Engaging By Design: How Engagement Strategies in Popular Computer and Video Games Can Inform Instructional Design

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Computer and video games are a prevalent form of entertainment in which the purpose of the design is to engage players. Game designers incorporate a number of strategies and tactics for engaging players in "gameplay." These strategies and tactics may provide instructional designers with new methods for engaging learners. This investigation presents a review of game design strategies and the implications of appropriating these strategies for instructional design. Specifically, this study presents an overview of the trajectory of player positioning or point of view, the role of narrative, and methods of interactive design. A comparison of engagement strategies in popular games and characteristics of engaged learning is also presented to examine how strategies of game design might be integrated into the existing framework of engaged learning.

☐ A game is a series of interesting choices.

—*Sid Meier*

During the past two decades computer and video games have become an increasingly prevalent form of entertainment in this country. The fact that more than $6 billion was spent in the United States in 2001 on the purchase of both computer and video games indicates that games are becoming a significant medium for entertainment (Interactive Digital Software Association, IDSA, 2002). Although this entertainment medium is still fairly new, in 2003 41% of the market for computer games and 22% of the market for video game was represented by middle-aged gamers (Entertainment Software Association, 2004). This significant percentage indicates that games are not a novel form of entertainment for the young, but rather a form of interactive entertainment that engages players of all ages.

Although the primary purpose of games is entertainment, the underlying design employs a variety of strategies and techniques intended to engage players in "gameplay." Strategies of design that lead to engagement may differ depending on the game genre, but may include role playing, narrative arcs, challenges, and interactive choices within the game, as well as interaction with other players. Depending on the genre and individual game, players may be required to analyze, synthesize, and use critical thinking skills in order to play and execute moves. Game designers are well versed in creating scenarios and events that subtly invoke these skills. Game design is at the forefront of cultivating innovative techniques for interactive design.

The field of instructional design and educa-

tional media has a long history of mining techniques and strategies from the design of various entertainment media such as film, television, and comics, and employing those techniques in the design of educational materials. As new media continue to develop, it is important for instructional designers to learn and borrow techniques from various venues such as the entertainment field for application in both existing and emerging educational media. Digital games are by no means novel to the field of education. Educational games and edutainment represent 7–9% of the computer and video game market (IDSA, 2002). Although educational computer games have stimulated a significant body of research, much of this research focuses on how educational games may enhance existing curriculum and materials (Frye & Frager, 1996; Miller, Dhaika & Groppe, 1996; Miller-Lachmann, Jones, Stone-Farina, DeLaoch & Kloten, 1995; Pahl, 1991; Teague & Teague, 1995). Despite the lack of significant research into design aspects of games, studies by such diverse researchers as Bruckman, (1993, 1997), Turkle (1995), Rieber (1996), Prensky (2001), Malone (1981a, 1981b), Bowman (1982) and Provenzo (1991) indicate that many of the strategies, tactics, and methods employed in popular gaming environments may also provide compelling strategies for the design of educational media and interactive learning environments.

Bruckman's (1993, 1997) and Turkle's (1995) research into multiuser domain (MUD) and multiuser domain, object oriented (MOO) environments deals with aspects of both role playing and community. Bruckman's (1997) investigation into her text-based virtual world, MOOSE Crossing™, revealed that this game-like virtual world setting provides avenues for community support and the development of social relationships. Additionally, virtual environments support the emergence of peer role models predicated on characteristics different from those occurring in traditional classroom settings. Bruckman argued that virtual environments such as MOOSE Crossing afford emotional support between participants, along with the presence of an appreciative audience. Similarly, Turkle's (1995) investigation into MUDs revealed that virtual environments allow users to experiment in a safe, nonthreatening environment, and to expand, explore, and reflect on different aspects of themselves.

Whereas Bruckman's (1993, 1997) and Turkle's (1995) respective research focused primarily on social aspects and role playing in virtual environments, research into psychological and sociological benefits of play revealed that games support intrinsic motivation as well as opportunities for imitation and learning by providing feedback, fantasy, and challenges (Rieber, 1996). Prensky (2001) similarly argued that computer and video games model and promote cognitive traits that are consistent with children raised with technology. According to Prensky, electronic games require active engagement in environments, which supports discovery, observation, trial and error, and problem solving. Additionally, computer games are graphical environments that require players to read the visual environment and interpret symbols. These skills are becoming increasingly important skills to foster in learning. Prensky's (2001) arguments about the value of integrating games in learning, coupled with those of Rieber (1996), indicate that embedded in the design of popular games are methods and strategies worth investigating. Despite these indications, research into *educational games* has often ignored both the methods by which the design of popular games engages players and how these methods might be integrated into both educational game design and the field of instructional design (Dickey, 2003).

Both Bowman's (1982) and Provenzo's (1991) research investigates the design of popular games and how game design might inform instructional design. Bowman's study described the motivational support found in the then popular video game, Pac-Man™, and the implications of extending those motivational supports into classroom learning. According to Bowman, extrinsic supports in the form of visual and aural feedback and accomplishments (i.e., the devouring of dots and attaining medals of achievement) do not adequately explain the appeal of the game. Bowman applied Csikszentmihalyi and Lawson's (1980) "flow state interaction" to explain the gameplay experience. The condition of flow or flow activities involves "deep concen-

tration, high and balanced challenges and skills, and a sense of control and satisfaction" (Csikszentmihalyi, 1990, p.83). Bowman argued that the popularity of Pac-Man could be attributed to inducing a flow state during gameplay because the game offers clear goals and immediate unambiguous feedback. Bowman asserted that this underlying design of motivational support in Pac-Man could be adapted for classroom instruction by supplying learners with a clear task, identification of roles and responsibilities, learners' choice, and a balance of learner skills with progressive challenges.

