single "right answer" that is determined in advance by the designer (Scott Kim, as quoted in Salen and Zimmerman, 2004). Instead, many highly regarded commercial games in various genres from role playing games to first-person shooters and strategy games (e.g., *BioShock*, *Fallout 3*, *Torchlight*, *Skyrim, Dead Space*) present players with objectives that can be achieved in a variety of ways through individualized strategies devised by the player. These games and ones like them present the player with a challenge, such as locating an object or defeating a swarm of enemies, but then allow the player to use a variety of tools and resources to attempt to overcome that challenge through trial and error.

The fact that learning in games occurs by a combination of pattern recognition and trial and error by way of direct individualized feedback and personalized instructional support also points out some of the difference between learning in video game environments as compared to the traditional classroom teaching methods imposed upon classroom teachers who are faced with class-size caps, standardized testing, and vast budget constraints. Certainly, a movement towards initiating many of these same holistic teaching methods in regular, non-playing classrooms is beginning to appear on the horizon (Kapp, 2012). Further, it is clear that that puzzles or questions with multiple correct answers can exist in both games and the classroom (e.g., certain math problems, applied engineering problems, or even some critical, evidence-supported analysis of writings and literature), but we also submit that dependent learners may find these scenarios equally daunting. In other words, this type of open-ended material may prove troublesome regardless of where it is being taught. This point underscores our position that it should be no surprise that dependent learners most likely would not care for, or being successful in, situations where pattern recognition and learning by trial and error are the primary means to acquire knowledge. We also submit that traditional teaching methods still remain the most commonly taught didactic principles in teacher preparation programs.

Finally, in terms of specific gameplay mechanics, one can imagine several gaming situations in which field independent perception is important. For example, in an adventure game, a player might be presented with a puzzle in which small items are camouflaged with the surrounding environment and must be collected and reassembled in a central location in order to open a hidden door to allow the player to continue exploring the area. In this type of situation, the ability to differentiate objects

from environmental context is vitally important. Other games are quite situational in that they challenge players to quickly recognize holistic events that encompass environment, objects within the environment, and obstacles resulting from the interactions of these two virtual types. In these cases, the correctness of a possible solution would depend upon the circumstances. For example, many first person shooter games require players to quickly react to swarms of enemy NPCs as environmental obstacles further retard their progress. In challenges such as this, a holistic understanding of the level as a whole is necessary for success, but so is the ability to see and react to individual elements within the level as they appear and threaten the player. For these situations, field independence is crucial.

METHODS AND ANALYSIS

Research Questions

For this study we explored the following questions:

- Are there any differences between the game-playing habits of pre-service teachers and their peers who are majoring in different fields? And are there any possible correlations between these game playing habits and dispositions towards the potential benefit of integrating games into their lessons?
- Does FD/FI cognitive style have any connection to preconceived notions about the relative value of using video games as an instructional tool?
- Are there any ancillary perceived negative characteristics about video gameplay that these individuals might have that would influence their adoption of video games in the classroom?
- Will actual experience and introduction to gameplay mechanics help to overcome some of these pre-conceived notions?
- Will playing on a console that is perceived to be more accessible and friendly for novice gamers (e.g., the Nintendo Wii) make a difference in terms of influencing future gameplay plans by pre-service educators?

Participants

This study was conducted with two randomly selected groups of undergraduate students enrolled in a pre-service teacher training class (n=58) at a large southeastern university. The subjects were randomly selected from various members of several sections of a pre-requisite Technology for Teachers course. This course is made up of individuals potentially interested in teaching a wide range of subjects and whose interest in teaching at the elementary, middle, and high school levels varied. The make-up of the class was 35 females and 23 males. All participants were in their twenties. The instructor of the selected classes offered extra credit for participation and an alternative means to earn similar credit for those who did not wish to participate. No one in the class selected the alternative assignment.

A small survey was conducted with these participants to determine their game-playing habits and preferences. Based on these results, it was determined that almost 60% of them had either never played a video game or had only played infrequently.

Instrumentation and Implementation

We utilized a pre and posttest Video Games Preference Inventory (Attachment A) that we developed in conjunction with an independent panel of six faculty members, one half of whom were experts in instructional design and the other half in game design at the university. We began with approximately 25 questions that were suggested by the panel. This list was pared down for duplication and uniqueness so that we could determine two major concepts:

participants' general attitudes towards games as a leisure time activity, and attitudes towards games as an instructional activity. The final version of this instrument asked ten specific questions that were graded on a five-point Likert scale. We added four multiple choice type questions and additional areas for participants to enter optional, open-ended responses. To verify reliability, we consulted one more time with our panel of experts that represented the fields of educational technology, research, and psychology. A split-half ratio analysis helped to inform the construct of the final version of the questionnaire, which resulted in a Cronbach's reliability ratio of .73 and a Spearman-Brown coefficient of .85.

