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**Massive Multiplayer Online Gaming:  
A Research Framework for Military Training and Education**

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**March 2005**



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**NOTICES**

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14. ABSTRACT ( <i>Maximum 200 words</i> ) Massive multiplayer online gaming, first popularized in the entertainment world, is now finding growing interest in education and training environments. The military and business have noted the potential for simulation and gaming technology to develop higher order thinking skills; in particular, they see potential in such areas as problem solving, metacognition, and decision making. However, much of the research in this area lags behind the technological advances, focusing on user demographics, attention spans, and perceptual skills, instead of addressing the impact these games might have on player's analysis, decision making, and reflection skills. In part, the current body of research represents the interests of the gaming industry, which is more focused on exploiting any new technology to satisfy the attitudes, preferences, and expectations of its users, rather than the interests of education and training. It also reflects the fact that this is an emerging area that suffers from limited research and strategic planning. The report reviews the relevant research literature and proposes 15 primary experiments.					
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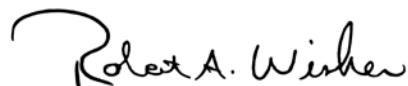
## FOREWORD

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The goal of the Advanced Distributed Learning (ADL) Initiative is to provide the highest quality education and training, tailored to individual needs, delivered cost effectively, anywhere at anytime. Since its inception in 1997, ADL has sought to create interoperability of online learning content through the Sharable Content Object Reference Model (SCORM) and to make quality content accessible from commonly designed content object repositories.

The current report examines multiplayer online games as a future focus area for ADL. The adoption of and interest generated by these games is truly incredible. From a review of the research literature, we know that playing such games can lead to measurable learning outcomes. How well these outcomes correspond to military training and education requirements needs to be understood to make full use of the capability. Can they become part of a performance support architecture? What are some of the key experiments that can help us understand the full range of benefits to learners and organizations?

This report examines these and related issues in online games. Its focus is on learning rather than the underlying technology. It is academic in nature, reflecting the findings in the research literature. This report serves as a research foundation for experimentation on massive multiplayer games within the military.



ROBERT A. WISHER  
Director, Advanced Distributed Learning Initiative





# **Massive Multiplayer Online Gaming: A Research Framework for Military Training and Education**

## **EXECUTIVE SUMMARY**

### Research Requirement:

The United States Military is undergoing significant change in the training of its workforce. Massive multiplayer online gaming (MMOG) is one technology that offers unique education, training, and performance support opportunities. While the research on MMOG is scant, there is a need for a review of measurement methodologies related to MMOGs for adult learners. In particular, this document notes trends in the use of games and simulations for education and training purposes, common and preferred communication features, motivational aspects of multiplayer games, and the results of preliminary research in this field. In addition, it outlines completed and ongoing efforts to develop training games in a military context as well as findings related to the transfer of performance in games to performance on occupational tasks. As is evident in this document, there is a pressing need to know how problem solving and decision-making skills are being measured in online gaming environments.

### Procedure:

Database searches yielded less than a dozen research reports specifically on MMOGs. Instead, most articles in this field related to press releases about trends in the industry. However, there were a number of research studies on various games and simulations in the military as well as education and business which inform this report. In reviewing these studies, significant gaps in the literature were noted. A set of 15 primary and 18 secondary experiments were designed to address most of the gaps that were identified in the review of the research literature.

### Findings:

There are many interesting research questions to be asked in the field of MMOG. Among the open questions or issues are those related to the benefits MMOGs when blending face-to-face and online learning, the impact of a learning community on player performance within a MMOG, variables that impact persistence of group members, the motivational aspects of MMOGs, the impact of MMOGs on player decision-making, leadership, and problem solving skills, the ability to influence MMOG role playing, and the prevalence and impact of online gaming addiction. In response, 15 primary experiments were designed that address these areas and many others.

### Utilization of Findings:

The proposed experiments can be implemented in a number of ways. For example, the experiments can be embedded in courses undergoing a transition from the classroom to a distributed learning environment. In addition, these experiments can be applied to either professional development education or specialized skill training throughout the military.



# MASSIVE MULTIPLAYER ONLINE GAMING: A RESEARCH FRAMEWORK FOR MILITARY TRAINING AND EDUCATION

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# **Massive Multiplayer Online Gaming: A Research Framework for Military Training and Education**

## **1. Introduction**

The field of computer gaming has risen to near equal status with the film and music industries in terms of revenue, customers, and employees (Kirriemuir, 2002). Jayakanthan (2002) likens the influence of the computer gaming industry on youth today to the influence of music, religion, and politics in previous decades. In fact, computer games are so popular that blockbuster films are being made about them (e.g. *Super Mario Brothers*). According to Snider (2004), launching a game costs roughly \$10 million with nearly half of that amount supporting development costs and the other half for marketing. Costs will depend, however, on the size and location of the development team, the need for highly skilled developers, the number of special effects, and number and types of platforms it is to be designed for (Sawyer, 2002).

Certain skills gained and practiced by gamers in massive multiplayer online gaming environments closely parallel those required by a military transforming itself to operating under the concept of network centric warfare. The technologies and practice methodologies employed in multiplayer games also hold great potential to provide appropriate network centric warfare training environments.

Network centric warfare describes an environment where “geographically or hierarchically dispersed, knowledgeable entities” are linked (Alberts, Garstka & Stein, 1999). Multiplayer games are built around the same concept of electronically linking participants and displaying them together in the same virtual space. Virtual teams in both network centric warfare and MMOGs create shared situational awareness through the sharing of information and through goal-directed collaboration. They also cut across hierarchical lines by empowering and expecting knowledgeable entities to “collaborate with one another to achieve a degree of self-synchronization” (Alberts et al., 1999).

### **1.1 Size and Growth of the Computer Gaming Industry**

The commercial computer gaming industry in the United States has been estimated at anywhere from \$7 billion (Herz & Macedonia, 2002) to \$9 billion (Vaknin, 2002) which rivals, and many now argue surpasses, Hollywood movie box office revenues of \$8.1 billion (Snider, 2002). Global estimates in 2002 for computer gaming were \$27 billion and growing at a rate of 20 percent annually in the United States alone (Delaney, 2003). Furthermore, the gaming industry’s yearly revenue in the U.S. is projected to soon pass both the record industry, as well as the home video sales market (Snider, 2002).

Computer games have reached a fairly ubiquitous level of availability -- whether one is in a hotel room, on an airplane, sitting at home reading the paper, or using a cell phone or wristwatch, odds are that a computer game is present. Already the gaming industry attracts more than 60 percent of the American population, with an average age of 28 (Kirriemuir, 2002). The numbers are higher for teenage boys, 75 percent of whom play

computer games (Lenhart, Rainie, & Lewis, 2001). The opportunities to play online games are projected to soar during the coming decade.

## **1.2 Impact of Computer Gaming in Everyday Life**

The widespread availability and popularity of gaming has led to questions about its effects on our lives. Through survey and ethnographic research, the Pew Internet and American Life Project (Jones, 2003) explored the impact of gaming and entertainment technology on the lives of college students. According to this study, 70 percent of college students played computer, video, or online games at least once, and 65 percent reported being regular or occasional game players. From such data, it is clear that once one has played a game, there is a high likelihood of a repeat occurrence.

In this age of multitasking, games are highly integrated into leisure activities such as music or interacting with friends. Initial computer games tended to be single-player or involved turn taking. Not surprisingly, many people stereotype computer games as isolated or individual activities. However, Jones (2003) argues that computer gaming should no longer be connoted as a solitary activity, but instead it should be considered a social endeavor involving friends, more like traditional board games.

Nearly half of the students in Jones' (2003) study admitted that gaming sometimes kept them from their studies. However, these college students viewed their time spent with these games as a positive aspect of their lives, in contrast to the more negative terms often seen in the research literature. Across these findings, Jones noted that college students selecting online gaming environments were doing so to take part in an extremely social activity but such activity was just part of many other tasks.

## **1.3 Differences between Games and Simulations**

Games and simulations are broadly used. Computer games include strategy games, building simulations, quests and adventures, sports games, war games, puzzles, educational games, and computer role playing games (Ju & Wagner, 1997). According to Sawyer (2002), the advantages of simulations and games is that they: (1) can foster strategic thinking and other learning benefits through repeated use; (2) utilize technology available to the general public; (3) can intertwine both fictional and non-fictional events.

Simulations attempt to provide an environment that represents or mimics reality so as to facilitate learning of the player or user. They often are built to engage the learner in situations or events that would be too costly, difficult, or hazardous in the real world (Gredler, 1996) or that may be deemed problematic for ethical reasons (e.g., frog dissection). They tend to immerse the learner in complex, evolving situations and relationships. In contrast, games attempt to foster skill development by providing entertaining challenges for the player. As Prensky (2001) notes, the structural components of games include fun, play, competition, goals, rules, and winning.

Gredler (1996) points to three key differences between simulations and games. First, games consist of rules that describe allowable moves, may not reflect the real world, and penalize for non-permissible actions. In contrast, simulations are based on relationships among several variables that tend to change over time, and, nonetheless, reflect authentic causal processes (Leemkuil, de Jong, & Ootes, 2000). Instead of attempting to win a game, those in a simulation experience are engaged in a more serious and authentic responsibilities. Finally, games tend to be linear, whereas simulations present different problems, issues, or situations depending upon previous participant decisions. Gredler (1996) also notes that certain games and simulations can also be differentiated by the types of tasks that are established as well as the actions that tend to be rewarded.

Games are motivational, in part, due to their uncertain outcome and the focus on a goal or challenge that the user needs to accomplish. Early work by Malone (1981) indicated that the most important feature of a game was having a goal. According to Malone (1980), the goals and challenges within games are important since they engage a player's self-esteem. Multiple game goals or different levels of goals provide incentives and challenges for players once an initial goal is accomplished. Game players, therefore, must develop skills and strategies in order to win or achieve a goal (Sawyer, 2002). Unlike most formal training or education, in games there are multiple paths to success.

In addition to the importance of having a goal, players can affect the outcome of the game; in effect, they have some control over their learning situation. In an educational environment, then, such goal-based learning and sense of control deemphasizes or shifts the role of the instructor. From this perspective, success in a computer game, can positively impact a person's self-esteem. Games are also designed to be interesting, fun, and played multiple times (Sawyer, 2002). Often they are multiplayer, and, more recently, massive multiplayer. Massive tends to mean that there can be hundreds, thousands, or even millions of game players in the same world simultaneously.

#### **1.4 Gaming, Technology, and Learning**

Gaming is not an isolated phenomenon. Its growth has paralleled advances in information and communication technologies, and both in turn have had a clear effect on learning. For example, enrollments in online courses are surging and today's students – immersed in an increasingly digital world – are seeking richer and more engaging learning experiences. Amid the rising tide of expectations, instructors are exploring innovative ways to use technology to foster interaction, collaboration, and excitement for learning.

Oblinger (2003) claims that the learners of the early part of the twenty-first century are accustomed to ubiquitous computing environments where multitasking and staying connected are the norms. She further notes that students who are active participants in the information age want to engage in relevant meaningful tasks rather than just complete worksheets and accumulate knowledge. For instance, many teenagers are opting to chat online with their friends instead of watching television or talking on the telephone. In schools as well as informal learning settings, they want to collect real world data and manipulate it. Instead of knowing basic facts of a situation or where a place is located,

learners can simply “Google” it. Perhaps, most importantly, as they engage in new forms of learning, they simultaneously expect their teachers to offer learning opportunities in exciting and engaging formats where they have some control and responsibility over their own learning (e.g., the Internet). They expect learning to be available on demand whether it is through online agents or using supplemental materials their instructors have posted.

The authenticity of learning environments also is on the rise. As Jayakanthan (2002) notes, when U.S. Embassies around the globe were threatened, game developers began designing new levels or challenges within their games to deal with hostile takeover training and other terrorist threats. These challenges were based on actual embassy floor plans, creating a realistic game context and environment. In a way, these were momentous changes since they shifted the power and control of game development from the game developer camp to the end users (Riddell, 1997).

### **1.5 Computer-Based Simulations in Education**

In response to this perceived need for authenticity, there has been an increase in the use of simulations in both home and school environments. Simulations can help learners understand how to run a business, build a town, or save an environment. Learners can watch changes in processes, explore different assumptions in key military battles, and create alternative worlds and histories (Rickard & Oblinger, 2004).

Aldrich (2002; Morrison & Aldrich, 2003) delineated different types of simulations. First, there are branching simulations, which he likens to adventure books. A branching simulation might take the player through a situation such as a mock customer encounter. Here, the simulation will continue down different paths and display outcomes depending on the decisions of the player or user. Business school spreadsheets are another type of simulation. Such simulations depict the results of changes in different variables such as pricing, inventory, and outsourcing, on corporate sales and profits. Third, Aldrich discusses game-based simulations such as quiz shows which have been popularized by gaming advocates such as Marc Prensky (2001). Fourth, product-based simulations have been proliferating with the popularity of Macromedia’s *Flash* software. A virtual product might show the user where and how a particular device works.

Each type of simulation has distinct advantages and disadvantages (Aldrich, 2002). For instance, branching models are good for developing soft skills and providing consistent assessment. In addition, they are highly adaptive. However, he noted that in a branching simulation, there is a continuous feeling of assessment to a user rather than a meaningful, self-directed experience. Each type of simulation has a downside. According to Aldrich, for instance, while real actors in a video-based simulation foster a sense of credibility and can display subtle aspects of specific skills needed, they are highly expensive to produce and are nearly impossible to change once created. Similarly, Aldrich points out that computer graphics-based simulations can help focus on specific skills or competencies needed and might tap or foster user creativity and adaptive, higher-level thinking skills.



One recent example of a computer graphics-based simulation is the *Virtual Leader* from SimuLearn (Aldrich, 2004; Morrison & Aldrich, 2003) which Aldrich, himself, helped produce. In a nutshell, *Virtual Leader* simulates a business meeting and requires the player to perform a number of social interaction tasks (e.g., introduce ideas, refocus the group on ideas, take ideas off the table) with other computer generated characters in order to be an effective leader. The player must negotiate through tensions raised, explicit and implicit signs of power, and comments that have little to do with the meeting.