Provenzo's (1991) research into various design aspects of video and computer games revealed that some of the appeal of games may be attributed to the fact that most are goal oriented with relatively few negative consequences for risks taken. As with Bowman, Provenzo also proposed that the underlying design of popular games might be adapted for educational use, and like Bowman, Provenzo also looked to motivation in the design of games to explain the appeal. Provenzo relied on Malone's (1981a, 1981b) study of intrinsic motivation to explain the appeal of Super Mario Bros. 2™. Malone's research identified the elements of challenge, fantasy, and curiosity present in successful games that could be incorporated into educational environments. Provenzo (1991) further elaborated on these elements by deconstructing Super Mario Bros. 2 and comparing the game to the elements identified by Malone's study of preferences of popular computer games (1981a, 1981b).

Bowman's (1982), Provenzo's (1991), and Malone's (1981a, 1981b) studies reveal commonalities of game design that include clear goals and tasks, reinforcing feedback, and increasing challenge. Each study also reveals aspects of design that are contextual among individual games, such as fantasy and curiosity. However, the games Bowman and Malone reviewed are nearly two decades old. Games have grown increasingly sophisticated in design. The simple one-screen mazes of Pac-Man have evolved into three-dimensional online multiplaying gaming environments with a full cast of both human and nonhuman players. Whereas research into intrinsic motivation might explain the appeal of such games as Pac-Man, Super Mario Bros., and even current gaming genres such as action–adventure and role-playing games, these studies may not suffice to explain the popularity of games such as Myst™, Riven™, and even SimCity™. The arguments both Bowman (1982) and Provenzo (1991) presented for recasting game design elements into classroom instruction are revealing for the then current level of game design; however, game design has evolved, and now incorporates narrative, role playing, multiplayers, representations of three dimensional spaces, and interactive elements beyond the limits of games represented in the previous studies. Games are becoming increasingly social environments, both in the design of massively multiple online games (MMOGs) and through Web-based gaming communities. Additionally, learning theories and paradigms have evolved.

The purpose of this research is to investigate how commercially popular computer games might inform instructional design by looking at methods, strategies, and devices that engage gameplayers, and comparing them to models of engagement in instructional design. Specifically I present (a) an overview of the trajectory of player positioning or point of view (POV: orthographic, isometric, and first person) in commercially popular games, (b) the role of narrative in popular game design and the positioning of the player within the narrative, and (c) methods employed in interactive design. Each section is followed by a discussion integrating research and the educational implications. Additionally, I present a comparison of methods of engagement in popular games to models of engaged learning, to examine how methods and strategies employed in popular game design might be integrated into the existing framework of engaged learning. My goal is to investigate game design methods, strategies, and devices to determine applicability for integrating methods of user engagement into instructional design.

THEORETICAL FRAMEWORK

Bowman's (1982), Malone's (1981a, 1981b), and Provenzo's (1991) research revealed some key aspects of design that support motivation. All three noted the presence of a clear task or goal,

progressive balance or hierarchy of skills and challenge, and immediate feedback. Provenzo also stated that there are relatively few negative consequences for risk taking, and Bowman noted the importance of choice. These elements are also aspects of engaged learning. Although the notion of engaged learning is somewhat elusive in the literature of instructional design, its underlying concept is that learners can become meaningfully engaged in the learning environment by being provided with both authentic activities and opportunities for interacting with other learners (Jones, Valdez, Norakowski & Rasmussen, 1994; Kearsley & Shneiderman, 1999; Scardamalia, Bereiter, McLean, Swallow & Woodruff, 1989; Shneiderman, 1992). Learners play an active role in the creation and development of projects, which requires them to use higher order thinking skills (Bell, Davis & Linn, 1996; Schlechty, 1990). According to Jones et al. (1994) and Schlechty (1997), elements of engaged learning include:

- Focused goals.
- Challenging tasks.
- Clear and compelling standards.
- Protection from adverse consequences for initial failures.
- Affirmation of performance.
- Affiliation with others.
- Novelty and variety.
- Choice.
- Authenticity.

The focus of learning is on completing challenging tasks that are typically complex and are sustained over a period of time. These tasks typically require students to stretch both cognitive and social skills. Within the context of completing the assigned task, students play the role of explorer as they both discover concepts and connections and interact with the material and resources. The focus of teaching in promoting engaged learning is on creating activities and environments that allow learners to become engaged in meaningful activities. The teacher acts both as a facilitator in creating the tasks and environment, and as the guide and coinvestigator to helping scaffold student learning (Hall, 1998; Jones et al., 1994).

The benefit of engaged learning is that this design promotes student collaboration and fosters students taking an active role in their learning. It is the interactions with other learners and the materials that allow students to analyze, synthesize, evaluate, and employ critical thinking skills as they make decisions and determine the course of their actions. The characteristics of engaged learning are not only desirable, but a necessary component for education in today's world. It is important to continually seek methods, strategies and exemplars for designing these environments.