Prior to administering the treatment, participants were given Group Embedded Figures Test (GEFT) to measure field dependence/independence. Then subjects were randomly assigned into two groups: one playing the *Tiger Woods PGA Tour 07* golf game on a Nintendo Wii, and another whose participants would play the same game on a Microsoft Xbox 360. This split was partly due to the fact the Nintendo Wii had just come on the market and much had already been written in advertising that these latest controllers would be of significant attraction for garnering new user/players into the genre. This game was selected based on our supposition that this particular gameplay was both generic and non-violent, thereby minimizing content preference bias. A golf game was also chosen because it is a familiar recreational sport with a simple goal (put the ball in the hole) and basic game mechanics (select power, aim, and drive or putt the ball).

Individuals were taken into separate rooms in which they were randomly assigned to either console type. They were given pretests to assess their attitudes toward games and gaming in general as an instrument for teaching and learning. We then provided minimal instruction on the game play mechanics. The game was set up to use a "Play Now" mode, which eliminated the complicated player configuration that normally occurs during career mode gameplay sessions. Participants were then asked to play the first two holes of golf; the average duration of gameplay was approximately ten minutes. This was a brief amount of time, but it enabled players to become familiar with the controls and implement the essential controls at least twice. However, it was likely not long enough to measure the impact and nature of flow and immersion, which would necessitate a more lengthy session. After playing, participants were asked to answer the questions on the post-test questionnaire.

Eight out of the ten questions on the pretest (Questions 2 - 8, and 10) were worded exactly the same as those asked on the posttest. Question 1 on the pretest asked how often participants played video games in the past, but the posttest question was revised to gauge their opinion of the console they had utilized during the study. The posttest question asked whether they felt that the console they utilized was intuitive. Question 9 on the pretest asked participants to report their views about playing video games. On the posttest, this question was modified to ask them to respond whether their experiences of playing during the study caused them to change their opinions and views on the mechanics of playing and would they be more interested in playing in the future. The data collected by these questions was important to our assessment about the attitudinal changes that occurred during gameplay.

It is important to note that we chose a console game rather that a computer game because we were curious to examine how much easier console games were to play (in large part due to a reduced control set – i.e., a controller versus a full QUERTY keyboard and mouse) and we wanted to gain some insights as to whether follow-up studies might provide further indication as to which type of console game would have the most significant effect on attributions towards video games. Console games were introduced to reach out to new gaming demographics. As teachers have been shown to be less technically savvy than their peers (Shelly, Cashman, Gunter, & Gunter

2007), we wanted to find out whether a more user friendly console type of system might have a significant bearing on their dispositions and attributions.

Data Analysis

Pretest preferences. The results from Questions 1 (I play video games regularly) and 2 (I would rather do other things) on the pretest survey both asked in different ways how often the participants played games and suggested a possible cause for non-play (namely, the lack of time). Taken together, these two questions added strength to our ability to infer significance from the responses. A review of responses to these questions indicates that a minority of participants (approximately 42%) played video games regularly. This percentage was relatively low given a recent statistic published by the Entertainment Software Association (2008) in which nearly 80% of individuals in this age group reportedly play games regularly. Similarly, Lenhart, Jones, and Macgill (2008) note that over half of American adults play games and that four in five young adults play games, with over half of these gamers (53%) playing on consoles. The fact that teachers as a group are familiar with and have less desire to play games for entertainment purposes than their peers in other professions may indicate one possible reason why games have not been integrated into the classroom on a widespread basis.

Question 2 asked whether the participants would rather be doing other things with their time than playing video games. Nearly 75% (43 out of 58) of the respondents indicated that they would rather be doing other things, providing further indication that video games were not a priority for them. In prior work (Kenny & McDaniel, 2011), we explored the reasons for this occurrence. We found that, based on responses to Question 3 (video games are too complex), controller issues and game complexity appeared *not* to figure into their decisions whether or not to play. Upon further review, we found that responses to one of the multiple-choice questions at the end of the pretest survey appeared to contradict these results. Close to 70% percent of the participants (40 out of 58) indicated that one of the least desirable aspects of video games was that they were too complicated, that video games were too difficult to learn, or that playing them took too long. In one of the multiple-choice questions, we asked participants how familiar they were with games. Only 17% (10 out of 58) indicated that they were 'very familiar' with games, with the remaining 83% choosing either 'somewhat familiar' or 'not familiar' as their choice. Of this group, over 30% (17 out of 58) indicated they were not familiar with video games at all. This suggested that the decision not to play was a matter of conscious choice; preconceptions about learning how to play games factored into those decisions.

It is worth repeating that this particular group of students was composed of pre-service teachers who, we found in a previous study, tended to play video games less often than their counterparts in other professions (Kenny & McDaniel, 2011). We hypothesized that one of the reasons for this was that because teachers generally follow the principle that learning usually requires some type of instruction, a trait that parallels the cognitive style found in field dependent individuals (Hong, Hwang, Tam, Lai, & Liu, 2012; Pithers, 2000; Saracho, 1991). We set out to determine the impact their learning styles might have on these decisions. We decided to measure learning preferences using the Group Embedded Figures Test (GEFT) an instrument developed by Witkin, Oltman, Raskin, and Karp (1971) to measure participants' ability to differentiate independently in ambiguous situations.