Clearly, there are many cognitive and metacognitive skills are embedded in playing the *Virtual Leader*. As alluded to above, from a cognitive standpoint, players learn how to recognize who has the power at particular points in meetings, when to reduce or raise tension in a room, how to gain power as a leader, and how to recognize ideas that appear to be hidden. From a more metacognitive perspective, players learn about goal setting and formulating plans to reach those goals, executing one's plans, obtaining feedback on their actions, and reflecting on and updating one's understanding of a situation after obtaining feedback (Aldrich, 2004). With this focus, Aldrich is not simply promoting a set of vital higher-order thinking skills; instead, he is promoting a cycle of learning.

Simulations are popular in other business situations and management processes. Data files, video clips, and flowcharts might help learners understand inventory control, customer order processing, and shipping schedules (Dessouky, Verma, Bailey, & Rickel, 2001). Higher-level outcomes might include learning how to make strategic planning decisions such as how to market products and where to locate new plants.

Stand alone simulations such as *SimTower*, and *SimCoaster* are exciting, initial indications of where this technology can lead learners. In those programs, feedback is typically from the system or game since the games are played alone. However, those using single player games can upload their scores or replays for others in the community to provide comments. As examples of the solution strategies of experts in the gaming community, such replays can help the problem solving skills and metacognitive processes of the users who access them as well as those posting them. And, with the recent rise of collaborative tools on the Web, it is standard practice for simulations to offer more than standard system feedback in solitary learning environments.

## **2. Massive Multiplayer Online Games**

### **2.1 Massive Multiplayer Online Games Defined**

Massive multiplayer online games (MMOGs) allow users to interact with other users around the globe in real-time. But what, specifically, are MMOGs? According to Squire and Steinkuehler (in press):

Massive multiplayer online games are highly graphical 3-D videogames played online, allowing individuals, through their self-created digital characters or "avatars," to interact not only with the gaming software (the designed

environment of the game and the computer-controlled characters within it) but with other players' avatars as well (p. 2)

They further point out that MMOGs are persistent worlds for both social and material exchanges that maintain a loose structure through fantasy and rich stories or narratives. Players in these worlds can pretty much do as they please; if they want to slay a dragon and an ogre, raise someone from the dead, siege a city or a castle, hunt for food, trade goods and services, or be the village idiot, they have the prerogative to do so as long as they are within the social boundaries of the game (Kolbert, 2001; Squire & Steinkuehler, in press). In *Star Wars Galaxies*, they can also swap stories and strategies at the virtual rebel outpost or local cantina with friends and foes from across the globe. In *Ultima Online*, such social rituals might also include pet shows, marriages, comedy nights, amateur theatricals, and disco parties (Kolbert, 2001). Whether one is interested in being a hero or villain, it is all possible in MMOGs. They embed escapist fantasies yet take on an emerging social realism in the memberships within the communities that form and the actions that unfold (Steinkuehler, 2004). Small wonder they are growing so fast.

## 2.2 Size and Growth of MMOGs

Even though not all games have been successful (e.g., *The Sims Online*, etc.), many scholars and leaders in the gaming field suggest that MMOGs are where most gaming activity will reside during the coming decade (Schatz, 2001). There is an expanding list of these MMOGs, including *Anarchy Online*, *EverQuest*, *Asherton's Call 2*, *Ultima Online*, and *Dark Age of Camelot*. As computer processing speed continues to increase, computer hard drives grow in capacity, available bandwidth expands, and hardware costs simultaneously plummet, the demand for MMOGs will continue to rise.

The scale in which they are used is impressive. By 1998, *Ultima Online* had more than 14,000 simultaneous players on many nights (Kim 1998). According to Herz and Macedonia (2002), by 2002, *EverQuest* hosted 350,000 players with over 100,000 players during peak times. More impressively, at about the same time, *Lineage* had 2.5 million subscribers (Vaknin, 2002). However, this is a cultural phenomenon as *Lineage* is mainly a Korean game and is embedded in the culture with pc gaming cafes (or "baangs", see Borland & Kanellos, 2004) which all have extremely high capacity. High scorers in this game are cultural heroes. As such *Lineage* is a highly social game which in many ways is played face-to-face since your opponents surround you at the café. While *Ultima Online* ranked somewhat lower at around a quarter of million subscribers in 2001, its players were intensely involved in this game; logging an average of 13 hours per week, which equates to more than 1 hundred and sixty million man hours per year.

Some individuals such as Woodcock (2004) have monthly reports on online gaming subscribers. By January 2004, Woodcock's (2004) monthly tracking of MMOG subscribers indicated that *EverQuest* subscribers had increased to 430,000, though it had peaked at 460,000 just six months earlier. By March 2004, Woodcock reports that *Star Wars Galaxies* had about 275,000 registered users of which perhaps 250,000 were active players. These numbers are particularly impressive given that this game had just been

released in June 2003. Even more impressive was *Final Fantasy XI*, released in North America in October 2003, which had over 500,000 subscribers as of January 2004, just three months following its' launch date (Shwayder, 2004).

Not all data on MMOG growth are so favorable. The highly publicized game "*The Sims Online*," has yet to break 100,000 subscribers, even though the company had targeted 400,000 subscribers by the end of 2003. And *Ultima Online* remained at roughly the 225,000 users it had three years earlier. In fact, in his most recent report, Woodcock (2004) suggests that the fantasy MMOG market is becoming saturated with too many games. Despite the potential market saturation, MMOGs are clearly a huge source of consumer entertainment in the early years of the twenty-first century.

There also are a variety of motivators that attract players to MMOGs. Unlike single user games in which the primary enticements to play are related to intrinsic motivation (Malone, 1980; Malone & Lepper, 1987), multiplayer games are filled with extrinsic motivators (e.g., competition, collaboration, recognition, and material goods; Chen, Shen, Ou, & Liu, 1998). For example, players are attracted to games by their desire to compete and collaborate, potential affiliations with a global network of players, their appetite for peer acknowledgement, and the tools available for custom character and scene creation. In effect, players are drawn into MMOGs by the possibility of being part of a community.

In many instances, the players, themselves, are part of constant modification and improvement of the games. Though not a MMOG, *The Sims* (not to be confused with *The Sims Online*) spurred a network of player Websites that showcased custom *Sim* objects and characters. In fact, over 90 percent of this game is produced by the player population (Herz & Macedonia, 2002). From a cognitive perspective, it is important to note that *The Sim* players are deeply engaged in the design process. From a social perspective, they also are involved in relationships with other players that are competitive as well as cooperative and collegial. The persistent nature of these environments intertwines all three types of relationships -- competitive, cooperative, and collegial -- thereby offering unique learning possibilities.

### **2.3 Features and Design of MMOGs**

There are a variety of features that make MMOGs attractive. Players might achieve particular milestones, access new weapons and tactics, take on increasingly challenging opponents and obstacles, and assume different roles or character identities (Herz & Macedonia, 2002). Herz and Macedonia further state that a multiplayer online game might embed player chat, tournaments, places to challenge opponents, and tools to share ideas and strategies. However, the relative impact of each feature is not fully understood.

In contrast to video games that revolve strictly around shooting and killing, in MMOGs there is more character development, friendships, and partnerships. Players might develop character roles and be better known for such roles than for their real world occupations, thereby granting them a status that they may not have previously experienced. They might form new friendships, build homes, shop, or reconstruct a

society after a major catastrophe (Knight, 2003). According to Herz and Macedonia (2002), “On a basic level, this interaction is what drives the massively multiplayer online world—the standard societal tensions that inform any city-sized population” (p. 8).

These online games are empowering to learners for many reasons. According to Gee (2003b), there are many learning principles implicitly built within the more effective games. Gee (2003a) argues that when playing a game, learning should be both frustrating and life enhancing. For games where there are rewards for longevity, life-enhancing events are crucial. Gee (2003b) also claims that they should foster a sense of co-design since the changes the user makes impacts the system. The player cannot be passive, but must be a participant. It is here that learners are involved in a problem space where expertise is built over time, and challenges increase (Downes, 2004). In MMOGs, information is available and used upon demand. The immediate application of such knowledge elevates the learning process and excites the learners. Gee (2003b) presents 36 learning principles that should be considered and built into video games. Ten of these principles, summarized in Table 1, are particularly pertinent to MMOGs.

Table 1  
Ten principles to be considered when creating MMOGs (adapted from Gee, 2003b)

Principle	Description
1. Achievement Principle	Learners should be constantly rewarded, at each level of game play and skill mastery.
2. Amplification of Input Principle	Learners should get out of the experience something greater than they put in.
3. Distributed Principle	Learners should find growth and knowledge in their interactions with other learners, technology, context, objects, and tools.
4. Identity Principle	Learners should have the ability to build a virtual identity and to reflect on its relationship to their real-world identity and their desired identity.
5. Multiple Routes Principle	There should be more than one way for learners to progress, encouraging them to make decisions and solve problems.
6. Practice Principle	Learners should be able to spend a lot of time practicing in an interesting setting.
7. Probing Principle	Learners should be encouraged to engage in cycles of action, hypothesis building, and inquiry.
8. “Psychosocial Moratorium” Principle	Learners should be able to take risks in artificial environments where there is a lower chance of real-world consequences.
9. “Regime of Competence” Principle	Learners should be challenged to push beyond their comfort or current ability zone, but not to an extent that is unsafe or unattainable.
10. Self-knowledge Principle	Learners should learn both about the learning environment and themselves via the gaming experience.

Based on extensive experience with games, Sellers (2002) suggested various principles for group design and interactions in “massively multiplayer games” (p. 1). In particular, he argued that it is the social bonds created by players that motivate them and keep them returning to a game. Sellers calls the initial social bonds that players form “temporary groups” (p. 4), noting that these interactions are low-commitment but enable players to more immediately feel confident, start the game, and make deeper social connections later in the game.

Listed below are some of the key features that Sellers (2002) recommends for building social interaction in MMOGs:

- Ability to know who is available and participating in the game along with their current location.
- Private, within-group communication, including ability to see others’ game statistics.
- Allowing for different, complementary roles with individual abilities, mirroring real-life complementary roles and boosting the functionality and desirability of teaming.
- Providing rewards for good group play and group accomplishments rather than focusing on the work of individual players.
- Develop permanent groups, such as guilds.

## **2.4 Social Elements of MMOGs**

While there are communities of practice underlying stand-alone games, some argue that there is an even stronger social foundation underlying MMOGs (Sellers, 2002). Multiplayer games may motivate through interdependent roles and the social bonds that are formed between players. In addition, they have specialized characters with their own highly contextualized jargon. And they may belong to guilds, allegiances, or other forms of associations through which their expertise is nurtured and promoted. According to Sellers (2002), “the broader the set of functional roles your game supports, the denser its gameplay and social web will be” (p. 7). Having unique talents or traits builds a sense of expertise and pride. As indicated, the social support, challenge, feedback, and sense of identity that players receive online in MMOG often provides psychological fulfillment that they may not be receiving in real life (Schiesel, 2003).

There are a wide variety of emotions expressed and felt when playing MMOGs. According to Baron (1999), much of the social and psychological foundations in multiplayer games revolve around the sense of glory and shame that they promote. He argues that the ever present record keeping and external audience has enormous power. And because of the multiple roles of online game players—spectators, visitors, participants, designers, etc.—the notion of audience is highly unique. Although new players may experience public embarrassment as they fumble to learn the game, when their skills and social networks begin to grow, they are likely to find opportunities for unique rewards and recognitions. Still, Baron argued, players return primarily for their

personal development in the social fabric of the community for that game, not just for the glory.

There are many roles embedded within MMOGs. Some of these roles can be extremely functional (e.g., tailors, miners, carpenters), while others involve fantasy (e.g., wizards, demons, ghosts; Sellers, 2002). In addition, there may be group roles embedded within the game by the designer (e.g., a leader) as well as those that might emerge or be designed by the players (e.g., explorers, trail guides, innkeepers, and docents). Those first entering a MMOG, often referred to as “newbies,” need patient, generous, and responsive guides. The strength and longevity of a game may depend on these people since everyone is, in a sense, a newbie at some point. Of course, there must be some type of rewards and recognition built into these systems that strengthen or enhance the opportunities for such guidance or help giving behavior. It is vital, therefore, for MMOG developers, evaluators, and users to think about how the skills of different characters benefit everyone in the group.

Some highly committed gamers will contribute to or invest in the community by finding and eliminating bugs or flaws (Rickard & Oblinger, 2004). In effect, they take some ownership over the learning process. The respect and recognition that they receive from the community for their work enhances that environment and fuels additional participation and pride. Acknowledgement is an extremely powerful incentive. As Rickard and Oblinger (2004) point out, “gaming—especially massive multiplayer games—builds communities of gamers who will continue playing as long as they can” (p. 16). Given today’s increased focus on cultivating communities of practice in the business world (Wenger, McDermott, & Snyder, 2002) as well as learning communities in education, research on the apprenticeship process in these MMOGs may prove highly interesting and informative.

Besides providing opportunities for apprenticeship, MMOGs typically are highly complex worlds. In an interview, Gee argued that these worlds offer opportunities for thinking about one’s decisions and reflecting on the impact of each of them (Johnson, 2003). In addition to such metacognitive monitoring skills, there are numerous learning opportunities during game play such as perceiving patterns in events and uncovering hidden relationships. Rickard and Oblinger (2004) note that the scenarios and plots that one must navigate in games foster critical thinking and problem solving skills. Teamwork is also crucial as a player’s success often will be dependent on the degree to which he or she collaborated or worked effectively with other players in virtual teams.

In addition to these cognitive and metacognitive skills, self-directed or exploratory environments, such as online games, offer a unique motivational atmosphere rich in fun, feedback, incentives, novelty, and challenges. Many motivational scholars have pointed out the importance of a supportive but challenging environment, choices, short-term goals, and immediate feedback on performance (Pintrich & Schunk, 1996; Reeve, 1996; Stipek, 1998). The authenticity and hands-on nature of these environments is another key motivator. According to Randy Hinrich, Microsoft Research Group Research Manager for Learning Science and Technology, “What we do is create environments where

students can practice what the teachers are telling them” (King, 2003, p. 3). In effect, the ability to apply what has been learned is an important aspect of online games.