The theoretical foundations of engaged learning can be found in both cognitive and constructivist perspectives. Schlechty's (1990, 1997) work draws on research in cognitive engagement. The focus of cognitive engagement is on the relationship between motivation, learning processes, and learning strategies for supporting self-regulated learning (Corno & Mandinach, 1983; Meece, Blumenfeld & Hoyle, 1988). Whereas the foundations of Schlechty's work came from a cognitive perspective, Kearsley and Shneiderman (1999) situated their work within a constructivist perspective of learning. Kearsley and Shneiderman stated that although they do not derive their concept of engagement theory from other theoretical frameworks for learning, they note the similarities between engagement theory and constructivist approaches toward learning (1999). The report by Jones et al., (1994), relies on both cognitive and constructivist perspectives in their interpretation of engaged learning.

Although there are obvious parallels between game design and constructivist-based methods (i.e., open learning environments and constructivist learning environments), there are also strong parallels between game design and cognitive-based methods in areas such as educational simulations. Therefore, this investigation will draw on both constructivist and cognitive research. It is my opinion that providing support from both cognitive and constructivist perspectives is productive, because differing epistemologies will likely reveal different aspects of game design strategies and learner engagement. Research from a constructivist perspective focuses on the relationship between the player–learner and the environment, and the

social aspects of the design, whereas research from a cognitive perspective focuses on the internal aspects of motivation and schema as fostered by design. There is value in using multiple lenses. Constructivist and cognitive perspectives illuminate different aspects of learning and design, and it is productive to view these perspectives not as mutually exclusive or competing theoretical perspectives but rather, as Sfard (1998) argued, as mutually complementary points of view.

GAMES AND ENGAGEMENT

Computer and video games have become commercially successful because they are designed to engage players. Single player, multiplayer, and MMOGs are becoming increasingly sophisticated in design. Strategies for engagement include player positioning or POV, narrative arc, and interactive choice. Although looking at these various aspects of game design is likely to yield information about the development of educational games, an investigation of popular games is also likely to yield information about design that would inform the field of instructional design for both traditional educational media and interactive learning environments.

The Trajectory of Player Positioning

As with most new media, early computer and video games were modeled on existing conventions. The early design of electronic games borrowed from traditional board games. In board games, all of the action takes place on a single two-dimensional space, and the player, who is external to the game, manipulates and moves pieces. Examples of this convention can be seen in early versions of such games as Pong™ and Pac-Man. All action occurs within a two-dimensional frame space with the player positioning being an orthographic or "God's eye" view of the gamespace. In an attempt to move beyond the single frame design, video games such as Super Mario Bros. incorporated the "side scroller," which allowed users to explore spaces initially hidden from the first view. This shift from a single screen to a scrolling environment incorporated a sense of both motion and discovery into gameplay. The advent of more advanced graphics capabilities supported the integration of the isometric view. The isometric view found in such games as SimCity and Civilization™ can roughly be described as "two and one half dimension." What is notable about the shift to an isometric view is that, although the player still has an overall view of the scene, there are areas of the environment obscured or blocked from view. With the advent of affordable graphics accelerator cards and faster processors, game designers have been able to create increasingly more sophisticated and immersive gamespace environments (Riddle, 2002). Games such as Quake™ and Doom™ marked a departure of external player positioning, and moved the player into the environment by using first-person POV. The result of this design shift is that players become part of the environment, no longer viewing the entire gamespace within one or several frames but, rather, encountering obscured information, events, actions, and activities as the they move through the graphical environment (Riddle).

Implications for instructional design. A discussion of the shift of player positioning may initially seem to hold little relevance for the design of educational materials, however, there are some admittedly tenuous yet interesting parallels to be drawn between the shift in player positioning and recent shifts in theoretical perspectives of learning. What is more important than these tenuous parallels, however, is what can be gained from making them.

The shift from an outside orthographic perspective to a first-person agent embedded in the gamespace marks a shift in moving the player from outside of the game into becoming part of the gaming environment. The result of this shift creates more engaging experiences for the player (Riddle, 2002). These changes in design have growing relevance for the design of materials for both traditional classroom activities and digital interactive learning environments. A parallel between player positioning in gamespace and learner positioning within differing theoretical perspectives of learning can illuminate and

inform instructional design about how to create engaging learning environments. For example, within a behaviorist perspective, the focus of the learning environment was to elicit the proper responses to stimuli. The positioning of the learner is external to the learning environment. Mastery of the desired material is the goal. However, the shift to a constructive epistemology marks a departure from an objectivist, systems approach to the design of instruction toward engaging learning environments that support the construction of knowledge (Duffy & Cunningham, 1996; Jonassen, 1999). Problem-based learning and project-based learning are two examples of methods that reflect this epistemological shift in the design of instruction. In both of these methods, learners are taking a first-person perspective within the learning environment. No longer is the focus on a God's eye view and mastery of a specific set of exercises, but rather information, events, actions, and activities are obscured from view and encountered as the learner moves through the learning materials and environment.