We found that over 30% of the participants could be clearly identified as being field dependent (i.e., less likely to be able to independently work through ambiguous circumstances). The test manual for the GEFT (Witkin et al., 1971) presented a quartile system that established that from 10-12 correct responses was the cut-off between these two characterizations. Reports

in the literature set a standard for an acceptable number of mistakes on the GEFT at 8 (Renna & Zenhausern, 1976). To be consistent, we utilized these same cut-offs, resulting in 17 out of the 58 individuals (approximately 30%) being identified as field dependent. We should point out that there appears to be some discrepancy in the literature regarding establishing strict cut-offs. As noted, a single cut-off may falsely classify individuals. We were cognizant of this and believe that the scores seem to indicate that an additional 10% of the sample could fall into the "field dependent" category. We believe that this is something worth looking into in future studies with a larger sample size, especially because we agree with Rushkoff (1999; 2010) who suggests numerous ways in which digital media is affecting cognition in general.

As a comparison, the GEFT was administered to a randomly selected group of undergraduate students in digital media (N=25) and close to 80% indicated on the same questionnaire that they played video games regularly. Of this group, nearly 100% of the students made less than 5 errors on the GEFT, indicating them as being strongly field independent.

Post Test Results. There was little indication that those who did not play video games prior to the activity would begin playing more often after participating in this intervention (Question 9: I am now more interested in video games). Approximately 56% percent of participants indicated that they disagreed with the statement that they were more interested in gaming than before. One of the multiple-choice questions asked whether their feelings about video games had changed as a result of their participation. Almost 62% of those asked indicated that their opinions had changed, with 95% of them indicating that it was for the positive. Of those who indicated that their opinions did not change, approximately one-half indicated that it was because they had already liked games before. The other half stated that they still did not care for games or still would rather be doing other things. A factor analysis for the type of console indicated that the Wiimote control in particular accounted for approximately 55% of the variance among responses.

Comparison of pre and posttest responses. In order to investigate changes in attributions about games, a paired sample t-test was calculated (Table 1) to compare responses to the questions on the pretest and posttest. Responses to Questions 3 (Video games are too complex), 5 (I feel comfortable playing), 7 (Video game controllers are too difficult), Question 8 (Playing is intimidating), and Question 10 (Video games can teach things) all appeared to change significantly from the pretest to the posttest. Questions 1 and 9, while seemingly significant, cannot be included in the analysis because they dealt with different issues on the pre and posttest.

In order to determine the interaction effects of the type of console on perceptions about game complexities and willingness to play, we calculated an ANOVA in which we compared responses on the relevant posttest questions (Questions 3, 5, 7, 8, and 9) as controlled for console type (Table 2). We found only one response to have an interaction effect at the .05-level: response to Post Question 9 (I am now more interested in playing). This suggests that some of the claims about the attraction and ease of use by Wii console makers hold some validity. We did find, however, that while these results seem to indicate that the type of console might help overcome some of the reluctance of this particular group about playing, nothing seemed to indicate that the type of console would have a significant effect on participants' long-term playing habits.

Comparison between learning style, gender, and playing habits. While the issue of gender was not central to our primary research questions for this study, we did some basic analysis for gender differences, resulting in some interesting results. In order to determine possible interactions between various questions asked and field dependence, an ANOVA was calculated (Table 3). Significance at the .05 level

Table 1. Paired samples t-test comparing pre and post-test responses

		Paired Differences					t	df	Sig. (2-Tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	preq1 - postq1	-.860	1.856	.246	-1.352	-.367	-3.497	56	.001
Pair 2	preq2 - postq2	.140	1.187	.157	-.175	.455	.893	56	.376
Pair 3	preq3 - postq3	.228	.846	.112	.004	.452	2.036	56	.046
Pair 4	preq4 - postq4	-.214	1.022	.137	-.488	.059	-1.569	55	.122
Pair 5	preq5 - postq5	-.368	1.304	.173	-.714	-.022	-2.133	56	.037
Pair 6	preq6 - postq6	-.140	.895	.119	-.378	.097	-1.184	56	.242
Pair 7	preq7 - postq7	.368	.993	.132	.105	.632	2.800	56	.007
Pair 8	preq8 - postq8	.211	.796	.105	-.001	.422	1.997	56	.051
Pair 9	preq9 - postq9	-.596	1.522	.202	-1.000	-.193	-2.959	56	.005
Pair 10	preq10 - postq10	.754	1.640	.217	.319	1.189	3.474	56	.001

Table 2. ANOVA for post question 9 (I am now interested in playing) controlled for console type

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	6.254	1	6.254	5.220	.026
Within Groups	65.887	55	1.198		
Total	72.140	56			

was found for Questions 1 (I play video games regularly), 3 (video games are too complex), 9 (video games are too violent), and 10 (video games can teach) on the pre-test and Question 10 (video games can teach) on the post test. These results seem to indicate preconceptions about games and potential indicators of game playing habits based on these cognitive styles. A more detailed analysis of the relationships of responses among those found to be of similar learning styles (within groups) pointed to some obvious conclusions that field dependent learners as a group did, in fact, perceive (as reported in the pre-test results) games as being more complex than their field independent counterparts, and that a correlation appeared to exist between game playing habits and learning style. While specific individuals were not questioned further on this phenomenon, we believe the significance of the differences between groups provides an indication that further study to fine tune causality is warranted.