### **3. Gaming Developments in the Military**

The Department of Defense (DOD) has placed an emphasis on restructuring the entire process of training. As described in the DOD Training Transformation Implementation Plan (Department of Defense, 2004)

The dramatic transformation of America’s strategic environment continues its significant impact on our military forces and its demand for an equally dramatic transformation in how we prepare forces for combat and noncombat operations ... we need to transform the way we train. (p.2)

The DOD recognizes a need for new warfare skills in challenging and rapidly developing missions (United States Joint Forces Command, 2002). Net-centric warfare, an emerging theory of war, involves a cultural change in virtual relationships involving many individuals and teams (Raduege, 2004). Power is gained from information, access, and speed, all characteristics of multiplayer games. As military operations become more integrated and networked, the importance of planning, decision making, and collaboration skills become increasingly obvious. To improve effectiveness, there is also an increased focus on sharing information between military planners and operators (United States Joint Forces Command, 2002).

With this focus on emerging technologies, the military is clearly interested in exploring the use of online collaborative games to train staff on the modern day intricacies of combat and noncombat operations. At the same time, the increasing focus on a remote-controlled agents has raised expectations and excitement for realistic simulations and games -- especially MMOGs. The military is developing games that could host thousands of networked players. In these games, players potentially could participate for months or years in different roles and later reflect on the consequences of their decisions and actions (Harmon, 2003). Debriefings or reflective processing of these games could help the user understand the purpose of the game and generalize it to different situations (Prensky, 2001). The immediate goal, of course, is to enhance decision making, problem solving, and reflection skills in the context of a military operation.

To help in the effort to provide better coordinated and timelier training technology strategies, the DOD created the Advanced Distributed Learning (ADL) Initiative as a collaborative partnership between government, industry, and academia to design and use interoperable learning environments (Wisher and Fletcher, 2004). For instance, distributed collaboration tools can enhance communication and strategic decision-making among participants. As part of these efforts, the Defense Acquisition University (DAU) redesigned its curriculum to meet the demands of budget cutbacks, a growing workforce, and a huge percent of retirements on the horizon (Schettler, 2003). The ADL Initiative is to examine methods for learning management systems to link to simulations and online games as a means to enrich learning environments and enhance learning outcomes.

Herz and Macedonia (2002) declare that simulations have been an integral part of U.S. military training for decades, though such use has been growing somewhat separately from the commercial gaming industry. They note that the military is finally exploiting advances in the commercial simulation and gaming industry to advance its training and education. The military has adopted commercial simulations and games for classroom and unit training.

In further recognition of the importance of entertainment in training technologies such as games and simulations, in August, 1999, the military created the Institute of Creative Technology (ICT) in Marina Del Ray, California. The ICT works closely with a number of departments of the University of Southern California to create active as opposed to passive programs and systems. This partnership evolved from a realization that the gaming industry customers of the past two decades may become the future recruits, and, potentially, the officers of the military. Furthermore, the gaming industry is increasingly linked to Hollywood movies, since most blockbuster films will have a coinciding video game (Snider, 2004), or, in some case, vice versa. These connections can help the military appeal to a wider population as a career opportunity.

A key part of this initiative is to utilize the motivational aspects of gaming entertainment, while fostering education and training (Jayakanthan, 2002). For instance, there is a push for more realistic simulated experiences and scenarios (including user ability to see, hear, and touch in the online environment) and intelligent computer-generated characters to foster learner engagement and challenge (The National Research Council Computer Science & Telecommunications Board, 1997). As part of this effort, motivational principles such as challenge, conflict, curiosity, control, and fantasy are built into these systems. The challenge is not in learning to handle or fire a weapon, but in learning to lead squads, units, or larger forces.

ICT is currently developing several Battle-Command games that test as well as foster leadership and strategic decision making. O'Neil, Baker, and Fisher (2002) reviewed the key features and evaluation specifications of three games that have been developed at ICT, namely, *Full Spectrum Command*, *Full Spectrum Warrior*, and *Full Spectrum Command Board Game*. These games might be used as supplemental course material or they could be fully integrated into specific courses. In addition, they might be single user or multi-user, short (15-20 minute) or long (1.5 hours), and easy (1 hour of reading plus 2 hours of practice) or hard to learn (4 hours of reading plus practice and homework). The focus when playing these games may shift between planning events to situational awareness to visualization to tactical decision making. Of course, each of these skills, strategies, and competencies require different instructional approaches and forms of assessment (O'Neil et al., 2002).

The U.S. Army, for instance, has distributed videogames at no cost as part of its recruitment efforts. Millions of potential recruits have gone through "basic training" in *America's Army*. Soon millions more will likely be playing, *Full Spectrum Warrior*, a military action game originally created by ICT in partnership with Pandemic Studios, on



their Xbox (Stevenson, 2003). Given the need for decision making, planning, and collaboration, mentioned earlier, it is not surprising that *Full Spectrum Warrior* focuses on quick decision making by a squad leader in both urban combat as well as in peacekeeping missions. Instead of simply reacting to threats, the player must devise a strategy or plan (DiMascio, 2004). While this game will never totally replace live training, it offers ideal supplemental training. In fact, it has been used by the Afghan National Army to fight alongside U.S. troops. In effect, the players must be able to recognize real threats, have extensive organizational and analysis skills, and, generally, be able to lead (Wired News, 2003). Decisions about a variety of military objectives must be made rapidly in a tense and hostile environment.

Based on the success of *America's Army*, the U.S. Army has entered into a unique contract with There.com, an innovative company in the MMOG space. Together they will create innovative training opportunities (Davis, 2003). Among the goals of this project is the development of MMOGs where tens, if not hundreds of thousands of soldiers can interact simultaneously. Defense officials are interested in developing programs that differ somewhat from typical MMOGs. For instance, such new programs might offer intrusive coaching to players, mission rehearsal for special operations, and after-action reviews for warfighters.

Many other MMOG types of programs are projected for the near future. According to Peck (2004), the *DARWARS* from the Defense Advanced Research Projects Agency is under development for on-demand personal training in military situations. While still in the planning stages, technologies built into *DARWARS* will include digital video of human instructors, intelligent tutoring systems, avatars, and MMOGs. Embedded in the *DARWARS* system, if built, will be after action reviews and team support resources. In addition, this program would target participant metacognition and reflection skills. In terms of research, *DARWARS* is based on the notion of continuously available wars for training (Defense Advanced Research Projects Agency, Defense Sciences Office, 2004). Thus, it may provide a unique longitudinal research environment and a testbed for group interaction and community building in MMOGs.

#### **4. Gaming Research**

Facts are accumulating about the impact of the Internet on physical activity, productivity, lifestyle, and psychological health. Studies exist on the timing and patterns of Internet use. However, online gaming is an area which has seen scant research (Jones, 2003), even less in MMOGs (Griffiths & Davies, 2002). Instead, the prevalent research is centered on adolescent youth in single user settings. Whereas studies of gamers in stand alone systems often foster sentiment that such individuals are socially withdrawn or introverted, MMOGs may involve more social interaction skill and be more educationally valuable than anticipated or promoted. In fact, the questions behind MMOGs may prove more interesting and educationally beneficial to answer than research on traditional computer-based games since players are forced to interact with each other.

Why is there such a dearth of research in this area? In part, the lack of research reflects the nature and funding of MMOGs and related technologies. Most of the widely known and promoted MMOGs are developed and supported by commercial companies. As such, most research conducted on these games is likely to be internal and unpublished – as well as focused on topics of interest to the company instead of vital research areas of interest to other audiences. Publications that discuss topics like MMOG applications in education tend to be either theoretical or anecdotal in nature rather than based on a systematic design and data collection. For example, it has been said that educational MMOGs are likely a good way to foster critical thinking skills, but the research to support this assertion has not been conducted. MMOGs are a relatively new phenomenon, another reason for the limited research.

There are controversies regarding who might offer the most insight into the gaming field – art/film/literary critics, anthropologists, sociologists, psychologists, learning scientists, or educators. One area of research interest is how gaming impacts a learner’s skill development. For instance, Green and Bavelier (2003) received wide attention for their study of video-gaming on perceptual and motor skills. They designed a series of five experiments that found video-gaming increases visual attention resources. Their work demonstrated that increased visual resource capacity can result from just 10 days of training with video-gaming. While finely tuned perceptual skills will not guarantee higher-order thinking and leadership, individuals with increased ability to process and react to information over time will have more resources to attend to any problems they encounter. Such resources include the ability to detect new enemies as well as track existing ones. Green and Bavelier suggest that future studies look at the impact of speeded perceptual processes and enhanced task management capabilities.

Other research has examined process skills and strategic planning. For example, one multi-player Web-based game, *SCUDHunt*, forces players to collaborate and share information obtained from initial search phase results in order to locate and eliminate SCUD launchers (ThoughtLink, 2002). A simple measure of decision quality used in this research was the percent of strikes which were successful. These *SCUDHunt* experiments investigated the quality of information, timeliness of information, command methods (e.g., by direction, plan, or influence), knowledge of assets, mode of communication on accuracy, shared situational awareness, and other subjective measures. Not surprisingly, the availability of a communication tool, whether direct (e.g., text chat or voice) or indirect (e.g., shared visualization), was a major contributor to the quality of decisions (ThoughtLink, 2001). In addition, those who were recognized leaders received the highest quality scores.

Beal and Christ (2004) explored the impact of the war game *Full Spectrum Command* (FSC), mentioned earlier, on the decision-making ability of 54 officers enrolled in the Infantry Captains Career Course. Half played FSC in addition to regular coursework, while the other half acted as the control group. Beal and Christ were interested in the impact of FSC on the decision-making style and decision-making performance of the participants as well as their perceptions of the training game and sense of involvement within it. The three decision-making styles analyzed were (1) analytic individuals who

tend to employ rational-thinking styles which focus on performance and training; (2) intuitive individuals who tend to employ experiential thinking styles which are goal oriented and impulsive; and (3) high regret-based emotional individuals who score higher on personal harm avoidance, self-doubt, and depression.

Unfortunately, participants in this study scored high on the pretest on the more favored analytic and intuitive styles. As a result, ceiling effects may have masked any positive impact of FSC on participant decision making. In addition, participant cognitive abilities, as measured by the Wonderlic Personnel Test, were not correlated with their decision-making style. And while the participants gave favorable impressions to the game, especially in terms of sense of challenge, realism, and personal involvement, they were more focused on the technological controls than on strategic planning and mission execution. Compounding the problems, the authors admitted to several key limitations in the study, including limited time to play FCS and the absence of a measure of the decision-making performance of game players. Still, there were some indicators that the game provided valuable tactical experiences.

As indicated earlier, the U.S. Army has provided a PC-based game for potential new recruits called "*America's Army*." The response to this game has been tremendous with more than 3.4 million registered users of which more than 2 million have completed its' Basic Training level (<http://www.americarmy.com>). Interestingly, *America's Army* game players completed over a hundred million missions in just over one year.

A study of *America's Army* with 20 new recruits and one ROTC cadet explored the motivational and informational aspects of this highly popular first-person game (Belanich, Sibley, & Orvis, 2004). In terms of information, the study participants recalled procedures of the game better than factual information. Moreover, information presented in a graphical and spoken format was better recalled by participants than print information. Based on these results, Belanich et al. (2004) suggest that print information not be eliminated but perhaps should be reduced during game play. This study also revealed that information related to a player's progress in the game was better recalled than information that was not relevant to a player's progression. In response to open-ended questions, the participants indicated that the key factors that impacted learner motivation related to player sense of challenge, game realism, opportunities to explore or discover new information, and learner control. According to the researchers, all four motivational variables should be considered in game development and use.

Recent survey research from the Human Computer Interaction Institute at Carnegie Mellon University investigated the social aspects of MMOG both within and outside participant gaming environments (Seay, Jerome, Lee, & Kraut, 2004). Over 1,800 players of *EverQuest*, *Dark Ages of Camelot*, *Asherton's Call*, or *Ultima Online* responded to Seay et al.'s 69 item survey. The results indicated that 90 percent of the players were males who played MMOGs for 15-21 hour per week. Those who claimed to be members of guilds were likely to spend more time playing online than those who did not. Nearly 40 percent played, at least in part, for the social experience. However, when asked to indicate the "main" reason for playing MMOGs, the primary responses were fun

(20 percent) and character growth (21 percent), while social contacts was listed as the main reason for just 15 percent of respondents. On the negative side, addiction was mentioned by 10 percent of respondents.

In similar research on MMOG players, Yee (2004) conducted a series of survey research studies on *EverQuest* (EQ) and other MMOGs as part of his senior thesis at Haverford College. During the year of his study, he collected more than 20,000 surveys from roughly 4,000 individual participants. Most of his surveys were multiple choice and consisted of 30-50 questions, requiring 5-10 minutes to complete. In order to gain respect in the MMOG community and learn the relevant online gaming lingo, Yee became an active player in EQ. His credibility enabled him to recruit thousands of participants for his studies from well known Websites that catered to MMOG players (Valenza, 2002).

In terms of whether MMOGs fostered or improved leadership and conflict resolution skills, more than half of Yee's respondents indicated that they learned mediation and overall leadership skills and abilities such as reducing group conflicts and tensions (2003). Nearly half indicated that they also learned persuasion skills and how to instill loyalty or encourage and motivate group members. What appealed to MMOG players was exploring fantasy worlds, enjoying social interactions, achieving goals, moving up game levels, and completing quests. Less satisfying were feelings of power, killing angry mobs, and crafting complex skills or learning a trade. Yee also explored the how long players had played a game before they quit. *Ultima Online* was the longest at 28.1 months followed by *EverQuest* at 22.7 months. Such game playing longevity and persistence indicates commitment and motivation for these multiplayer online games.

Recent research on MMOGs reveals how complex they are to study. Steinkuehler used cognitive ethnography to investigate the cultural practices and consequences of a MMOG called *Lineage* (Steinkuehler, 2003). In *Lineage*, a game that takes place during medieval times, complete with elves, knights, magicians, princes, and princesses, there are blood pledges or guilds which vie for different castles or kingdoms. Characters gain reputations, wars break out over stories and rumors, special alliances are formed, and countless stories are told. Her extensive description of this MMOG environment was intended to help others understand what happens in different virtual gaming communities. For instance, she was interested in how new learners are apprenticed into the community through different activities, the role that different technology or cognitive tools play in such an environment, and the contexts in which different learning community events occur.