What is important about this shift is that new media continue to be developed. In the history of instructional design, techniques and strategies of popular media have commonly been appropriated for the design of instruction. As media continue to evolve, it is important that designers look not only at how new forms can be appropriated for learning, but also at the underlying values promoted by the design. Game designers are the pioneers in interactive design. The techniques they employ allow for increasing engagement and player control in the gameplay environment. The role of the player has become more active and individualized, and at the same time, more social and central to the game. Value is placed on environmental design and how the individual player may interact with various aspects of the environment. In order to appropriate game design conventions for traditional educational purposes and interactive learning environments, it is important to look at the underlying epistemology that will be promoted in the design. The parallel between game design and learner positioning within differing theoretical perspectives of learning reveals that the values perpetuated in the design of contemporary gameplay may be a better match for the design of constructivist learning environments than for design from a behaviorist perspective.

This analysis of player–learner positioning has focused primarily on a holistic level of overall design. Although informative on a design level, it reveals little about the advantages gained by allowing individual learners to interact within an environment from both a first-person perspective and with the affordances of being able to shift between varying perspectives. According to game designer Alan Riddle (2002), the shift of first-person player positioning creates more engaging experiences for the player. Players discover and encounter the environment as they continue to play. Research into the educational uses of virtual reality reveals that there are benefits to be gained by providing three-dimensional learning environments that support both multiple and first-person perspectives (Bricken, 1990; Dede, Salzman, & Loftin, 1996). Bricken and Byrne (1994) noted that immersive three-dimensional environments afford learners opportunities to learn by interacting first hand with virtual objects, which, depending on content, may lead to better conceptual understanding of the content. This is partly because of the first-person interface (Bricken, 1991). Winn (1993) argued that virtual reality technology allows learners to approach some concepts as first-person nonsymbolic experiences, whereas too often information is codified and represented as "third-person symbolic experiences." According to Winn, virtual environments can help bridge the gap between experiential learning and information representation.

This parallel between game-space design and learning-environment design reveals some of the potential that the design of popular computer and video games may hold for the field of instructional design. The positioning of the learner in the learning environment is only one example of how game design might inform instructional design. Certainly the role of narrative and aspects of interactive design in popular games will yield much valuable information for the design of engaging learning environments.

Narrative

According to Bruner (1990), narrative is both a means of reasoning and a means of representation. It is inherently sequential. Narrative is the means by which humans both frame and recount their experiences (Polkinghorne, 1988). It may be real or fantasy, based not on plausibility of facts, but rather on the integrity of structure internal to discourse (Bruner). Within the game design community, the role of narrative in games fuels an often passionate and ever ongoing debate (Aarseth, 2001; Frasca, 2001; Juul, 2001). Advocates of narrative in game design argue that a strong narrative line can create more immersive and engaging gameplay (Adams, 2001; Bringsjord, 2001), but opponents argue that central to gameplay is interaction, not storytelling (Juul, 1998; Laramée, 2002). One of the primary contentions of incorporating narrative into gameplay is that narrative is primarily linear in construct. The degree to which our concept and construction of narrative has been influenced by media is among the arguments posed by both advocates and opponents of narrative in game design. Typical narrative arcs include a beginning of the story, a rising arc of conflict leading to a climax, and finally a denouement. This works well within the medium types of books and films. Although artists have challenged and created nonlinear pieces within these media, the linear nature of books and film imposes, to some degree, limits on how narratives can be constructed. Games represent a new, nonlinear medium that affords interactive opportunities for players. The affordance of player input interferes with and alters the nature of linear narrative (Pedersen, 2003). The challenge to designers is how to tell a story and still permit the player to affect or possibly change the story, depending on choices made throughout the game. One strategy for infusing story and plot into gameplay includes branching stories, in which the player's choice significantly affects both the storyline and the outcome (Rouse, 2001). A second strategy is to keep the narrative line intact, but to allow players a choice in the order in which they access various components of the story (Rouse). Both of these strategies integrate narrative into gameplay. With the evolution of MMOGs, players now have the opportunity to create their own narrative experiences both within the gameplay environment and with interactions external to the gamespace (Jakobsson & Taylor, 2003).

Regardless of one's stance in the argument, narrative has a long history of being embedded in game design. Among devices used to support gameplay are both plot-based and character-based narrative (Sikora, 2002). *Plot-based narrative* typically involves complex scenarios with a broad scale and a multitude of characters. Examples of plot-based narrative include Myst and Riven, in which the overriding focus is on the player performing actions that support and advance the plot. *Character-based narrative* typically involves the development of detailed characters. Players identify and take on the role of a character within the game (Sikora). Examples of character-based narratives include Lara Croft Tomb Raider™ and Buffy the Vampire Slayer™, in which action centers on a central character. The player–character is often undertaking a quest or journey. What is intriguing about this form of narrative is that frequently the character undergoes some type of transformation within various stages of the game. Typical narrative devices that may be included within both plot-based and character-based storylines include backstory, cut scenes, flashbacks, foreshadowing, cliffhangers, and red herrings (Onder, 2002).