Table 4 shows where significance was detected based on the gender of participants. The table shows that only one pre-test question (Question 3: video games are too complex) indicates a significant interaction with gender. Previous studies identified gender differences and cognitive style affect learning and perceiving (Fritz, 1994; Vermigli & Toni, 2004). The results here generally follow the same track. As the majority of participants were females and

Table 3. ANOVA of interaction between responses and field dependence for selected questions

		Sum of Squares	df	Mean Square	F	Sig.
Pre-Q1: I play video games on a regular basis	Between Groups	4.924	1	4.924	4.397	.043
	Within Groups	41.434	37	1.120		
Pre-Q3: Video games are too complex	Between Groups	6.225	1	6.225	6.637	.015
Pre-Q9: Video games are too violent	Between Groups	6.023	1	6.023	5.449	.025
	Within Groups	40.900	37	1.105		
	Total	46.923	38			
Pre-Q10: Video games can teach	Between Groups	5.050	1	5.050	7.001	.025
	Within Groups	26.693	37	.721		
	Total	31.744	38			
Post-Q10: Video games can teach	Between Groups	2.780	1	2.780	3.498	.012
	Within Groups	28.614	36	.795		
	Total	31.395	37			

Table 4. Tests of between-subjects effects: ANOVA for field dependence and gender. Dependent variable: post question 3 (video games are too complex).

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	8.711(a)	2	4.355	4.731	.016
Intercept	6.156	1	6.156	6.687	.014
Male/Female	5.056	1	5.056	5.492	.025
Dependent/Independent	4.933	1	4.933	5.358	.027
Error	29.461	32	.921		
Total	403.000	35			
Corrected Total	38.171	34			

R Squared = .228 (Adjusted R Squared = .180)

field dependence seems to track to females, it was not surprising that an interaction might exist.

As can be seen in Tables 5 and 6 for pretest Questions 1 (I play video games regularly) and 2 (I would rather do other things) on the questionnaire, a minority of field dependent individuals indicated that they played video games regularly and a strong majority indicated that they would rather be doing other things. When taken together, field dependence accounted for over 88% of the variance in the answers for these two questions (Table 7). What this means is that even though field dependent participants were in the minority, this factor appeared to have a significant impact on the perceptions

Table 5. Frequency count of responses for field dependent participants on question 1 (I play video games regularly)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1-Strong Disagree	22	37.9	39.3	39.3
	2-Disagree	8	13.8	14.3	53.6
	3-No Opinion	1	1.7	1.8	55.4
	4-Agree	12	20.7	21.4	76.8
	5-Strongly Agree	13	22.4	23.2	100.0
	Total	56	96.6	100.0	
Missing	System	2	3.4		
Total		58	100.0		

Table 6. Frequency count of responses for field dependent participants on question 2 (I would rather do other things)

	Frequency	Percent	Valid Percent	Cumulative Percent
1-Strong Disagree	3	5.2	5.4	5.4
2-Disagree	9	15.5	16.1	21.4
3-No Opinion	8	13.8	14.3	35.7
4-Agree	22	37.9	39.3	75.0
5-Strongly Agree	14	24.1	25.0	100.0
Total	56	96.6	100.0	
System	2	3.4		
Total	58	100.0		

Table 7. Total variance explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	Percent of Variance	Cumulative Percent	Total	Percent of Variance	Cumulative Percent
1 (FD)	1.764	88.188	88.188	1.764	88.188	88.188
2 (FI)	.236	11.812	100.000			

of these individuals surveyed. These results also show in more detail how those identified as being field dependent responded to these two questions and show more accurately how negatively they felt about playing video games due to perceived complexity.

Additional relevant data was found in the resulting groupings of the short answers provided before and after the gameplay sessions on the Wii or Xbox 360 (see Table 8), as independently transcribed and tabulated by student assistants in the undergraduate digital media program.

Table 8. Pre-test short answer summary: Most appealing aspect of video games

Game Feature	Respondents	Percent
Gameplay (controller)	13	22
Story (overall story, characters, plot)	10	17
Immersion (involvement)	8	14
Graphics and sounds	4	7
Competition (difficulty)	2	3
Online capabilities (socialization)	2	3
Relaxation (fun)	2	3
Exercise	1	2
Interactivity	1	2
Violence	1	2

These results were interpreted by the authors using keyword analysis and grouped into common clusters. On the pre-test, answers for the most appealing aspect of video games included competition, gameplay, characters, nonlinearity, relaxation, immersion, storyline, interactivity, and online capabilities for socialization. This confirms the game design literature stressing these features that gamers want from electronic games (Rouse III, 2005). As expected, gameplay was seen as the most appealing aspect of games (22% responding), but surprisingly, story was also highly rated (17% of respondents indicated story as the most appealing factor). This suggests that this particular segment of gamers may enjoy watching games being played by others more so than playing games themselves. This answer from one respondent was particularly indicative of this: "I like video games that are fun to play and watch. Games you don't have to be involved with, but still enjoy." Other data from this question indicates a general lack of awareness of the particular features of games, as evidenced by the number of vague or ambiguous answers indicating immersion/involvement and interactivity as favorite features. Other respondents left this question blank or answered in multiple categories. Variant answers grouped with each category are shown beside the primary keywords in parentheses. Only 44 of the 58 eight participants chose to respond to the open-ended questions.