Steinkuehler's ethnography was conducted through participant observation in order to be immersed in the gaming experience. As Steinkuehler notes, a participant observation can record and transcribe naturally occurring game-related activities and events, game related communications (e.g., discussion board posts, e-mails, chat and instant messages, bulletin board posts, e-mails, etc.), and all relevant documents of the online community (e.g., community-written player manuals, fan or e-commerce related Web sites, press releases,

white papers, technical reports, community-authored scenarios and game fictions, company- and community-written player manuals and guidebooks, etc.).

In her study, discourse analysis was conducted on player discussion and chat transcripts. Additionally, players were analyzed and categorized in terms of a community continuum from newcomer, newbie, rookie, or legitimate peripheral participant (LPP) (per Lave & Wenger, 1991) to status as a veteran, central participant, or expert. She notes that through participation in valued practices or activities, one's character or online identity acquires pertinent knowledge of the game content (knowledge of terrain, enemies, weapons, etc.), points system, goods available, social status, and social connections or networks that move the player from the side-lines or fringes of the game to become a more important or knowledgeable player within it. As this occurs, playing the game may become an essential or pervasive part of one's daily life. Not surprisingly, she found that central participants or experts use terminology relevant to previous versions of a game, whereas newcomers do not. Understanding any specialized terminology or specific maneuvers of a game like *Lineage* is certainly related to one's participation and role within a community of practice.

Such research begs questions of how masters or experts of the game enculturate the new players into it. How is their tacit knowledge shared with the rest of the community? Can the process be described? Can training programs be created from it? As Steinkuehler (2003, 2004) herself asks, what are the shared social spaces (Schrage, 1990) and material practices that foster different ways of interacting, communicating, behaving, and valuing? How might the skills learned in the MMOG transfer to the real world? And what is real and what is one's virtual identity? For instance, Steinkuehler noted that aspects of the online world in *Lineage* can reemerge or spill over into the real world through telephone calls, e-mail, and physical meetings.

Steinkuehler (2004) found that those who have mastered the social and material practices of *Lineage* tend to scaffold or assist new gamers who lack sufficient knowledge and skill to perform well (see Tharp, 1993; Tharp & Gallimore, 1988). Such scaffolded assistance might be evident when modeling successful performance, sending key information on how to navigate a difficult terrain, offering opportunities for practicing new skills, and providing timely and situated feedback on one's performance. Not too surprisingly, she found the experts tend to grant newcomers increasing control of the learning situation over time.

In the end, Steinkuehler cautions that the focus cannot be simply on the MMOG technology or the curricular material that needs to be learned. The design of the system must include the appropriate and emergent social structures or practices that will always accompany the technology. In addition, she argues that without cognitive ethnography, it would be extremely difficult to distinguish the types of practices, understandings, and identities that MMOGs foster and equally hard to determine whether these are productive, and, if so, portable to other environments. Of course, while some such as Steinkuehler may point to the apprenticeship process within a game, extensive insight might be revealed from exploring how games were used differently from the ways in

which game developers envisioned. Such work diverges from that which looks at the social and cultural behavior of a consciously constructed culture shaped by certain technological and commercial imperatives.

#### **4.1 Related Research**

Research conducted in related areas, such as small-group gaming environments, stand alone computer games, and educational simulations, may be of use to developers, researchers, and users of MMOGs. Such research is described below.

Research on learner preferences in personal computer games may provide useful tips for designing MMOGs. For instance, Ju and Wagner (1997) conducted an analysis of computer-based adventure games to determine (a) attributes of the games (b) variables that make the games appealing, and (c) factors that influence a game's ability to contribute to the learning process. In particular, the authors were interested in how these games might be used in managerial training situations. After revealing a long history of using simulation-based games as part of managerial training, they categorized managerial games in terms of the desired area of learning outcomes (e.g., problem solving games or resource allocation games).

Through their analysis of many games, Ju and Wagner (1997) identified a model of adventure games. The basic components of adventure games within this model included:

- (1) Story, which sets forth the basic characteristics of the game by specifying (a) story characteristics, (b) actors and actor characteristics, (c) resources, (d) tasks, and (e) setting. It is through the interaction of these elements that the adventure game takes its' basic form.
- (2) Development approach, which basically refers to how the specific details of the game are created and whether actors and setting are virtual (computer-generated) or real (video). This part of the model does not really affect the content or play of the game.
- (3) Implementation, which refers to the visual and technical aspects or interface of the game. Implementation includes the user's input options as well as the output options such as scoring and feedback.

As alluded to in the research from Steinkuehler (2004) above, one area that would benefit from additional study is how to scaffold learning in simulation environments (de Jong & van Joolingen 1998). Simulations may contain conceptual models that focus on principles, concepts, and facts, or operational models that target procedures and experiential learning. In their detailed report, de Jong and van Joolingen cite a variety of studies comparing simulation-based instruction to expository or instructor-led instruction, noting varied results. For example, Bangert-Drowns, Kulik and Kulik (1985) found that simulation based learning did not raise examination scores. However, de Jong and van

Joolingen note that the issue may not be the inherent effectiveness of simulations but rather the challenges of using discovery learning. In terms of hypothesis generation, it is quite possible that learners do not know what a hypothesis is, and, furthermore, those who do may not be able to generate a hypothesis given the data found in a simulation.

In various studies (see Chinn & Brewer, 1993; Chambers et al., 1994) it has been shown that learners often do a poor job of dealing with large amounts of anomalous data that appear in a simulation. Once learners have a hypothesis, they may be likely to engage in a phenomenon called confirmation bias in which they look to support rather than disconfirm their working hypothesis. The dangers here are that learners may navigate the learning environment seeing only what they want to see and, therefore, miss clues that would guide them to a more fitting or appropriate hypothesis. Another challenge of using discovery learning is the level of learner self-regulation. The presence of self-regulation strategies prior to engaging in the discovery learning activity may well be a major determinant of a learner's potential success in that environment or learning activity. Relating this back to MMOGs, which also may heavily rely on discovery learning when used in an educational context, it is important to consider the guidelines or supports learners may need to help ensure learning objectives are met.

Siemer (1995) recommends an evaluation methodology for intelligent gaming simulations that target both internal and external evaluation. Within this context, internal evaluation refers to the examination of the game's architecture, what it does, and how it reacts to user input. To this end, Siemer argues that one might draw upon Littman and Soloway's (1988) suggestion that intelligent tutoring systems be evaluated using analysis of three key parts of the program:

- (1) Knowledge level (does the program contain sufficient knowledge to meet learning objectives?);
- (2) Program process (how does the program work?); and
- (3) Tutorial domain (what should the program do?).

External evaluation, per Siemer's methodology, refers to the study of the game's usefulness to the learner in terms of both promoting learning and motivating the learner. This same methodology might readily be applied to MMOGs, with internal evaluation focusing on the game's content and functioning and external evaluation focusing on the learners' interactions and resulting learning gains.

In a study of learner preferences regarding elements of computer-based games, participant reactions to four commercial games – a strategy game, a simulation, a shooting game, and an adventure game – were gathered (Amory, Naicker, Vincent, & Adams, 1999). The researchers found that the simplest game was the most appealing (in this case, the shooting game) and the most complex game (in this case, the simulation) had the least appeal. In terms of learning, the adventure game was deemed best for laying instructional foundations. While there were no differences in responses from male and female subjects in this study, significant differences were found between racial groups. Based on their results, Armory et al. suggest studying how one's educational

background and socio-economic status might affect whether or not they have the requisite psycho-social and cognitive skills for success within a particular game type. In addition, they note that if learning goals are involved it might be important to ensure that learners are adequately prepared for their interactions in the MMOG.

Sempsey and Johnston (2000) examined the social climate of 31 multi-user domains or MUDs by comparing them to face-to-face (FTF) group dynamics. They found that MUDs were more likely to foster self-expression, innovation, independence, and self-discovery. In contrast, FTF groups scored higher in terms of order and organization as well as leader control. No significant differences were found in terms of cohesion, leader support, task orientation, and anger/aggression. This study suggests that online groups are perhaps more likely to generate independent thinking and expression and less likely to be leader-centered than FTF groups, although both are equally likely to band together and meet their stated goals.

One concern that is sometimes expressed about entertainment-based gaming is the violent nature of many games. Gaming stories often involve some type of war-based scenario or require players to either defend themselves or attack others. The impact of these violent interactions on the users' demeanor is one area of concern. Of course, within a military context this also is a real issue given the nature of training and resulting job tasks. In a meta-analysis of 35 research reports involving more than 4,000 children and adults, Anderson and Bushman (2001) found a positive and significant link between violent video games and aggression. They concluded that violent videogames increase physiological arousal and thoughts and feelings related to aggression or harming another individual. They noted, however, that there is a need for more longitudinal research that may help determine if repeated exposure to violent video games increased the long-term nature of this aggression.

## **4.2 MMOGs and Online Community**

Promoters of MMOG discuss the importance of persistent groups and worlds. It is important to understand how persistent groups might facilitate or be facilitated by an online community. There are many components to an online community (See Bonk, Wisher, & Nigrelli, in press; Chao, 2001; Rovai, 2002; Schlager, Fusco, & Schank, 2002). Communities are collections of people who are bound together by some type of goal or common purpose (Schwier, 1999). McLoughlin and Oliver (1999) contend that in a community of learners, the participants know and value each other, discuss their common concerns and experiences, lend support to each other, trust one another, share aspects of control and responsibility in the learning environment, and feel safe taking risks. Schwier (1999) points out that a learning community also needs:

- (1) A leader to set the tone;
- (2) Technology tools that facilitate task completion and interpersonal relationships without getting in the way;
- (3) A safe place to participate and communicate; and
- (4) Opportunities for storytelling.



As indicated, there must be a purpose or reason for the initial activity or quest. The goal or intent might be to problem solve, collaborate, share information, learn something new, or accomplish some feat.

Learning communities have a number of common principles. Chao (2001) and Bonk et al. (in press) note that online learning communities require membership, goals, purpose, identity, shared knowledge, rituals, member participation or contributions, celebrations of success or accomplishments, and, perhaps most importantly, trust. In a MMOG, such communities might foster interaction and communication about the game as well as resource sharing, negotiation and social construction of meaning, and expressions of support and encouragement among players or students (Palloff & Pratt, 1999). Such an electronic community, moreover, should have its own meeting or gathering place and member roles as well as norms for resolving disputes.

The learning that takes place in a community-based environment, such as an educational MMOG, needs not be focused solely on the content, tasks, and interactions embedded by the game designers. Nevertheless, the tasks will likely drive the types of peer learning opportunities that develop. When there are shared goals, idea negotiation, and rituals or common practices, typically there are opportunities for members to work beside and learn from more competent members (Barab & Duffy, 2000). This idea follows Lave and Wenger's (1991) concept of legitimate peripheral participation (LPP) in a community of practice, and is consistent with Steinkuehler's (2004) research findings, mentioned earlier. New members of the community will likely look to more experienced members for guidance, whether explicitly asking for help or more tacitly observing the actions of those members.

In effect, when a community of practice and cognitive apprenticeship is formed, new members have opportunities to observe and internalize some of the goals, practices, and rituals of existing members. The expectation is that learners will both contribute to and benefit from the community through their involvement. Over time, newcomers replace the old timers (Brown, 2001), creating a cycle of life within the community.

Of course, the designers of these games and sellers of commercial goods related to it have a vested interest in the forming of such communities. Their continuing existence is dependent on certain roles being fulfilled and maintained. In fact, companies may pay someone to act in certain community building or enhancing roles. Hence, the development of a community of practice and associated apprenticeship process may not be naturally occurring at all.

Aspects of community development are explored in some of the primary and secondary research studies detailed in the following section. While the development of online communities of learning is important for education, training, and performance support, the above research review highlighted a number of additional gaps in existing MMOG research that are directly or indirectly addressed in some of the studies suggested below.

## **5. Suggestions for Research**

### **5.1 Fifteen Primary Experiments**

O'Neil et al. (2002) point out that there is scant information about the impact of games on adults. Given the state of educational research, Steinkuehler (2004) notes that it is ironic that there is such a paucity of research on cognitive and cultural aspects of MMOGs. The field is replete with publications and conferences related to virtual online communities and online learning in general, and it has had a fascination for nearly two decades with the impact of social interaction on learning. In addition to cognitive and sociocultural questions and issues, there is a need for MMOG research in many other crucial areas including the perceived authenticity of multiplayer online games, the processes and principles one might learn or be exposed to when playing them, and the prior experiences that might facilitate success. In an effort to illuminate areas that might be explored, fifteen primary MMOG research studies are suggested below.

#### **5.1.1 Research Study I. Impact of After Action Review (AAR) on MMOG Performance and Decision Making Style**

For a training game to be maximally effective there must be some type of after-action review (AAR) (O'Neil et al., 2002). In essence, this AAR serves the purpose of debriefing the MMOG experience, or connecting it to other training events. In this proposed study, 100 individuals will play a MMOG for a period of three months. One group will engage in extensive AARs after the three months and a second group will not. The focus of the data collection will be on performance and decision-making style. After the AAR, both the treatment and control groups will be divided into two groups, for a total of four groups. Two groups (one receiving the AAR and one not receiving the AAR treatment) will play the same MMOG and two groups will then play a different one for an additional two-month period. Game performances (e.g., hits/misses, rounds expended, and loss exchange ratios, etc.) across the four groups will be compared to determine if the AAR experience enhanced the players' decision-making processes (O'Neil et al., 2002). Data also will be collected about any tactical lessons learned by the participants. When combined, the tactical and the performance data should provide unique insights into the player decision-making processes and results. Participants will also be given a decision-making instrument to determine if there was any impact of the MMOGs and AARs on decision-making style (e.g., analytical, intuitive, and regret-based emotional; Nygren, 2000). In an open-ended questionnaire, participants will be asked questions about how they identified elements of the task, strategies that proved effective, and how the lessons learned in the game might be applied to their particular job or within their organization (Corbeil, 2003). There also will be individual interviews with six participants from each group. Additionally, these participants will engage in focus group discussions about this experience. The focus group discussion will emphasize the strategies that were used and the results as well as what they might do differently next time.