The two main devices for integrating narrative into game design are backstory and cut scenes. *Backstory* is the background or history of the storyline. Its purpose is to provide a dramatic context for the action and interaction in the game (Crawford, 2003). A backstory may be as simple as a brief sketch of the main characters and key conflicts within the storyline (e.g., A long time ago in a galaxy far, far away . . .) or it may be as complex as a player's manual with a detailed history of key characters and conflicts, along with maps that illustrate the gameplay terrain, and in-depth explanations of items and actions. *Cut scenes* are elements of storyline interspersed and revealed during the course of the gameplay. Cut scenes take many forms, and may be as elaborate as sections of full screen motion video or as simple as journal entries, book chapters, images, audio broadcasts, or

even conversations with nonplayer characters (NPCs). The purpose of cut scenes is to further the storyline and to establish and support the mood and tone of the game. Cut scenes are sometimes used as *information dumps* to provide players with key information. They may also be used as a type of reward for completing puzzles or challenges (Hancock, 2002). Other types of cut scenes include flashbacks, foreshadowing, cliff hangers, and red herrings (Hancock; Onder, 2002). Although narrative may also be supported through interactive elements such as the setting and interactions with other characters and NPCs, and through player actions and feedback, cut scenes and backstory are often the primary devices for integrating narrative into gameplay. Despite the devices used, narrative storyline is most engaging when the narrative devices do more than just advance the story, and the culmination of narrative support and player choice constructs the story.

Relevance for instructional design. Malone (1981a, 1981b) identified the elements of challenge, fantasy, and curiosity present in popular games that could be integrated into educational settings. Narrative is a device that enables and supports fantasy. The use of narrative, although not necessarily in the form of fantasy, has also played varying roles in instructional design for multiple fields. Narrative in the form of case studies has routinely been used in such diverse fields as teacher education, medicine, and the arts (Eisner, 1998; Shulman, 1992). The benefit of integrating narrative in instructional design is that it provides opportunities for reflection, evaluation, illustration, exemplification, and inquiry (Conle, 2003; Eisner). Additionally, narrative has been found to aid in comprehension (Laurillard, 1998) as well as serving as a tool for navigation in multimedia environments (McLellan, 1993). Narrative has been integrated into instructional design in the use of problem-based and project-based learning (Dodge, 1995; Egan, 1988; Laurillard; Weller, 2000), however, little has been written about the pragmatic application of narrative in instructional materials, and how to create compelling narratives to support multiple learning activities in complex, multifaceted environments, and to sustain interest over time. Game design reconstructs narrative as a story with elements of immersion, agency, and participation.

Looking at how narrative is woven into and at times supports the design of gameplay will likely inform instructional designers of how this device can be incorporated into learning activities and thematic units to sustain and enhance engagement over periods of time. Both backstory and cut scenes can be integrated in problem-based learning, project-based learning, and case studies, with backstory providing a dramatic context for learning while cut scenes are interspersed throughout the activity to both advance the narrative storyline and provide feedback based on learner choices. The mechanics of how to frame these devices can be as simple as text narratives or as elaborate as images, audio, characters, and text embedded in Web-based or 3-D virtual environments.

Certainly there are aspects of plot narrative present in both educational games (Where in the World Is Carmen Sandiego™) and educational activities (The Adventures of Jasper Woodbury™), however, where game design may prove most relevant is in the design of a spatial narrative or spatial storytelling (Carson, 2000; Cognition and Technology Group at Vanderbilt, 1992; Jenkins, 2002; Schell, 2003). The role of narrative in educational materials is often based on a linear timeline. This may be attributable to the fact that books, films, or video often serve as the primary medium. However, computer and video gaming environments illustrate how space and architecture can be used as compelling infrastructures for narrative based, not on timelines, but rather on spatial relationships. Games provide narrative spaces (Jenkins). Narrative spaces allow players to interact with each other, other characters, the environment, and aspects of the game. These narrative spaces are mapped throughout an environment, and the narrative is constructed by the relationships between space and events. As with the hero's journey in epic poems or the narrative architecture imposed on gothic cathedrals, these spaces allow for a coconstruction of tales, with a possible shift in narrative authority. Carson, an environmental designer, argued that virtual environments such as those found in three-

dimensional games allow players to experience a story through an imagined physical space. According to Carson, the use of such devices as placing and arranging items in the environment allows players to come to their own conclusions in cause-and-effect vignettes. Although this notion of designing educational spaces holds great implications for the design of educational materials for such diverse fields as science, history, and social studies, what may be most fruitful in examining narrative in game design is the notion of using an architectural or environmental metaphor for the design or landscaping of educational environments.

Interactive Design

Games are designed to engage players. Game designers are at the forefront in developing interactive design. Elements of interactive design include the various dimensions of a setting, the roles and characters within a game environment, and "hooks" that afford actions and feedback to the players. In order to investigate how these elements might be incorporated into instructional design, it is necessary to look at how they function in engaging players in game design.

Setting. Within different game genres, the setting plays a variable role in the design by supporting the narrative, providing a sense of immersion, and defining the gamespace (Laramée, 2002; Rollings & Adams, 2003). According to game designers Rollings and Adams, a game setting can be defined by physical, temporal, environmental, emotional, and ethical dimensions. The physical dimension defines the physical space in which the player's character–avatar[1] or game pieces move around (Adams, 2003; Rollings & Adams). This dimension comprises scale and boundaries, which define the size and edges of the playing environment. For example, the physical dimensions of the setting for computer chess is likely to be significantly smaller in scale and have more distinctive boundaries than a more elaborate setting such as one found in the online game EverQuest™.