Table 9 indicates similarly predicted results, with gameplay and learning the rules of a new game being seen as least appealing. 28% of respondents indicated a general distaste for learning the rules and controls of games in general, while an additional 9% focused on the controller specifically. Also unappealing to this sample was the amount of violence in games, with 17% of respondents noting this feature on their pre-test questionnaire.

Additional answers gathered from the pre-test short answers about whether or not the activity was likely to change one's mind about gaming revealed a variety of attitudes:

- I'm somewhat interested; some [games] I like and others I don't. I don't think one activity will change my mind;
- Yes, because I think video games might be able to teach some content in certain classrooms;
- I'm open minded to the idea of incorporating video games (certain ones) into the classroom;
- I have other things I would rather do with my time.

Table 9. Pre-test short answer summary: Least appealing aspect of video games

Game Feature	Respondents	Percent
Gameplay (general complexity, learning game rules)	16	28
Violence (immoral behaviors, stealing, etc.)	10	17
Gameplay (controller specifically)	5	9
Time required (too time consuming)	3	5
Technical issues (camera angles, disorientation, load times, glitches)	2	3
Story (complicated plots, confusing story, boring story)	2	3
Repetition (boring, repetitive gameplay)	1	2
Addiction (potentially addicting)	1	2
Sexism (overly endowed female characters)	1	2

Short answers collected from the post-test revealed that in every case, the activity either positively influenced attitudes toward games or did not change attitudes (Table 10). No participants indicated that the activity negatively influenced their attitudes toward games, and several who selected "no change" indicated that they had liked playing games before the activity and still enjoyed them after the activity. Those non-gamers who played the Wii console were slightly more likely to have a more positive attitude toward games after the activity.

When participants were debriefed after the activity, additional information about the overall gameplay experience was collected. Some of the feedback from participants reveled preexisting notions of gameplay being difficult that were not confirmed by the activity. For example, one participant using the Wii noted, "I just never tried. I just assumed it was hard. It's actually not that bad." Other Wii users were even more positive, noting, "It was quite simple – and addictive!" and "It was more fun than I thought. I wouldn't mind playing some more." Not every Wii player was enthusiastic; one stated, "I'd rather do other things with my time." Some players also equated the heightened kinesthetic dimension of the Wii with increased interactivity and indicated enjoyment related to this.

Feedback from Xbox 360 players included statements such as "I think the games can be fun and educational, but I don't have the time to spend playing them," and "I enjoyed playing but I would rather be doing something else." Some Xbox 360 players also enjoyed the activity, though, and one stated "I loved the golf game. I thought it would be boring, but once I started playing I didn't want to stop," another described it as "a fun and positive experience," and yet another said "It actually was kind of cool." Xbox 360 players were also more likely to address the difficulty curve, which makes sense given the additional complexity of the Xbox controller relative to the Wiimote. One player noted the importance of practice in learning the controls.

Table 10. Attitudes toward games, Xbox vs. Wii (post-test survey answers)

	Participants (Wii)	Participants (Xbox)
Positive Change	8	4
Negative Change	0	0
No Change	10	11

DISCUSSION

In this study, we examined the impact of cognitive style on attitudes toward console video games. Following up on this, we devised a preliminary experiment in which participants played the same game on either the Nintendo Wii or Microsoft Xbox 360 console in order to determine if attitudes were likely to change based on the particular type of console and gameplay that was advertised as being easier and less cumbersome to play. Although there were relatively few participants in this study, the results of this pilot experiment suggest further research along these lines. These preliminary results indicate that the type of console might help overcome some of the reluctance of this particular group about playing, but nothing seemed to point toward any long-term changes would result from the introduction of a different type of console. These findings suggest that the goal of using video games as learning technologies may face significant barriers in terms of teacher attitudes and their eventual move to incorporate games in the classroom.

We suggest that this reluctance may be partly due to perceived difficulty of playing games on the part of field dependent individuals. We found that, in contrast to college undergraduates in more technological disciplines (in our case, digital media students), a relatively larger segment of pre-service students (30%) were classified as field dependent according to the GEFT. These students also tended to initially be more negative toward games prior to their experience with them.

On the other hand, after they became exposed to the actual mechanics of a game in an applied setting, many of them shifted in a more positive direction their feelings toward video games. This was especially true of those participants who played using the Wii console. This is an encouraging finding that bears further investigation. It is also worth studying this relationship using other genres of console video games besides just sports games such as *Tiger Woods PGA Tour 07*. Utilizing a sports game in this study, while ideal from a gameplay mechanics perspective, may have also introduced a compound. For example, individuals in the sample may have had a preference to sports and/or were pre-service teachers training to teach a subject related to sports in general, golfing, or an active subject such as physical education. However, we believe that because the subjects were chosen at random from the general academic field of education, this preference most likely did not play a significant role in shaping participant's responses to the questionnaires. Nonetheless, additional survey questions which would allow researchers to control for these potential confounds would be useful in future work. We also recognize that the inverse is also potentially true; we may have benefited more from engagement by using games suitable for the individual pre-service teachers' major subjects. Despite these cautionary notes, we submit that the study does provide sufficient evidence for the need to familiarize the teachers with gaming media in general.