Experiment: Explore impact of Impact of after action review (AAR) on MMOG performance and decision making style

Independent variable: After-action review	Dependent variable: Decision-making style and performance and attitudes.
<ol style="list-style-type: none"> <li>1. Group 1: AAR and same game</li> <li>2. Group 2: AAR and different game</li> <li>3. Group 3: No AAR and same game</li> <li>4. Group 4: No AAR and different game</li> </ol>	<ul style="list-style-type: none"> <li>• Participant attitudes</li> <li>• Decision-making style</li> <li>• Game performance</li> <li>• Decision making tactics and strategies</li> </ul>

Procedures:

- Record performance on game for all participants. Compare performance by treatment group.
- Collect decision-making style information for all participants. Compare decision-making style by treatment group.
- Survey of attitudes toward MMOG given to all participants.
- Collect information about decision making tactics and strategies with an open-ended questionnaire.
- Six participants in each group will be interviewed.
- Six participants in each group will take part in focus group sessions.
- Online chat transcripts and bulletin board messages from game play will be analyzed.

Hypotheses:

1. Groups with AAR will perform better than group without AAR.
2. Group with AAR that continues on same game will perform highest.
3. Groups with AAR and who play a different game will exhibit the most change in leadership style.
4. All groups will display a change in leadership style.
5. Groups with AAR will display more awareness of decision making tactics and strategies.
6. Groups with AAR will have higher satisfaction than those without it.

**5.1.2 Research Study II. Impact of Addiction to MMOG.**

There are many reports about the potential addictive nature of computer games (Griffiths & Davies, 2002). In fact, there are a host of social, psychological, and emotional problems associated with overuse of the Internet (e.g., depression, deviant behaviors, academic troubles, job burnout, over-involvement in online behaviors, unemployment, etc.; Young, 2004). As the use of the Internet increases across aspects of life, such addictions are bound to proliferate. In this study, different levels of MMOG will be compared using an adapted version of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-IV) addiction criteria for MMOG (Young, 2004). This study will investigate whether over-involvement in MMOGs is related to problematic addictions. For instance, does MMOG use negatively impact job performance? The questions below are based on a list of Internet addiction items from Young (2004) (see [http://www.netaddiction.com/resources/internet\\_addiction\\_test.htm](http://www.netaddiction.com/resources/internet_addiction_test.htm)).

- Do you feel preoccupied with Massive Multiplayer Online Games (do you think about previous gaming events and activities or anticipate the next online session)?
- Do you feel the need to use the Internet for MMOG with increasing amounts of time in order to achieve satisfaction?
- Have you repeatedly made unsuccessful efforts to control, cut back, or stop Internet use related to MMOG?
- Do you feel restless, moody, depressed, or irritable when attempting to cut down or stop Internet use?
- Do you stay online longer than originally intended when playing MMOGs?
- Have you jeopardized or risked the loss of a significant relationship, job, educational or career opportunity because of playing MMOGs?
- Have you lied to superiors, family members, therapists, or others to conceal the extent of involvement in MMOGs?
- Do you use the MMOGs as a way of escaping from problems or of relieving a dysphoric mood (for example, feelings of helplessness, guilt, anxiety, depression)?

Additional questions might address the amount of time spent playing MMOGs compared with other personal and professional activities (e.g., time with friends, volunteer work, entertaining at home, club meetings, etc.).

Experiment: Investigate impact of addictive behaviors on time spent playing MMOGs and job performance.

Independent variable: MMOG addictions.	Dependent variable: Time spent in MMOG environments, job performance.
1. Questionnaire related to MMOG addictions. (Note: this study could utilize regression or path analyses, or it could be a correlational study).	<ul style="list-style-type: none"> <li>• Job performance ratings by supervisor.</li> <li>• Hours spent in MMOG per week.</li> </ul>

Procedures:

- Complete a scale related to MMOG addictions.
- Collect self-report questionnaires related to time spent playing MMOG.
- Collect supervisor ratings of employee performance.
- Collect information relevant to signs of addictive behaviors (e.g., days called in sick, depression, problem behaviors, criminal records, etc.).

Hypotheses:

1. Addiction to MMOGs will be negatively related to job performance.
2. Addiction to MMOGs will be positively related to hours spent playing online games.
3. Addiction to MMOGs will be highly correlated with escaping from problems, irritability, moodiness, and feelings of helplessness.

### 5.1.3 Research Study III. Sense of Community and Group Longevity or Persistence

Long-term associations with a group of online game players, or persistent groups, provide a sense of belonging that Abraham Maslow emphasized as important to self-actualization. Since social networks and bonding take place over extended periods of engagement, it is important to determine the key attributes of successful groups. For example, do they have features such as a purpose, strong leadership, gathering places and shared social spaces, a unique vocabulary, member profiles, or a range of roles? Within the context of MMOGs, what group-related factors motivate players to return? Do long term groups have more of a sense of belonging than temporary groups (Sellers, 2002)? Do they believe that they are part of something larger than themselves? Do they feel more of a purpose or mission?

While research on online communities is increasingly more popular, there remain numerous areas to investigate. How do the MMOG communities form and adjust over time? What facilitates longevity of groups or guilds in MMOGs? This study will explore online communities in several MMOGs. It will look at how communities form and are maintained. Participants will complete a “sense of community” index or scale, which will be correlated with group longevity.

Experiment: Does a sense of community lead to group longevity and sense of belonging?

#### Method

- Record group longevity.
- Collect data on sense of community and belonging to environment (use community index or scale).
- Interview participants about sense of community.

#### Hypotheses:

1. Sense of community leads to greater game playing and group persistence.

Additionally, this study will generate descriptive data about the nature of and factors influencing the development of a sense of community within MMOGs.

#### Follow-up:

Train one group in how to identify and foster a sense of community. Compare this group with a no training control group.

### 5.1.4 Research Study IV. Describe the Apprenticeship Process in MMOG.

A multi-user online game might be an ideal environment in which to watch a situated learning environment unfold over time (Chen et al., 1998). Here, the learner can watch expert performance and internalize it prior to becoming an active member or legitimate peripheral participant. In an MMOG, the newcomer has opportunities to observe as well as actively participate within a community of practice (Wenger, 1998; Wenger,

McDermott, & Synder, 2002). The tools and tasks will provide one indicator of the effectiveness of the apprenticeship process in the online community.

Following the research of Steinkuehler (2003), a cognitive ethnography method will be employed in this study. A cognitive ethnography thickly describes different cultures emerging in the MMOG environment. Through this thick description, a better understanding of the apprenticeship process in MMOGs will emerge. Part of the research will include a discourse analysis on relevant discussion, e-mail, and chat transcripts to see how the players are sharing their knowledge and assisting each other as they develop new skills and status within the game environment. And as detailed by Lave and Wenger (1991), player movement on a learning trajectory from the periphery to inbound to insider within the MMOG also will be analyzed. Additionally, players will be asked about how different tools (e.g., public profiles, group chat, lobby, group Web logs or blogs, collaborative knowledge bases, calendars, game Web sites) impacted on their participation in the apprenticeship process.

Qualitative Study: Describe the apprenticeship process in a MMOG.

Methods
<ol style="list-style-type: none"><li>1. Observe one or more MMOGs over a series or weeks or months.</li><li>2. Collect transcripts of MMOG communications (e.g., chats, bulletin boards, and blogs) and game logs.</li><li>3. Conduct discourse analyses.</li><li>4. Track player development and compare to player participation in online communications.</li><li>5. Interview participants about the apprenticeship process and sense of community felt in MMOG.</li><li>6. Interview any instructors, guides, instructional designers, or experts involved in the apprenticeship process.</li></ol>

### 5.1.5 Research Study V. Game Authenticity and Constructivism

Constructivism emphasizes the active involvement of learners in real-life concepts or experiences. Ideally, tools used within MMOGs that are based on constructivist principles should foster engaged learning and deep processing of information, multiple representations of reality, an appreciation of multiple perspectives or viewpoints, collaborative construction of knowledge and social negotiation of meaning, and reflective practice (Lainema & Makkonen, 2003). Additionally, these tools should provide authentic experiences for learners as much as possible. In this study, MMOG instructors and learners will be asked about their sense of game realism (authenticity) and fantasy. In addition, they will complete a constructivist learning scale to assess the degree of negotiation, collaboration, and active engagement evident in different MMOGs. Achievement or performance, attitudes, and persistence will be compared to the sense of realism and degree of constructivism learners perceive in different MMOGs.

Experiment: How Does Game Realism and Active Learning Impact Performance and Satisfaction.

<p>Independent variable: Sense of game realism or fantasy; sense of active learning or constructivism for different MMOGs. (Note: might conduct regression or path analyses or simple correlations.)</p>	<p>Dependent variable: Game performance, attitudes, persistence, motivation.</p>
<ol style="list-style-type: none"> <li>1. Part I of Study: Complete sense of realism-fantasy scale and sense of constructivism or active learning scale before and after playing different MMOGs for a month.</li> <li>2. Part II of Study: Assign new set of participants to two groups: Group 1: High sense of realism in MMOGs; Group 2: Low sense of realism in MMOGs.</li> <li>3. Part III of Study: Assign participants to two groups: Group 1: High sense of constructivism in MMOGs; Group 2: Low sense of constructivism in MMOGs.</li> </ol>	<ul style="list-style-type: none"> <li>• Collect game performance scores.</li> <li>• Administer game satisfaction questionnaire.</li> <li>• Interview players about what makes a MMOG authenticity and fantasy.</li> <li>• Record group longevity.</li> <li>• Interview participants about sense of community.</li> <li>• Complete checklist of intrinsic and extrinsic MMOG motivators.</li> </ul>

Hypotheses:

1. Part 1: Sense of realism or authenticity related to higher satisfaction, group persistence or longevity, and game performance.
2. Part 1: Sense of constructivism related to higher satisfaction, group persistence or longevity, and game performance.
3. Part II: Higher realism increases game performance, attitudes, and persistence.
4. Part III: The more active the learning environment, the higher the performance, satisfaction, and persistence.

**5.1.6 Research Study VI. Bandwidth Constraints and Differences**

In a computer network, latency refers to the length of time a message takes to move from one designated node to another. Smed, Kaukoranta, and Hakonen (2002) note that the variance in latency measures is known as “jitter,” and suggest that in MMOGs an acceptable latency might range from 0.1 to 1.0 seconds. In effect, higher latencies might be acceptable as long as there is minimal jitter. Participant acceptance of latency might vary according to whether the activity is performance-based (i.e., first person shooter games), strategic, or reflective. If participants are dissatisfied with the latency they are experiencing, they may be less likely to play regularly or truly engage in a multiplayer online game. This study, therefore, compares the impact of bandwidth variations on overall game performance as well as player attitudes, persistence, and commitment.

Experiment: Impact of bandwidth and latency on online game performance.

Independent variable: Game bandwidth.	Dependent variable: Game performance, attitudes, game commitment or persistence, motivation.
1. Collect information of game player hardware platforms and bandwidth or Internet connections.	<ul style="list-style-type: none"> <li>• Collect game performance scores.</li> <li>• Administer game satisfaction questionnaire.</li> <li>• Administer game persistence or commitment instrument.</li> <li>• Have players record impressions of system latencies during different points or levels of game playing.</li> <li>• Collect computer log data (or use data mining) to verify system latencies.</li> </ul>

Hypotheses:

1. Longer latencies result in lower game satisfaction and game performance.
2. Longer latencies reduce participants' degree of commitment and motivation.

### 5.1.7 Research Study VII. Role Assignment: Achievers, Socializers, Explorers, Killers

There are many different player types in an MMOG environment. In a fairly simple taxonomy, Bartle (1996) details four key roles in a MUD environment: achievers, explorers, socializers, and killers. Some may seek high achievement in the system and the status brought about by winning. According to Bartle, the focus on accumulating points, wealth, or whatever the currency or goal of the game is a key marker of individuals who might be labeled "achievers." Others may be motivated to understand the system or game well enough to be able to train others in it. They delight in finding unusual or unknown places and interesting game features (e.g., bugs) and sharing that knowledge. These players, known as explorers, might help with training manuals and FAQs and usually will be highly valued as team members for their knowledge. Other game players are often online simply to search for a social forum rich in personal or professional relationships. These socializers might excel at mentoring those new to the game, brokering connections, recruiting new team members, and holding groups together. Bartle notes that someone in this role is interested in people and human relations and tends to have a high level of empathy, good listening skills, and a ready ability to joke or share humor, and generally entertain others. Finally, there are players who are dubbed killers. They tend to cause other players grief or discomfort. They focus on acquiring weapons of some type and using them on other players to cause death, havoc, or distress within the game. Kim (1998) argued that it is fairly common to assume this role online



since it tends to be more exciting and interactive for players than other roles, even if those interactions are negative in nature.

Role assignment has the potential to be an important factor in the educational use of MMOGs. For example, it is possible that certain roles foster particular types of learning. Perhaps players should be encouraged to assume roles that are most fitting with their job requirements. Alternatively, they might be required to rotate through roles to experience the MMOG from a variety of perspectives.

This study will have two groups. In group one, players will be assigned particular roles (e.g., achievers, explorers, socializers, and killers). In group two, players will be allowed to assume any role they want. After playing a MMOG for one to two months, participants will be encouraged to change their role or perspective. The study will explore how players assumed their initial roles, how easy it is for players to move among these roles, and which roles promoted qualities such as leadership, management, and vision. Additionally, data will be collected about participant performance and persistence to help determine what effect, if any, roles had on their game play.

Experiment: How do different roles impact game performance, persistence, and decision-making?

Independent variable: Role assignment.	Dependent variable: Game performance, attitudes, game commitment or persistence, motivation.
<ol style="list-style-type: none"> <li>1. Group 1: Assign to particular role (i.e., socializer, achiever, killer, and explorer).</li> <li>2. Group 2: Allow to assume roles.</li> </ol>	<ul style="list-style-type: none"> <li>• Collect game performance scores.</li> <li>• Administer game satisfaction questionnaire.</li> <li>• Administer game persistence or commitment instrument.</li> <li>• Collect decision-making style data.</li> <li>• Interview participants about roles assumed and roles they changed to.</li> </ul>

Hypotheses:

1. Individuals allowed to assume their own roles will be more satisfied with their performance and online gaming in general.