The temporal dimension (Rollings & Adams, 2003) defines the role of time in the game. It not only describes temporal aspects such has how much time a player has to complete an action, but also defines whether the game will include nightfall, seasons, and time passage, as well as delineating the impact that time passage will have on gameplay. For example, during several hours of playing the game Diablo™, a player may cycle through day and night several times, however, the passage of time has little impact on the game, whereas in a game such as Syberia,™ there is no day and night cycle, yet time is more literal and at times seems to parallel real-world time.

The environmental dimension (Rollings & Adams, 2003) defines both the game setting appearance and atmosphere. It characterizes the game setting as fantasy or realism, the historical context, the geographical location, and the overall mood and tone. Although the focus of the environmental dimension is visual, it also outlines the cultural context and, to some degree, backstory of the game. The environmental dimension is manifested in the use of color and lighting, the shape, size, and placement of objects within the environment, and the supporting materials such as menus and documentation. The game Alice,™ for example, uses muted colors and distorted objects to invoke an eerie and disturbing environment, whereas the drab colors and realistic scale of objects in the game Medal of Honor™ convey a sense of realism more consistent with the subject of the game.

The emotional dimension (Rollings & Adams, 2003) describes the emotions of both the characters in the game and the types of emotions that the design is intended to invoke within the game. The emotional dimension can support both character development and the narrative framework of the game. The ethical dimension (Rollings & Adams) defines the moral aspects of the game. It is by defining this aspect that character and roles logically follow rules that govern conventions within the context of the game.

Relevance for instructional design. An investiga-

1 The visual representation of a user–player in the virtual environment.

tion of game design strategies reveals that the setting, to varying degrees, supports the gameplay by providing physical, temporal, environmental, emotional, and ethical dimensions. The careful blending of all five of these dimensions helps foster a sense of suspended disbelief and provides players with a sense of immersive engagement in the gameplay environment. The use of settings and scenarios is a strategy that is employed in a variety of instructional methods and activities. Problem-based learning (Barrows, 1986; Duffy & Cunningham, 1996; Savery & Duffy, 1995), project-based learning (Blumenfeld et al., 1991; Thomas, 2000), anchored instruction (Bransford, Sherwood, Hasselbring, Kinzer, & Williams, 1990; Cognition and Technology Group at Vanderbilt, 1990, 1993), and case studies (Ertmer & Quinn, 1999; Julian, Larson, & Kinzie, 1999) are methods that often employ the use of settings to support learning. Many of these methods employ the use of a setting as a macrocontext for embedding learning in complex and/or realistic environments (Duffy & Cunningham; Jonassen, 1999; Lave & Wenger, 1991; Perkins, 1992). However, rarely are instructional settings as fully realized and supported as those found in gaming environments. Strategies employed in game design may be of great use in the design of complex digital and, possibly, even nondigital learning environments by providing methods and guides for delineating various domains that comprise an interactive setting, as well as by providing models for how various dimensions (physical, temporal, environmental, emotional, and ethical) might affect both learner engagement and interaction.

Roles and characters. In computer and video games, often the player is cast as the main character within the gameplay environment. This main character may be predefined in both appearance and dialogue, and the player interacts in the gameplay environment as this character. For other games, such as the multiplayer online games EverQuest and Sims Online™, players may to varying degrees select their own character and character attributes. When players' characters are not predefined, their dialogue may be limited, whereas dialogue between players is often free flowing. Both the physical representation of characters and the dialogue help establish a sense of immersion or telepresence in the gameplay environment. Many game environments are also inhabited by NPCs. These characters, which often aid the players or attempt to prevent them from achieving their goals, also support the narrative within the game.

Character development in game design varies from genre to genre and even from game to game within a genre, however, importance is placed on the creation of compelling characters with which players not only empathize, but whose roles they are also willing to assume. There are a variety of techniques that game designers use to create a bond or psychological proximity between player and character (Schell, 2003). These techniques include establishing a link between the character and the environment (Gard, 2000), providing player interactive choices (Schell), and establishing emotional depth through the use of symbols, dialogue, and through interactions with NPCs (Freeman, 2002, 2003).

Relevance for instructional design. The use of role playing is not novel to instructional design. A variety of research about the educational use of virtual communities has addressed the value of learners taking on multiple personae or creating unique identities in computer-mediated environments (Bruckman, 1997; Bruckman & Resnick, 1995; Dede, 1995, 2000; Riner, 1996; Turkle, 1995). Among the benefits noted are a reduction of inhibitions, the development of peer role models, role reversals between students, teachers, and between peers, and the emergence of anonymous or *fluid* identities (Bruckman, 1997; Dede, 1995; Riner; Turkle). Game design has refined techniques and strategies for developing complex characters. These strategies could likely be adapted into various types of educational methods. For example, the use of case studies for teaching might benefit greatly from the integration of strategies and techniques for developing roles and supplemental characters, particularly for interactive Web-based case study learning environments (Julian, Kinzie, & Larsen, 1998). With the integration of the Web, MOOs, and educational three-dimen-

sional environments, likely strategies for character development will greatly benefit from the development of intelligent agents and bots[2] within computer-mediated learning environments.