Gender differences seem to be an area that needs further review. We discovered many of these differences independently and through only a preliminary analysis, as testing for gender differences was not central to our original intent. While there are some indications in the research that females might historically be less likely to engage with technology (Viswanath, 2000), we did not set out to examine this effect. The makeup of the pre-service sample was highly slanted towards females versus males, where the opposite was true for the digital media group. So, we had originally decided to control for this potential confound. We did find, however unintended, that there seems to be an interesting interaction among gender and learning preferences and cognitive style. While we cannot draw any major conclusions from this particular study, we do suspect that controlling for gender will uncover some interesting results if we do conduct further research in this area. Results also seem to indicate that becoming familiar with video gameplay needs to become a more important aspect of pre-service teacher training. We found that many of those who did not believe that games would (or should) become

a part of their instructional plans, eventually changed their minds after their experiences with them. This concurs with previous research that all technology should become a required aspect of pre-service instruction (Brush, Glazewski, Rutowski, & Berg, 2009; Schrader, Zeng, & Young, 2005).

The results of this study are also important (especially those found in our analysis of the open-ended questions) because they indicate that one barrier to supporting the adoption of games in the classroom may be the lack of enthusiasm for games due to incorrect preconceived notions that correspond to their general learning styles on the part of those who elect to go into the teaching profession. We can only hypothesize the extent to which this issue is accentuated on the part of older teachers, who are further removed in age from their millennial students who are being brought up in the digital age. While we cannot generalize these results to any other groups, we do suspect that many teachers gravitate towards showing preference to learning activities associated with the field dependent cognitive style. Further, the open-ended responses seem to indicate that the effect of these preferences appear to have a bearing on general attitudes towards games, and in turn seem to be affecting their choices of instructional interventions for their classrooms. Based on the initial findings from these responses, we believe these hypotheses are worthy of further, more detailed investigation.

CONCLUSION

We do not suggest that all preconceived, negative reactions towards games can be attributed to cognitive style. But, based on these findings, we believe we can hypothesize with a certain degree of confidence that many of teachers' negative attitudes towards using video games in their classrooms can be overcome through changes and modifications to teacher training curricula. This might include more time allotted for making these individuals more comfortable with teaching as it occurs in gaming, such as through the mechanism of trial and error and the idea of rewarding failure to increase engagement and the willingness to take risks. This can be accomplished with methods courses that include familiarization with the gaming genre and additional exposure to the variety of simulation and gaming tools that would be useful in instructional settings. Unfortunately, given that many of the instructors that we know who teach pre-service teachers also themselves lack training in using games to teach effectively, this is likely to be more difficult to accomplish.

We suggest that developing an awareness of the barriers of psychological attitudes and preconceived notions towards games on the part of those responsible for teaching with games is an important first step. If the cognitive residue theorized by Salomon et al. (1991) applies to game interactions, then even a simple exposure to games may prove beneficial to changing teacher attitudes about games and in improving self-efficacy about these potential teaching and learning technologies.

At the time of this writing, recent industry research indicates that many teachers' attitudes toward games are becoming more positive. The Entertainment Software Association (2012) claims that 32 percent of teachers now use digital games in the classroom 2-4 days per week (with 18 percent using games daily). As the adoption of games becomes more common and widespread, it will be vitally important for the research and development communities alike to generate research and tools that support the successful deployment of these interactive technologies as they move into the hands of teachers. Familiarization with the games allows teachers to provide young learners with the proper guidance and pedagogical tools so as to help these students use games gainfully and productively for particular learning tasks. Building and distributing systems that are useful, familiar, and non-threatening to both field-dependent and field-independent learning styles will be a useful first step in this direction. Future longitudinal studies involving a review of when and how pre-service teachers

are exposed to instructional gameplay can help to confirm or dispute these findings and guide future policy efforts.

REFERENCES

Altun, A., & Cakan, M. (2006). Undergraduate students' academic achievement, field dependent/independent cognitive styles and attitude toward computers. *Journal of Educational Technology & Society*, *9*(1), 289–297.

Ayersman, D. J. (1995). Effects of knowledge representation, format, and hypermedia instruction on metacognitive accuracy. *Computers in Human Behavior*, *11*, 533–555. doi:10.1016/0747-5632(95)80016-2.

Bloom-Feshbach, J. (1980). Differentiation: Field dependence, spatial ability, and hemispherical specialization. *Journal of Personality*, *48*(2), 135–148. doi:10.1111/j.1467-6494.1980.tb00823.x PMID:7391917.

Brush, T., Glazewski, K., Rutowski, K., & Berg, K. (2009). Integrating technology in a field-based teacher training program: The PT3@ASU project. *Educational Technology Research and Development*, *51*(1), 57–72. doi:10.1007/BF02504518.