### 5.1.8 Research Study VIII. Cognitive Tools and MMOG Performance and Dialogue

In addition to using post-game reflection, another way to build conceptual knowledge is to engage in dialogue with peers or experts about the game during game play. Specific cognitive tools (i.e., discussion forums, bulletin boards, debate tools, concept mapping tools, surveys and polling tools, etc.) might be used to support MMOG play by mediating social interaction and fostering depth of discussion. Tools might assist in collaborative argumentation, questioning, articulation of ideas, idea critique, and elaboration of points of view. Ravenscroft and Matheson (2002) found that, while there are a plethora of

contextual factors to consider, dialogue-based games can significantly improve student conceptual understanding. In this study, students will be assigned to a control group (game play only) or a treatment group (game play plus discussion) to determine the impact of concurrent discussion with cognitive support tools.

Experiment: Can cognitive support tools enhance performance and strategic decision-making within MMOG?

Independent variable: Supplemental cognitive tools.	Dependent variable: Game performance, attitudes, depth of understanding, motivation.
<ol style="list-style-type: none"> <li>1. Treatment group utilizes collaboration and conferencing tools within MMOG.</li> <li>2. Control group does not access such tools.</li> </ol>	<ul style="list-style-type: none"> <li>• Collect game performance scores.</li> <li>• Administer game satisfaction questionnaire.</li> <li>• Interview participants about their use of supplemental cognitive tools.</li> <li>• Participants complete strategic planning documents for particular situations similar to the online game they played.</li> </ul>

Hypotheses:

1. Groups with cognitive support tools will outperform those without access to those tools.
2. Strategic planning scores will be higher for groups which have cognitive tool support.

### 5.1.9 Research Study IX. Collaboration and Virtual Teaming in MMOG: Co-located and Distance Groups

During the last decade there has been intensive growth in collaborative technologies for online learning as well as work (Bonk & Wisner, 2000). As a result, there is increasing interest in how to establish and use virtual teams (ThoughtLink, 2002). One relevant area of research is whether co-located and virtual teams develop and work differently. In this study, one treatment group or guild will include group members who are co-located, while the other group or guild will have members who are located at a distance from each other. The study will explore how strategic plans and ideas are presented and negotiated within these two types of groups. Relevant points of comparison will include how the groups are coordinated; the types of communication and teaming structures that are used; how norms and procedures are negotiated within the MMOG environment (Graham, 2002, 2003); the methods of conflict resolution; the use of communication tools; and participant expectations and experiences regarding feedback and support.

Additionally, participant satisfaction with their team and perceptions of team success may vary based on team type. Factors such as group cohesion or timely completion of tasks may be viewed as indicators of a positive group experience. Interviews with team

members can indicate group member satisfaction. Online chats or discussions among group members also might be used to help determine the effectiveness of the groups.

Experiment: What is the impact of team member location on group or guild performance within MMOG?

Independent variable: Assignment to group with co-located or distant team members.	Dependent variable: Game performance, attitudes, group cohesion and attrition, motivation.
<ol style="list-style-type: none"> <li>1. Assign half of the participants to groups with members at different locations around the globe.</li> <li>2. Assign half of the participants to groups with co-located members.</li> </ol>	<ul style="list-style-type: none"> <li>• Collect game performance scores.</li> <li>• Administer game satisfaction questionnaire.</li> <li>• Give participants team effectiveness survey or questionnaire.</li> <li>• Analyze team negotiation processes.</li> </ul>

Hypotheses:

1. Groups with co-located team members will engage in more social chat or interaction.
2. Groups with co-located team members will make more assumptions and use specific lingo and abbreviations.

### 5.1.10 Research Study X. Decision-making, Leadership, and Interpersonal Conflict in MMOGs.

Research on group decision support systems (GDSS) has revealed that these systems result in more time to make a decision, higher decision quality, better overall performance, and a higher degree of satisfaction with the decision (Dasgupta, 2003). Dasgupta points out that most GDSS studies have taken place in highly controlled environments. With greater use of the Internet to support group functioning, there is a need to replicate some of these studies in more dynamic and decentralized online environments. Instead of being located in a computer lab, individuals and groups can be located across different departments, organizations, countries, and continents. MMOGs offer one such environment to explore the quality, confidence, and speed of online decision-making.

As indicated earlier, some scholars are increasingly focusing on how simulations and games can impact group as well as individual decision-making. Aspects of decision-making that may be explored include the quality of the decision, the level of satisfaction with the decision among group members, the confidence in the soundness or correctness of a decision, and the extent of conflict during the decision-making process (Dasgupta, Chanin, & Ioannidis, 2000). In terms of the latter, styles of handling interpersonal conflict (e.g., compromising, obliging, dominating, avoiding, integrating, etc.) might be compared to the quality of decisions or solutions. These styles also are important to help understand the principles and practices of leadership within MMOGs. For example, how

is leadership decided and instantiated within these online games? How do different types of leaders impact group cohesion and the effectiveness of decision making? How successful is bottom-up and top-down leadership in MMOGs? What is the overall quality of decision making and leadership displayed in predetermined versus emergent groups? Are real-world leaders threatened by gaming scenarios wherein they might not be the leader?

Qualitative study: How are ways of handling interpersonal conflict in MMOGs related to the quality of decision-making and group cohesion?

**Methods:**

1. Collect game performance scores.
2. Administer game satisfaction questionnaire.
3. Observe ways of handling interpersonal conflict online.
4. Record decisions made in MMOGs and categorize decision making types.
5. Collect decision making style information.
6. Record group cohesion and longevity.

**Hypotheses:**

1. Groups with co-located team members will engage in more social chat or interaction.
2. Groups with co-located team members will make more assumptions and use specific lingo and abbreviations.

**5.1.11 Research Study XI. Learning from Mistakes and Learning Histories.**

Computer log tools and other devices provide a history of learner progress and decision-making that can be used for review and reflection. Session histories might be replayed or evaluated immediately after they are recorded or after a significant delay (Rose et al., 2000). By encouraging learner review, session histories can enhance learner’s metacognitive skills such as reflection. In this study, half of the participants will review their histories with a mentor as well as peers, whereas half will reflect individually on their session histories. Post performance on a series of problem solving tasks will be compared across groups.

Experiment: Can review of session histories impact on metacognitive skills.

Independent variable: Type of session histories (mentor/peer and individual).	Dependent variable: Game performance, attitudes, metacognitive skills, strategic decision making.
<ol style="list-style-type: none"> <li>1. Group 1: Mentors and peer review of session history.</li> <li>2. Group 2: Self-reflection on session history.</li> </ol>	<ul style="list-style-type: none"> <li>• Collect game performance scores.</li> <li>• Administer game satisfaction questionnaire.</li> <li>• Give participants survey on satisfaction with game environment.</li> <li>• Metacognitive awareness of tactical</li> </ul>

	decisions. <ul style="list-style-type: none"> <li>• Solve similar scenarios or problems.</li> </ul>
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Hypotheses:

1. Group with peer and mentor reviews will score better than self-review group.
2. Group with peer and mentor reviews will display greater metacognitive skill and strategic decision making skill.

### 5.1.12 Research Study XII. Learning Style and Game Selection.

Learners have different individual learning preferences. For instance, some are more sensory and others more intuitive; some are more global and others more analytical or detail-oriented; some prefer hands-on and active learning experiences whereas others enjoy more passive, receptive learning; and some students might learn best from visual representations whereas others will strictly want verbal materials. Different types of games may address preferences for different learning styles or target different ways of knowing the material (Hill, Ray, Blair, & Carver, 2003). In this study, students will be administered the Index of Learning Styles questionnaire (Felder & Solomon, 2004). They will then be allowed to select from 4-8 different online games that had been previously categorized as high on text, visuals, hands-on experiences, or reflective exercises. Their choices will be compared to their learning style preferences as well as their game performance and attitudes.

Experiment: Will participants select MMOGs that match their preferred learning styles?

Independent variable: Learning styles.	Dependent variable: Game selection, game performance, participant satisfaction with game environment.
<ol style="list-style-type: none"> <li>1. Administer Kolb's learning style inventory; sort participants into different learning style preferences.</li> </ol>	<ul style="list-style-type: none"> <li>• Allow participants to choose game.</li> <li>• Collect game performance scores.</li> <li>• Administer game satisfaction questionnaire.</li> <li>• Give participants survey or questionnaire regarding satisfaction with game selection.</li> </ul>

Hypotheses:

1. Participants will select online games that most closely match their preferred learning styles.
2. Participants that select a game the matches their learning style will perform better and be more satisfied than those who do not.

### 5.1.13 Research Study XIII. Game-based Motivation.

Intrinsic motivators (e.g., curiosity, fantasy, and challenge) might be more applicable to single-user games, whereas multi-player games add extrinsic motivators such as recognition, competition, and collaboration. A study might be conducted wherein participants complete a Likert scale rating of statements for the degree of engagement or the most interesting factors related to their MMOG (Chen et al., 1998). For example, what are the social and psychological factors (e.g., challenge, fantasy, control, need for achievement, curiosity, identity, fulfillment, goal setting, sense of persistence, collaboration and information exchange, social networking, and variety) as well as the technological factors (e.g., real time chats, custom avatars, animations, and audio) that engage them in a MMOG experience? They might also rate their agreement with different issues related to their attitudes and activities in the MMOG in a pre-post fashion. Motivational factors might be compared for high and low achieving students, per Chen et al. (1998). Other indicators of motivation include time spent in the system and completion rates or advancement to higher game levels (Siemer & Angelides, 1995).

Experimental study: What is motivational about MMOGs?

#### Methods:

1. Administer motivational factor checklist.
2. Engage in MMOG activity for set period of time.
3. Readminister motivational checklist.
4. Compare high and low achieving players on motivational checklist.
5. Compare computer log information to motivational indices.

#### Hypotheses:

1. Students who play games for challenge and a high need for achievement will perform better on MMOGs than those who play primarily for social networking needs.
2. Low achievers will have more social needs met by MMOG environments than high achievers.
3. Social and psychological motivational factors will be more related to performance than technological factors.

#### **5.1.14 Research Study XIV. Problem Solving Processes and Types of Knowledge Facilitated by MMOGs.**

Researchers have been curious about whether computer game play improves problem solving skills. Problem solving, in fact, is often viewed as the main reason to use simulations and games (Leemkuil et al., 2000). According to Mayer and Wittrock (1996), problem solving is the “cognitive processing directed achieving a goal when no solution method is obvious to the problem solver” (p. 47). Amory, Naicker, Vincent, and Adams (1999) had college age students play four different commercial games and then asked them to assess the importance of different skills (e.g., logic, memory, mathematics, visualization, reflexes, and problem solving) in playing each game. Not surprisingly, problem solving was a skill consistently mentioned by the subjects.

A related issue to problem solving is to understand the types of knowledge that are facilitated by MMOG. In a study of adventure gaming with college students, Ju and Wagner (1997) found factual knowledge was more easily retrieved than planning skills and negative knowledge. It remains unknown whether MMOGs foster cause and effect knowledge, strategic planning, conceptual learning, or just basic facts about a particular game. Also, do MMOG players retain more procedural or declarative knowledge? And will different types of MMOGs foster different types of knowledge? In this study, subjects will be asked different levels or types of questions, “what is the name of...,” “how would you conduct...,” “what happens if...,” and “how would you get to...”? Of interest, is the type of knowledge most remembered—strategic or declarative. Additionally, learner performance in the MMOG environment will be compared to the types of knowledge remembered.

Experiment: What type of knowledge do MMOG participants focus on?

##### **Methods:**

1. Play 3-4 different MMOGs for a set time period (e.g., 1-2 weeks of 1-2 months). Some games may be more social and others more tactical.
2. Both one week and one month after completion, ask participants procedural, declarative, technological, and strategic or tactical questions related to each game.
3. Compare knowledge retention to game performance.

##### **Hypotheses:**

1. Participants who retain more strategic knowledge will have higher game performance scores.

### 5.1.15 Research Study XV. Social Skills and Friendship Development.

Online shared spaces are important to group functioning and performance (Schrage, 1990). Socialization during MMOG may take many forms. In terms of social spaces, players may congregate in launching pads, pit stops, or staging areas (Koster, 2004). They may also use these spaces need to recover after the adventure. It is vital to understand how activity is spawned and accelerates in these social spaces as well as what transpires cognitively, socially, and emotionally in order to better support group communication and performance.

Orvis, Wisher, Bonk, and Olson (2001) found that social activity was present in about 30 percent of synchronous training. In the context of MMOGs, the average time spent socializing in the environment is an open research question, along with the participants' reasons for socializing (e.g., to explain rules, provide strategic advice, or offer support). Not all game players may value or use the social options. To begin learning about these issues, in this study, learners will be observed as they engage in game play and negotiate ideas and their social situation. They will then be interviewed about their preferences for different types of online social spaces when playing in MMOGs. The results might help improve the design and availability of social spaces and tools valued by players during MMOG play as well as enhance their productivity and the overall outcomes of MMOGs.

Experiment: What social activities and support tools are favored when playing MMOGs?

#### Methods

1. Observe activities and tools favored by online gaming participants.
2. Interview players about their preferred social outlets. What are their favored social activities and tools when playing MMOGs? When do they use them? How might they redesign online games for their social preferences?

## 5.2 MMOG Assessment and Evaluation

In addition to the primary and secondary research studies mapped out above, it is vital to explore the effectiveness of MMOGs using different assessment and evaluation techniques. Bonk and Wisher (in press) discuss a range of evaluation methods within online environments. Of course, MMOG stakeholders will each have different assessment and evaluation criteria and needs. As O'Neil et al. (2002) argue, the four levels of Kirkpatrick's (1998, 2001) model of training evaluation might help analyze the effectiveness of the MMOG environments. Even though this model was developed decades prior to the emergence of the Internet, it helps explain why the evaluation of e-learning is important (Bonk & Wisher, in press).

The first level of the Kirkpatrick model would ask participants questions about their reactions to the game. Evaluation questions would relate to how to improve the MMOG in terms of participant satisfaction. Also, participants might be asked about what they liked most, found most difficult and what obstacles they faced. At the second level, the evaluation focus shifts to learning – specifically, participant knowledge, attitudes, and



skills that were gained or refined as a result of the MMOG. At the third levels, the evaluation might directly explore what happens when trainees return to their jobs or start a new one after the training game. The concern here is with the transfer of knowledge, skills, and attitudes to the real world. Such information might be revealed through direct observations, supervisor feedback, and peer evaluations. Finally, at the fourth level of the Kirkpatrick model, the focus might shift to the impact of MMOG on enhanced unit readiness or productivity as well as reductions in costs or accidents. Given these four levels of evaluation, it is clear that there are numerous measures and approaches that might be drawn upon to address particular stakeholder needs and interests (Bonk & Wisner, in press). Thus, the Kirkpatrick model would provide a useful way of ensuring that MMOGs are thoroughly evaluated for both immediate and long-term impact on the organization.