Actions, feedback, and affordances. Typically, most gameplay is goal oriented. The focus of the setting, story, and character is on the player–character achieving a particular goal. The interaction within the gameplay is rule bound. Rules define what the player–character can do. They also define victory and loss conditions. Rules must be consistent with the character in order to be believable. Interaction is afforded by the challenges the player–character faces and the obstacles that must be overcome (Rollings & Adams, 2003). Various type of interactivity are achieved through the affordances of gameplay *hooks.* According to Howland (2002), such hooks are "anything that requires the player to make a decision that relates to the game, and thus keeps them playing" (p. 78). Hooks are the types of choices a player makes in the course of the game. Howland outlined a variety of hooks used in game design, including *action hooks, resource hooks, tactical and strategic hooks,* and *time hooks.* These hooks are manifested in different ways depending on the game genre. For example, action hooks (choices) in a role-playing game might include quests and missions, whereas in an action game they might include decisions about exploration, navigation, and who and what to avoid and/or follow. In multiplayer online games, action hooks might include communication with other players and alliances within communities. Resource hooks in various game genres may include arsenals, ammunition, health, wealth, and the mental state of the character. Resource hooks indirectly affect actions because reservoirs of resources may alter or impede actions taken by the character. Tactical hooks are decisions characters make throughout the game about how resources might be allocated and strategies to employ during key aspects of the game. For example, in action games this might include map memorization and way-finding strategies, and in role-playing games it might include character types and skill affordances. Time hooks involve counters and timers that impose temporal limits on the actions of a character such as actions that must be completed within a prescribed time frame (Howland). The genre of the game and the type of actions determine the types of hooks or choices available and employed, but typically a player encounters a multitude of hooks throughout a game.

Relevance for instructional design. Central to the design of gameplay is choice. Players continually make choices as to who to be, where to move, what to do, and how to allocate resources. These choices—hooks—both personalize the experience and affect the gameplay. Designers embed these hooks within the gaming environment as part of the interactive design. Hooks make for engaging gameplay; however, they may also provide instructional designers with methods for creating engaging learning environments. Whereas the term *hooks* may be unique to game design, educational simulations in various forms have long implemented aspects of choice, action, feedback, resource management, and tactical and strategic planning. Educational simulations may range from experiential simulations in which learners explore cause and effect relationships, to complex symbolic simulations in which learners observe and explore interacting processes (Bell, 1999; Gredler, 1992, 1996). Typically the purpose of educational simulations is to represent or reproduce a real or imaginary environment in order to understand how various aspects of a physical or social system work by observing the results of actions (Alessi & Trollip, 1991; Gredler, 1996; Hannafin & Peck, 1988; Horn & Cleves, 1980; Rieber, 1996; Riner & Clodius, 1995). Gaming design and educational simulations share common elements of interactive design, such as defined parameters and allocated resources. Additionally, both may prompt similar results, such as reflection and analysis. Although educational simulations provide representations of a real or imaginary social or physical system, what game design offers

2 Derived from the word *robot.* A small comptuer program represented as an agent, that is typically endowed with elements of artificial intelligence so that it responds to commands or reacts to situations.

instructional designers is pragmatic methods for characterizing an educational simulation or interactive learning environment by providing tactics and methods of integrating first-person perspective, settings, roles, and actions within a narrative arc. Gaming design has refined the aspect of choice by the identification of various hooks that require users to, at times, analyze and synthesize diverse sources of information, plan strategies, problem solve by forming hypothesis, and evaluate (Prensky, 2001). Whereas gameplay is primarily for entertainment, the design of sophisticated gaming environments requires players to implement higher order thinking skills in order to navigate and interact. This may prove to be of the greatest value for instructional designers because these are the very skills that educators and instructional designers attempt to foster in learning environments.

Game Design and Instructional Design

Proponents of engaged learning argue that learners can become meaningfully engaged in the learning environment by being provided with activities that allow them to play an active role and make judgments about progress toward defined goals (Bell et al., 1996; Schlechty, 1990). The learner plays an active role in the construction of knowledge, while the role of the teacher is to provide materials and an environment that support the learner's engagement in the learning tasks. Although key components of engaged learning have been identified, few models and exemplars for achieving these components have been presented in the literature about engaged learning. Popular video and computer games are designed to engage players both over time and, for some games (MMOGs), over distance. This investigation reveals devices that game designers implement in the design that may be of assistance for the development of learning environments. A comparison of the theoretical construct of engaged learning with gaming methods, strategies, and devices reveals that they contain similarities; both engaged learning and game design stress the importance of focused goals and challenging tasks. However, what an analysis of game design reveals is methods and strategies for creating learning activities and environments that support those goals and tasks. For example, the use of narrative and role playing are ways in which game design aids players in maintaining focus on goals. Additionally the integration of NPCs along with user first-person perspective helps reinforce or maintain both the narrative and role playing. Challenging tasks are reinforced by providing dimensions of the setting (physical, temporal, emotional, etc.) and through the use of hooks or choices that users must continually make within the gameplay environment. These choices require players to strategize balancing both resources and time with actions that the player believes will help accomplish a particular goal.

Aspects of game design fit into the existing model of engaged learning and provide a fuller framework and methods for integrating engagement strategies for both traditional educational media and interactive learning environments. Table 1 illustrates where game design can be usefully integrated into the existing framework of engaged learning.

The purpose of game design is entertainment, whereas the purpose of instructional design is education. Yet it may not be productive to view these two undertakings as polar opposites or mutually exclusive. Good game design requires much of players in terms of time, emotion, and problem-solving skills. Clearly a study of game design illuminates strategies and devices meant to engage players in an entertainment setting, but can these strategies and devices be adapted for use in an educational setting? Evidence suggests that likely game design can be integrated into various types of learning environments and activities (e.g., problem-based learning, project-based learning, case studies, and educational games and simulations); however, given the wide range of possible environments and activities, it is difficult and perhaps premature to generate operational guidelines. Learning activities vary in how they are actualized. Therefore, rather than prescribing guidelines, it is more productive to supply exploratory questions to provide operational guidance for designers seeking to instantiate game design strategies and devices into various learning activities. Obviously content and context will determine which elements would be

Table 1 ☐ A comparison of engaged learning and game design elements.

Engaged Learning	*Game Design*
• Focused goals • Challenging tasks • Clear & compelling standards • Protection from adverse consequences for initial failures • Affirmation of performance • Affiliation with others • Novelty & variety • Choice (Hall, 1998; Jones et al., 1994; Schlechty, 1997)	• Focused goals ◦ Narrative ◦ Character roles ▪ Interaction with NPC and other players ▪ Perspective • Challenging tasks ◦ Setting ◦ Action hooks (choice) ◦ Resource hooks (choice) ◦ Tactical and strategic hooks (choice) ◦ Time hooks • Clear & compelling standards • Protection from adverse consequences for initial failures ◦ Role-playing • Affirmation of performance ◦ Hooks • Affiliation with others ◦ Role-playing ◦ Nonplayer character • Novelty & variety ◦ Narrative arcs • Choice (Howland, 2002; Rollings & Adams, 2003)

Table 2 ☐ Design questions for integrating game design strategies to support learning activities.

Narrative
Backstory: • What is the primary obstacle or conflict that must be overcome (e.g., a deadline, limited resources or a mystery to be solved)? • Who are the main characters and how are they constructed (e.g., assigned roles or learner created)? • How will the backstory (history and dramatic context) be conveyed (e.g., a journal, a job brief, or a narrator)? • Who is telling the (back)story (e.g., omnipresent narrator or another character in the narrative)? Cut Scenes: • What is the purpose of the cut

Table continues.

most appropriate to employ. Table 2 provides an example of the types of questions a designer might consider addressing when designing learning activities and environments to support engaged learning.

DISCUSSION AND CONCLUSION

The purpose of this research was to investigate how the design of games might inform instructional design by looking at methods, strategies, and devices that engage game players, and comparing them to a model of engaged learning. The findings reveal that aspects of player positioning, narrative, and interaction in game design, in addition to providing more detailed methods for creating engaging learning environments, may also serve as a type of guiding architecture for the design of interactive learning environments.

Table 2 □ *Continued.*

scene (e.g., reaction to choices made by learner or to advance the narrative storyline)?
What types will be used (e.g., flashbacks, information dumps, embedded in setting, or character dialogue)?
How will the cut scenes be revealed (e.g., dialogue, journal entries, newspaper reports, or through a mentor–guide)?
When will they be revealed?
Perspective
• Where is the learner positioned in the environment (i.e., first person or omnipotent observer)?
• How will information be revealed to the learner (e.g., as the learner encounters or finds it, through maps and/or manuals)?
Interactive Design
Setting:
• What are the physical dimensions (i.e., scale and boundary)?
• What are the temporal dimensions (e.g., era, seasons, time passage, and time to complete actions)?
• What are the environmental dimensions (e.g., fantasy, reality, historical context, geographical location, atmosphere and appearance)?
• What is the emotion that this activity hopes to evoke and how will this be conveyed?
• What are the ethical dimensions or moral aspects of this activity? How will they be defined (e.g., character description and narrative)?
Roles and Characters:
• Who are the main characters and how are they constructed (e.g., assigned roles or learner created)?
Actions and Feedback:
• What types of choices or hooks will help support the learning activity?
◦ Action hooks: Quests, missions, and navigational choices, communication with other learners and NPC.
◦ Resource hooks: Libraries, maps, text, images, statistics, etc.
◦ Tactical hooks: Strategies, allocating resources, wayfinding.
◦ Time hooks: Temporal limits

Game design provides assistance to instructional designers not in the form of a system or a formula to be applied, but rather as a type of architectural model for promoting engaged learning.

It was not the purpose of this research to provide the ultimate study of the design of popular games, or to advocate implementing popular games into a learning environment, but rather this investigation was limited to looking at how various design elements of popular computer and video games might help inform instructional designers about creating engaging learning environments. It is acknowledged that the goal of game design is entertainment, whereas the goal of instructional design is learning. This investigation revealed that there is much more to be explored from the study of game design. No attempt was made to address critical or cultural issues in game design. Issues of how race, gender, and ethnicity are represented in any potential educational environment are of concern to most educators, and further research about game design should be conducted about these issues. Additionally, the mine field of violence in popular games was purposefully avoided in this investigation.

Although constructivism has gained prominence during the past two decades, there is still much research to be garnered in the areas of designing constructivist learning environments and the opportunities new interactive media may provide in fostering learning. I believe that this research has yielded information into how game design may assist instructional designers in the development of problem-based, project-based, and constructivist learning environments by looking at the roles of narrative, role playing, learner positioning, and interactive choice. □

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