Burton, J. K., Moore, M., & Holmes, G. A. (1995). Hypermedia concepts and research: An overview. *Computers in Human Behavior*, *11*(3-4), 345–369. doi:10.1016/0747-5632(95)80004-R.

Carpenter, G. A. (1988, March). Adaptive resonance theory (ART). *Computer*, *21*(3), 77–88. doi:10.1109/2.33.

Chen, C., & Rada, R. (1996). Interacting with hypertext: A meta-analysis of experimental studies. *Human-Computer Interaction*, *11*, 125–156. doi:10.1207/s15327051hci1102_2.

Entertainment Software Association. (2008). *2008 game player data*. Retrieved October 26, 2009 from http://www.theesa.com/facts/gameplayer.asp

Entertainment Software Association. (2012). *Teacher attitudes about digital games in the classroom*. Retrieved January 10, 2013 from http://www.theesa.com/facts/research_0512.asp

Fahle, M. (1994). Human pattern recognition: Parallel processing and perceptual learning. *Perception*, *23*(4), 411–427. doi:10.1068/p230411 PMID:7991342.

Frank, B. M. (1984). Effect of field independence-dependence and study technique on learning from a lecture. *American Educational Research Journal*, *21*(3), 669–678. doi:10.3102/00028312021003669.

Frank, B. M. (1986). Cognitive styles and teacher education: Field dependence and areas of specialization among teacher education majors. *The Journal of Educational Research*, *80*(1), 19–22.

Fritz, R. L. (1994). Gender differences in field-dependence and educational style. *Journal of Vocational Education Research*, *19*(1), 1–21.

Garger, S., & Guild, P. (1984). Learning styles: The crucial differences. *Curriculum Review*, 9-12.

Gee, J. P. (2003). *What video games have to teach us about learning and literacy*. New York, NY: Palgrave Macmillan. doi:10.1145/950566.950595.

Hong, J., Hwang, M., Tam, K., Lai, Y., & Liu, L. (2012). Effects of cognitive style on digital jigsaw puzzle performance: A GridWare analysis. *Computers in Human Behavior*, *28*(3), 920–928. doi:10.1016/j.chb.2011.12.012.

Huebner, T. (2009). The continuum of teacher learning. *How Teachers Learn, 66*(5), 88-91. Retrieved January 25, 2013, from: http://www.ascd.org/publications/educational-leadership/feb09/vol66/num05/The-Continuum-of-Teacher-Learning.aspx

Juul, J. (2005). *Half-real: Video games between real worlds and fictional rules*. Cambridge, UK: The MIT Press.

Kapp, K. M. (2012). *The gamification of learning and instruction: Game-based methods and strategies for training and education*. San Francisco, CA: Wiley.

Kenny, R., & McDaniel, R. (2011). The role teachers' expectations and value assessments play in their adopting and integrating video games into the curriculum. *British Journal of Educational Technology*, *42*(2), 197–213. doi:10.1111/j.1467-8535.2009.01007.x.

Kenny, R., & Wirth, J. (2009). Implementing constructivist learning experiences through best practices in interactive performance. *Journal of Effective Teaching*, *9*, 34–47.

Koster, R. (2004). *A theory of fun for game design*. Phoenix, AZ: Paraglyph.

Lenhart, A., Jones, S., & Macgill, A. (2008). Adults and video games. *Report of the Pew Research Center's Internet & American Life Project*. Retrieved January 10, 2013 from http://www.pewinternet.org/Reports/2008/Adults-and-Video-Games.aspx

Loh, C. S. (2009). Researching and developing serious games as interactive learning instructions. *International Journal of Gaming and Computer-Mediated Simulations*, *1*(4), 1–9. doi:10.4018/jgcms.2009091501.

Lovrich, D. (2006). *The science teacher: Feature classroom applications of top-down and bottom-up processing*. NSTA WebNews Digest. Retrieved May 1, 2012 from http://www.nsta.org/publications/news/story.aspx?id=53144.

McGonigal, J. (2011). *Reality is broken: Why games make us better and how they can change the world*. New York, NY: Penguin.

McKenna, F. P. (2006). Learning implications of field dependence-independence: Cognitive style versus cognitive ability. *Applied Cognitive Psychology*, *4*(6), 425–437. doi:10.1002/acp.2350040602.

Pillay, H., Brownlee, J., & Wilss, L. (1999). Cognition and recreational computer games: Implications for educational technology. *Journal of Research on Computing in Education*, *32*(1), 203–216.

Pithers, R. (2000). *Field dependence-field independence and vocational teachers* (Working Paper). Retrieved June 1, 2010, from http://www.uts.edu.au/fac/edu/rcvet/working%20papers/WP0051Pithers.pdf

Putnam, T., & Borko, H. (2000). What do new views of knowledge and thinking have to say about research on teacher learning? *Educational Researcher*, *29*(1), 4–15. doi:10.3102/0013189X029001004.

Renna, M., & Zenhausern, R. (1976). The group embedded figures test: Normative data. *Perceptual and Motor Skills*, *43*, 1176–1178. doi:10.2466/pms.1976.43.3f.1176.

Rouse, R. III. (2005). *Game design theory and practice* (2nd ed.). Plano, TX: Wordware Publishing.