## **6. Future Directions**

While this is not a report on the market potential of MMOG, research is currently needed on a wide assortment of variables that could, in turn, impact on products and innovations that vendors offer. Lack of entrepreneurship and innovation in the online gaming industry will likely never be the problem. Costs will continue to plummet, innovative features will be added, and processing speed will be significantly increased. The problems, instead, will arise in how to use them effectively, and, in conjunction, determining the most relevant and important research questions and avenues to pursue. The research questions raised in this report relate primarily to higher level skills and cognitive processes as well as issues of identity and social affiliation. Among the more salient issues were those related to sense of community, group persistence, intrinsic and extrinsic motivational factors, player apprenticeship, and the impact of playing MMOGs on decision making, problem solving, and leadership.

During the coming decade, online games and simulations will become increasingly interactive and sophisticated. Advances in pedagogical agent technology will provide additional layers of guidance, challenges, and control within these systems. According to Dessouky et al. (2001), “the primary role for agents will be to recognize student learning opportunities and ensure that students recognize them as well” (p. 179). As agents and artificial intelligence as well as additional customization and options are added to the MMOG experience, there will be increasing avenues for education, training, and performance support within these environments. If some of the research recommended in this report is conducted during the next few years, it should provide some answers and directions on where and how to take advantage of the next evolution of MMOG technology.

## 7. References

- Alberts, A., Gartska, J., & Stein, F. (1999). *Network centric warfare: Developing and leveraging information superiority* (pp. 5-6). Washington, D.C.: C4ISR Cooperative Research Program, Department of Defense, 1999.
- Aldrich, C. (2002). Field guide to educational simulations. *Learning Circuits*, American Society for Training and Development. Retrieved April 11, 2004, from <http://www.learningcircuits.org/NR/rdonlyres/3FBFC2B6-4517-4E35-A9BE-E34EE719D134/1353/Aldrich.pdf>
- Aldrich, C. (2004). *Simulations and the future of learning: An innovative (and perhaps revolutionary) approach to e-learning*. San Francisco, CA: Pfeiffer Publishing.
- Anderson, C. A., & Bushman, B. J. (2001, September). Effects of violent video games on aggressive behavior, aggressive cognition, physiological arousal, and prosocial behavior: A meta-analytic review of the scientific literature. *Psychological Science*, 12(5), 353-359.
- Amory, A., Naicker, K., Vincent, J., & Adams, C. (1999). The use of computer games as an educational tool: Identification of appropriate game types and game elements. *British Journal of Educational Technology*, 30 (4), 311-321.
- Asakawa, T., & Gilbert, N. (2003). Synthesizing experiences: Lessons to be learned in Internet-mediated simulation games. *Simulation & Games*, 34(1), 10-22.
- Barab, S. A., & Duffy, T. (2000). From practice fields to communities of practice. In D. Jonassen, & S. M. Land. (Eds.). *Theoretical foundations of learning environments* (pp. 25-56). Mahwah, NJ: Lawrence Erlbaum Associates.
- Bangert-Drowns, R. L., Kulik, J. A., & Kulik, C. L. (1985). Effectiveness of computer-based education in secondary schools. *Journal of Computer-Based Instruction*, 12(3), 59-68.
- Baron, J. (1999, November). *Glory and shame: Powerful psychology in multiplayer games*. Proceedings of the Game Developers Conference, San Francisco, CA. Gamasutra. Retrieved November 10, 1999, from [http://gamasutra.com/features/19991110/Baron\\_01.htm](http://gamasutra.com/features/19991110/Baron_01.htm).
- Bartle, R. A. (1996, June). Hearts, clubs, diamonds, spades: Players who suit MUDs. *Journal of MUD Research*, 1(1). Retrieved May 10, 2004, from <http://www.mud.co.uk/richard/hcds.htm>.
- Bartle, R. (2003). *Designing virtual worlds*. Indianapolis, IN: New Riders Press.

- Beal, S. A., & Christ, R. E. (2004). *Training effectiveness evaluation in the Full Spectrum Command game* (Technical Report No.1140). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.
- Belanich, J., Sibley, D. E., & Orvis, K. L. (2004). *Instructional characteristics and motivational features of a PC-based game* (Research Report No. 1822). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.
- Bonk, C. J., & Wisner, R. A. (2000). *Applying collaborative and e-learning tools to military distance learning: A research framework* (Technical Report No. 1107). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences. Retrieved May 20, from [http://www.publicationsshare.com/docs/Dist.Learn\(Wisner\).pdf](http://www.publicationshare.com/docs/Dist.Learn(Wisner).pdf).
- Bonk, C. J., & Wisner, R. A. (in press). Getting a sense of e-learning evaluation methods. To appear in S. Reddy (Ed.). *Training and Development - Vol. 2: Role of Technology in Training*. Hyderabad, India: ICFAI Press.
- Bonk, C. J., Wisner, R. A., & Nigrelli, M. L. (in press). Learning communities, communities of practice: Principles, technologies, and examples. To appear in K. Littleton, D. Faulkner, & D. Miell (Eds.), *Learning to collaborate, collaborating to learn*. City, State: NOVA Science.
- Borland, J., & Kanellos, M. (2004, July 28). South Korea leads the way. *CNET News.com*, Retrieved October 1, 2004, from [http://news.com.com/South+Korea+leads+the+way/2009-1034\\_3-5261393.html?tag=nl](http://news.com.com/South+Korea+leads+the+way/2009-1034_3-5261393.html?tag=nl)
- Brown, R. (2001). The process of community-building in distance learning classes. *Journal of Asynchronous Learning Networks*, 5(2). Retrieved December 24, 2002, from [http://www.aln.org/alnweb/journal/Vol5\\_issue2/Brown/Brown.htm](http://www.aln.org/alnweb/journal/Vol5_issue2/Brown/Brown.htm).
- Chambers, S. K., Haselhuhn, C., Andre, T., Mayberry, C., Wellington, S., Krafka, S., Volmer, J., & Berger, J. (1994). *The acquisition of a scientific understanding of electricity: Hands-on versus computer simulation experience; conceptual change versus didactic text*. Paper presented at the Annual Meeting of the American Educational Research Association, New Orleans, LA.
- Chao, C. (2001). *Toward an understanding of sense of community and meaningful learning experiences in an on-line language education course*. Unpublished doctoral dissertation, University of Indiana, Bloomington.
- Chen, G. D., Shen, G. Y., Ou, K. L., & Liu, B. J. (1998). *Promoting motivation and eliminating disorientation for Web based courses by a multi-user game*. Proceedings of the Ed Media/Ed Telecom 99 World Conference on Educational

- Multimedia and Hypermedia and World Conference on Educational Telecommunications, Frieberg, Germany.
- Chinn, C. A., & Brewer, W. F. (1993). The role of anomalous data in knowledge acquisition: A theoretical framework and implications for science instruction. *Review of Educational Research*, 63, 1-49.
- Corbeil, P. (2003). IN THE HIVE: A game on internal communications inspired by nature. *Simulation & Gaming*, 34(1), 164-166.
- Dasgupta, S. (2003). The role of controlled and dynamic process environments in group decision making: An exploratory study. *Simulation & Gaming*, 34(1), 54-68.
- Dasgupta, S., Chanin, M., & Ioannidis, A. (2000). Group decision making using knowledge-based systems—An experimental study. *Simulations and Gaming: An Interdisciplinary Journal of Theory, Practice, and Research*, 31(4), 536-544.
- Davis, J. (2003, September 8). Soldiers would play against each other. *Inside the Army*, Volume, 1.
- Defense Advanced Research Projects Agency, Defense Sciences Office (2004). Website: Training superiority (DARWARS). Retrieved May 2, 2004, from [http://www.darpa.mil/dso/thrust/biosci/training\\_super.htm](http://www.darpa.mil/dso/thrust/biosci/training_super.htm)
- Department of Defense (2004, June 9). *Department of Defense training transformation implementation plan*. Washington, DC: The Pentagon, Office of the Under Secretary for Personnel and Readiness.
- de Jong, T., & van Joolingen, W. R. (1998). Scientific discovery learning with computer simulations of conceptual domains. *Review of Educational Research*, 68(2), 179-201.
- Delaney, K. (2003, November 3). Are videogames ready to be taken seriously by media reviewers? *The Wall Street Journal*, p. B1. Retrieved May 20, 2004, from [http://www.gamegirladvance.com/archives/2003/11/03/the\\_wsj\\_gets\\_it.html](http://www.gamegirladvance.com/archives/2003/11/03/the_wsj_gets_it.html)
- Dessouky, M. M., Verma, S., Bailey, D. E., & Rickel, J. (2001). A methodology for developing a web-based factory simulator for manufacturing education. *IIE Transactions*, 33, 167-180.
- DiMascio, J. (2004, April 12). Ft. Benning soldiers among the first to sample commercial X-box game. *Inside the Army*, p. 1.
- Downes, S. (2004, March 15). Learning by doing: James Paul Gee at RIMA ICEF. *Stephen's Web*. Retrieved March 29, 2004, from <http://www.downes.ca/cgi-bin/website/view.cgi?dbs=Article&key=1079385148>

- Felder, R. M., & Solomon, B. A. (2004). *Index of Learning Styles Questionnaire*. Retrieved May 31, 2004, from North Carolina State University Web site: <http://www.engr.ncsu.edu/learningstyles/ilsweb.html>
- Gee, J. P. (2003a, June 20). From video games, learning about learning. *The Chronicle of Higher Education*, pp. B13. Retrieved April 10, 2004, from <http://chronicle.com/prm/weekly/v49/i41/41b01301.htm>.
- Gee, J. P. (2003b). *What video games have to teach us about learning and literacy*. Palgrave, NY: MacMillan.
- Gokhale, A. A. (1996). Effectiveness of computer simulation for enhancing higher order thinking. *Journal of Industrial Teacher Education*, 33(4), 36-46.
- Graham, C. R. (2002). *Understanding and facilitating computer mediated teamwork: A study of how norms develop in online learning teams*. Unpublished doctoral dissertation, Indiana University at Bloomington, IN. Retrieved June 3, 2004, from [http://www.byu.edu/ipt/faculty/documents/charles\\_graham\\_dissertation.doc](http://www.byu.edu/ipt/faculty/documents/charles_graham_dissertation.doc)
- Graham, C. R. (2003). A model of norm development for computer-mediated teamwork. *Small Group Research*, 34(3), 322-352.
- Gredler, M. E. (1996). Educational games and simulations: A technology in search of a (research) paradigm. In D.H. Jonassen (Ed.), *Handbook of Research for Educational Communications and Technology* (pp. 521-540). New York, NY: Simon & Schuster Macmillan.
- Green, C. S., & Bavelier, D. (2003). Action video game modifies visual selective attention. *Nature*, 423, 534-537.
- Griffiths, M. D., & Davies, M. N. O. (2002). Excessive online computer gaming: Implications for education. *Journal of Computer Assisted Learning*, 18, 379-380.
- Harmon, A. (2003, April). More than just a game, but how close to reality? *New York Times*. Retrieved May 2, 2004, from <http://www.peostri.army.mil/PAO/pressrelease/moreThan.jsp>.
- Herz, J. C., & Macedonia, M. R. (2002, April). Computer games and the military: Two views. *Defense Horizons*, 11. Retrieved May 3, 2004, from <http://www.ndu.edu/inss/DefHor/DH11/DH11.htm>.
- Hill, J. D. J., Ray, C. K., Blair, J. R. S., & Carver, C. A. (2003, February). *Puzzles and games: Addressing different learning styles in teaching operating systems concepts*. Proceedings of the 34<sup>th</sup> SIGCSE technical symposium on computer science education, Reno, Nevada, 182-186. Retrieved May 11, 2004, from

<http://delivery.acm.org/10.1145/620000/611964/p182hill.pdf?key1=611964&key2=6391334801&coll=portal&dl=ACM&CFID=21402756&CFTOKEN=64725806>

- Jayakanthan, R. (2002). Application of computer games in the field of education. *The Electronic Library*, 20(2), 98-102.
- Johnson, A. (2003, September 21). The learning game--Researchers study video gaming principles that apply to education. *Wisconsin Technology Network*. Retrieved May 2, 2004, from <http://www.wistechnology.com/article.php?id=243>.
- Jones, S. (2003). Let the games begin: Gaming technology and edutainment among college students. Pew Internet and American Life Project, Washington, DC. Retrieved April 10, 2004, from <http://www.pewinternet.org/reports/toc.asp?Report=93>.
- de Jong, T., & van Joolingen, W. R. (1998). Scientific discovery learning with computer simulations of conceptual domains. *Review of Educational Research*, 68, 179-202.
- Ju, E., & Wagner, C. (1997). Personal computer adventure games: Their structure, principles, and applicability for training. *The DATA BASE for Advances in Information Systems*, 28(2), 78-92.
- Kim, A. J. (1998, May). Killers have more fun. *Wired News*. Retrieved May 14, 2004, from [http://hotwired.wired.com/collections/gaming/6.05\\_killers\\_fun1.html](http://hotwired.wired.com/collections/gaming/6.05_killers_fun1.html)
- King, B. (2003). Educators turn to games for help. *Wired News*. Retrieved April 10, 2004, from <http://www.wired.com/news/games/0,2101,59855,00.html>
- Kirkpatrick, D.L (1998). *Evaluating training programs: The four levels* (2<sup>nd</sup> ed.). San Francisco, CA: Berret-Koehler.
- Kirkpatrick, D.L (2001). *Evaluating training programs: Inside the four levels*. Proceedings of the 17<sup>th</sup> annual Training Director's Forum (pp. 545-572), Las Vegas, NV.
- Kirriemuir, J. (2002, February). Video gaming, education and digital learning technologies. *D-Lib*, 8(2). Retrieved April 10, 2004, from <http://www.dlib.org/dlib/february02/kirriemuir/02kirriemuir.html>
- Knight, W. (2003, April). Million-user online game previewed. *New.scientist.com*. Retrieved April 7, 2004, from <http://www.newscientist.com>
- Kolbert, E. (2001, May 28). Pimps and dragons. *The New Yorker*.

- Koster, R. (2004). *On socialization and convenience*. Retrieved May 9, 2004, from <http://www.legendmud.org/raph/gaming/socialization.html>
- Lainema, T., & Makkonen, P. (2003, March). Applying constructivist approach to educational business games: Case REALGAME. *Simulations and Gaming: An Interdisciplinary Journal of Theory, Practice, and Research*, 34(1), 131-149.
- Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. New York, NY: Cambridge University Press.
- Learning and Training Innovations (2003, September 18). *Bersin offers guide to e-learning application simulation tools*. News. Retrieved May 21, 2004, from <http://www.ltimagazine.com/ltimagazine/article/articleDetail.jsp?id=70007>
- Leemkuil, H., de Jong, T., & Ootes, S. (2000). *Review of educational use of games and simulations*. EC project KITS (Knowledge management Interactive Training System). EC project KITS (IST-1999-13078), KITS Deliverable D1, Enschede: KITS consortium. University of Twente, The Netherlands. Retrieved May 14, 2004, from <http://kits.edte.utwente.nl/documents/D1.pdf>.
- Lenhart, A., Rainie, L., & Lewis, O. (2001). Teenage life online. *Pew Internet and American Life Project*, Washington, DC. Retrieved April 10, 2004, from <http://www.pewinternet.org/reports/toc.asp?Report=36>.
- Littman, D., & Soloway, E. (1988). Evaluating ITSs: The cognitive science perspective. In M. C. Polson & J. J. Richardson (Eds.), *Foundations of Intelligent Tutoring Systems*. Mahwah, NJ: Lawrence Erlbaum.
- Malone, T. (1980). What makes things fun to learn: Heuristics for designing instructional computer games. *Proceedings of the 3rd ACM SIGSMALL symposium and the first SIGPC symposium on Small systems*, 162-169.
- Malone, T. (1981). Toward a theory of intrinsically motivating instruction. *Cognitive Science*, 4, 333-369.
- Malone, T. W., & Lepper, M. R. (1987). Making learning fun: A taxonomy of intrinsic motivations for learning. In R. E. Snow and M. J. Farr (Eds.), *Aptitude, learning, and instruction*. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Mayer, R.E., & Wittrock, M.C. (1996). Problem-solving transfer. In D.C. Berliner & R.C. Calfee (Eds.), *Handbook of educational psychology* (pp. 47-62). New York: Macmillan.
- McLoughlin, C., & Oliver, R. (1999). Pedagogical roles and dynamics in telematics environments. In M. Selinger & J. Pearson (Eds.), *Telematics in education: Trends and issues*. Amsterdam, The Netherlands: Pergamon.

- Morrison, J. L., & Aldrich, C. (2003, September/October). Simulations and the learning revolution: An interview with Clark Aldrich. *The Technology Source*. Retrieved April 11, 2004, from <http://ts.mivu.org/default.asp?show=article&id=2032>
- The National Research Council Computer Science & Telecommunications Board (1997). *Modeling & Simulation: Linking Entertainment & Defense*. Washington, D.C.: National Academy Press.
- Nygren, T. E. (2000, November). *Development of a measure of decision making styles to predict performance in a dynamic judgment/decision making task*. Paper presented at the 41<sup>st</sup> Annual Meeting of the Psychonomics Society, New Orleans, LA.
- Oblinger, D. (2003, July/August). Boomers, gen-xers, and millennials: Understanding the new students. *Educause*, 38(4), 37-47. Retrieved April 9, 2004, from <http://www.educause.edu/ir/library/pdf/erm0342.pdf>.
- O'Neil, H., Baker, E. L., & Fisher, J. (2002). *A formative evaluation of ICT games*. Los Angeles, CA: The University of Southern California.
- Orvis, K. L., Wisher, R. A., Bonk, C. J., & Olson, T. (2002). Communication patterns during synchronous Web-based military training in problem solving. *Computers in Human Behavior*, 18(6), 783-795.
- Palloff, R. M., & Pratt, K. (1999). *Building learning communities in cyberspace: Effective strategies for the online classroom*. San Francisco, CA: Jossey-Bass.
- Peck, M. (2004, January). DARPA sketches futuristic 'virtual schoolhouse.' *National Defense Magazine*. Retrieved May 2, 2004 from <http://www.nationaldefensemagazine.org/article.cfm?Id=1312>.
- Pintrich, P. R., & Schunk, D. H. (1996). *Motivation in education: Theory, research, and applications*. Englewood Cliffs, NJ: Merrill.
- Prensky, M. (2001). *Digital game-based learning*. New York, NY: McGraw-Hill.
- Raduege, H. D. (2004). Net-centric warfare is changing the battlefield environment. *CrossTalk: The Journal of Defense Software Engineering*, 17(1), 7-9.
- Ravenscroft, A., & Matheson, M. P. (2002). Developing and evaluating dialogue games for collaborative e-learning. *Journal of Computer Assisted Learning*, 18, 93-101.
- Raybourn, E. M. (1998). Designing DomeCityMOO training collaboratory: A multi-user simulation in a text-based networked virtual environment that supports non-



- scripted interactions toward intercultural understanding. *SIGGROUP Bulletin*, 19(3), 35-37.
- Reeve, J. M. (1996). *Motivating others: Nurturing inner motivational resources*. Needham Heights, MA; Allyn & Bacon.
- Rickard, W., & Oblinger, D. (2004). *Higher education leaders symposium: Unlocking the potential of gaming technology*. Redmond, WA: Microsoft Corporation. Retrieved April 11, 2004, from <http://www7.nationalacademies.org/jtru/Gaming%20Technology.pdf>.
- Riddell, R. (1997, April). Doom goes to war. *Wired Magazine*. Retrieved September 27, 2004, from [http://hotwired.wired.com/collections/future\\_of\\_war/5.04\\_doom\\_pr.html](http://hotwired.wired.com/collections/future_of_war/5.04_doom_pr.html)
- Rose, A., Salter, R., Keswani, S., Kositsyna, N., Plaisant, C., Rubloff, G., & Shneiderman, B. (2000, April). *Simulation based learning environments and the use of learning histories*. Paper presented at the CHI Conference, The Hague, The Netherlands.
- Rovai, A. (2002). Building a sense of community at a distance. *International Journal of Open and Distance Learning*, 3(1). Retrieved December 24, 2002, from <http://www.irrodl.org/content/v3.1/rovai.html>
- Sawyer, B. (2002). *Serious games: Improving policy through game-based learning and simulation*. Foresight and governance project. Washington, DC.: Woodrow Wilson International Center for Scholars, Publication 2002-1. Retrieved May 12, 2004, from <http://wwics.si.edu/topics/docs/ACF3F.pdf>
- Schatz, A. (2001, June 21). The onset of anarchy. *The Lycos 50 daily report*. Retrieved April 10, 2004, from <http://50.lycos.com/062101.html>
- Schlager, M. S., Fusco, J., & Schank, P. (2002). *Evolution of an on-line education community of practice*. K. A. Renniger & W. Shumar (Eds.), *Building virtual communities: Learning and change in cyberspace*. New York, NY: Cambridge University Press.
- Schettler, J. (2003, February). Weapons of mass instruction. *Training Magazine*, 40(2), 20-22, 24-26.
- Schiesel, S. (2003, June 12). Voyager to a strange planet. *The New York Times*. Retrieved June 13, 2003, from <http://query.nytimes.com/gst/abstract.html?res=F10F1EFE355D0C718DDDAF0894DB404482>

- Schrage, M. (1990). *Shared minds: The technologies of collaboration*. New York, NY: Random House.
- Schwier, R.A. (1999, June). Turning learning environments into learning communities: Expanding the notion of interaction in multimedia. *Proceedings of the World Conference on Educational Multimedia, Hypermedia and Telecommunications, Seattle, Washington: Association for the Advancement of Computers in Education*.
- Seay, A. F., Jerome, W. J., Lee, K. S., & Kraut, R. E. (2004). *Project massive: A study of online gaming communities*. Extended abstracts of the Conference on Human Factors in Computing Systems, pp. 1421-1424, Vienna, Austria. Retrieved May 14, 2004, from <http://delivery.acm.org/10.1145/990000/986080/p1421-seay.pdf?key1=986080&key2=4316454801&coll=GUIDE&dl=ACM&CFID=21537523&CFTOKEN=81438270>.
- Sellers, M. (2002, September 16). Creating effective groups and group roles in MMP games. *Gamasutra*. Retrieved June 10, 2003, from [http://www.gamasutra.com/resource\\_guide/20020916/sellers\\_01.htm](http://www.gamasutra.com/resource_guide/20020916/sellers_01.htm).
- Sempsey, J. J., & Johnston, D. A. (2000). The psychological dynamics and social climate of text-based virtual reality. *Journal of Virtual Environments*, 5(1).
- Shwayder, R. (2004, March 26). The MMOG battle: EQ vs FFXI. *GameWatchers.net*. Retrieved May 14, 2004, from <http://www.gamewatchers.net/displayarticle.php?article=109>.
- Siemer, J. (1995). *Evaluating intelligent tutoring with gaming-simulations*. Paper presented at the Winter Simulation Conference.
- Siemer, J., & Angelides, M. C. (1994). *Embedding an intelligent tutoring system in a business gaming- simulation environment*. Proceedings of the Winter Simulation Conference (pp. 1399-1406), Orlando, Florida. Retrieved May 31, 2004, from <http://delivery.acm.org/10.1145/200000/194914/p1399-siemer.pdf?key1=194914&key2=4212606801&coll=portal&dl=ACM&CFID=21954772&CFTOKEN=56354256>.
- Smed, J., Kaukoranta, T., & Hakonen, H. (2002). Aspects of networking in multiplayer computer games. *The Electronic Library*, 20(2), 87-97.
- Snider, M. (2002, May 23). Where movies end, games begin. *USA Today*. Retrieved May 14, 2002, from <http://www.usatoday.com/tech/techreviews/2002/5/23/e3.htm>.
- Snider, M. (2004, May 10). Hollywood at the controls: Video games feed off each other. *USA Today*, 1D-2D.

- Squire, K. D., & Steinkuehler, C. A. (in press). Generating cyberculture/s: The case of Star Wars Galaxies. To appear in A. Park (Ed.), *Cyberlines: Languages and cultures of the Internet* (2<sup>nd</sup> ed.). Albert Park, Australia: James Nicholas Publishers.
- Steinkuehler, C. A. (2003). *Massively multiplayer online videogames as a constellation of literacy practices*. Paper presented at the International Conference on Literacy, Ghent, Belgium. Retrieved May 13, 2004, from <http://www.sit.wisc.edu/~steinkuehler/papers/SteinkuehlerAILA2003.pdf>.
- Steinkuehler, C. A. (2004). *Learning in massively multiplayer online games*. Paper to be presented at the International Conference of the Learning Sciences (ICLS), Los Angeles, CA. Retrieved May 13, 2004, from <http://www.sit.wisc.edu/~steinkuehler/papers/SteinkuehlerICLS2004.pdf>.
- Stevenson, R. (2003, May). U.S. Army creates video game to train soldiers. Technology—Reuters. *Yahoo! News*. Retrieved May 15, 2003.
- Stipek, D. J. (1998). *Motivation to learn: From theory to practice* (3rd ed.). Boston, MA: Allyn & Bacon.
- Tharp, R. (1993). Institutional and social context of educational reform: Practice and reform. In E. A. Forman, N. Minick, & C. A. Stone (Eds.), *Contexts for learning: Sociocultural dynamics in children's development*. New York, NY: Oxford University Press.
- Tharp, R., & Gallimore, R. (1988). *Rousing minds to life: Teaching, learning, and schooling in a social context*. Cambridge, MA: Cambridge University Press.
- ThoughtLink (2001, November). *Key drivers for C2 performance: Data mining SCUDHunt experiment data*. Vienna, VA: Thoughtlink, Inc.
- ThoughtLink (2002, October). *Meta-analysis of team performance accuracy and shared situational awareness in SCUDHunt experiments*. Vienna, VA: Thoughtlink, Inc.
- United States Joint Forces Command (2002, November). *Millennium challenge 2002 executive report: Thinking differently*. Norfolk, VA: United States Joint Forces Command.
- Vaknin, S. (2002, February 2). TrendSitters: Games people play. *Electronic Book Web*. Retrieved May 13, 2004, from [http://12.108.175.91/ebookweb/discuss/msgReader\\$1405](http://12.108.175.91/ebookweb/discuss/msgReader$1405)
- Valenza, J. K. (2002, December 26). Gamers are playing, maybe learning too. *The Philadelphia Inquirer, Philly.com*. Retrieved May 15, 2004, from

- [http://www.philly.com/mld/philly/living/columnists/joyce\\_kasman\\_valenza/4814055.htm?1c](http://www.philly.com/mld/philly/living/columnists/joyce_kasman_valenza/4814055.htm?1c).
- Wenger, E. (1998). *Communities of practice: Learning, meaning, and identity*. New York, NY: Cambridge University Press.
- Wenger, E., McDermott, R., & Snyder, W. M. (2002). *Cultivating communities of practice: A guide to managing knowledge*. Boston, MA: Harvard Business School Press.
- Wired News (2003, October 3). *Military training is just a game*. Retrieved May 2, 2004, from [http://www.wired.com/news/games/0,2101,60688,00.html?tw=wn\\_story\\_related](http://www.wired.com/news/games/0,2101,60688,00.html?tw=wn_story_related)
- Wisher, R.A., & Fletcher, J. D. (2004). The case for advanced distributed learning. *Information and Security: An International Journal*, 14, 17-25.
- Woodcock, B. S. (2004, March). *An analysis of MMOG subscription growth—Version 8.0*. Retrieved May 14, 2004, from <http://pw1.netcom.com/~sirbruce/Subscriptions.html>
- Yee, N. (2003). *Learning leadership skills*. The Daedalus Project. Retrieved June 2, 2004, from <http://www.nickyee.com/daedalus/archives/000338.php>
- Yee, N. (2004). *The Daedalus Project*. Retrieved June 2, 2004, from <http://www.nickyee.com/daedalus/>
- Young, K. (2004). *Internet addiction: Evaluation and treatment*. Retrieved May 3, 2004, from [http://www.studentbmj.com/back\\_issues/1099/editorials/351.html](http://www.studentbmj.com/back_issues/1099/editorials/351.html)