Rushkoff, D. (1999). *Playing the future: What we can learn from digital kids*. New York, NY: Riverhead Trade.

Rushkoff, D. (2010). *Program or be programmed: Ten commandments for the digital age*. New York, NY: OR Books.

Sadler-Smith, E., & Riding, R. (1999). Cognitive style and instructional preferences. *Instructional Science*, *27*(5), 355–371. doi:10.1007/BF00892031.

Salen, K., & Zimmerman, E. (2004). *Rules of play: Game design fundamentals*. Cambridge, MA: The MIT Press.

Salomon, G., Perkins, D. N., & Globerson, T. (1991). Partners in cognition: Extending human intelligence with intelligent technologies. *Educational Researcher*, *20*(3), 2–9. doi:10.3102/0013189X020003002.

Saracho, O. N. (1991). Students' preference for field dependence-independence teacher characteristics. *Educational Psychology: An International Journal of Experimental Educational Psychology*, *11*(3-4), 323–332.

Schell, J. (2008). *The art of game design: A book of lenses*. Burlington, MA: Morgan Kaufmann.

Schrader, P. G., Zheng, D., & Young, M. (2005). Teacher's perceptions of video games: MMOGs and the future of pre-sevice teacher education. *Innovate, 2*(3). Retrieved March 1, 2012 from http://innovateonline.info/pdf/vol2_issue3/

Shelly, G. B., Cashman, T. J., Gunter, R., & Gunter, G. (2007). *Teachers discovering computers: Integrating technology and digital media in the classroom*. Boston, MA: Thomson Course Technology.

Suits, B. (2005). *The grasshopper: Games, life and utopia* (pp. 54–55). Broadview Press.

Vermigli, P., & Toni, A. (2004). Attachment and field dependence: Individual differences in information processing. *European Psychologist*, *9*(1), 43–55. doi:10.1027/1016-9040.9.1.43.

Viswanath, V. (2000). Why don't men ever stop to ask for directions? Gender, social influence and their role in technology acceptance and usage behavior. *Management Information Systems Quarterly*, *24*, 1.

Witkin, H., Oltman, P., Raskin, E., & Karp, S. (1971). *A manual for the embedded figures test*. Palo Alto, CA: Consulting Psychologists Press.

Witkin, H. A., Dyk, R. B., Faterson, H. F., Goodenough, D. R., & Karp, S. A. (1962). *Psychological differentiation: Studies of development*. New York, NY: John Wiley and Sons. doi:10.1037/13128-000.

Witkin, H. A., Goodenough, D. R., & Oltman, P. K. (1979). Psychological differentiation: current status. *Journal of Personality and Social Psychology*, *37*(7), 1127–1145. doi:10.1037/0022-3514.37.7.1127.

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APPENDIX A

Pre-Test Questionnaire

Participant ID: _____

For each of the statements in Table 11, please indicate the extent of your agreement or disagreement by checking the appropriate box under the column that describes your feelings.

Table 11. Pre-test questionnaire

	Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree
1. I play video games on a regular basis.					
2. I would rather do other things than play video games.					
3. Video games are too complex to learn.					
4. Video games are too time-consuming to utilize in the classroom.					
5. I feel comfortable playing video games.					
6. I prefer to play video games that have a strong story.					
7. Video game controllers are too difficult to use.					
8. The act of playing video games is intimidating to me.					
9. I think video games are too violent to use in the classroom.					
10. I think video games can teach things in the classroom.					

Table 12. Short answers to pre-test questionnaire (use back of paper if you need to)

How familiar with video games are you? (Circle one) Very familiar Somewhat familiar Not familiar
What do you think is the most appealing aspect of video games (game play, controller, story, involvement, etc.)?
What do you think is the least appealing aspect of video games (game play, controller, learning how to play, etc.)?
As a result of doing this activity, do you think your feelings about video games will change? (Circle one) Yes No Explain your choice:

APPENDIX B

Post-Test Questionnaire

Participant ID: _____

For each of the statements in Table 13, please indicate the extent of your agreement or disagreement by checking the appropriate box under the column that describes your feelings.

Table 13. Post-test questionnaire

	Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree
1. I felt that the console I played was intuitive and easy to use.					
2. I would rather do other things than play video games.					
3. Video games are too complex to learn.					
4. Video games are too time-consuming to utilize in the classroom.					
5. I feel comfortable playing video games.					
6. I prefer to play video games that have a strong story.					
7. Video game controllers are too difficult to use.					
8. The act of playing video games is intimidating to me.					
9. As a result of doing this activity I am now more interested in playing video games.					
10. I think video games can teach things in the classroom.					

Table 14. Short answers to post-test questionnaire (use back of paper if you need to)

As a result of doing this activity has your view of video games changed? If so, how? If not, why not?
As the result of doing this activity, what do you think is the most appealing aspect of video games (game play, controller, story, involvement, etc.)?
As a result of doing this activity, what do you think is the least appealing aspect of video games (game play, controller, learning how to play, etc.)?
As a result of doing this activity, have your feelings about video games changed? (Circle one) For the positive For the negative No Change Explain your choice: