LEARNING STRATEGIES IN PLAY DURING BASIC TRAINING FOR MEDAL OF HONOR AND CALL OF DUTY VIDEO GAMES

Yadi Ziaeehezarjeribi

Submitted to the faculty of the University Graduate School

in partial fulfillment of the requirements

for the degree

Doctor of Philosophy

in the Department of Instructional System Technology

in the Indiana University School of Education,

Indiana University

October 2010

Accepted by the Graduate Faculty, Indiana University,
in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

Doctoral Committee

_____

Committee Chair: Curtis J. Bonk, Ph.D., IST.

_____

Director of Dissertation: Robert L. Appelman, Ph.D., IST

_____

Thom Gillespie, Ph.D., South University

_____

Lee Sheldon, MFA., Telecommunications

Dissertation Defense Date: October , 2010

Dedication and Acknowledgements

This dissertation is dedicated to my brother Morteza and my sister Miriam Ziaeehezarjeribi. My brother and sister's childhood memories gave me the strength to accomplish my goal of completing my doctorate and a new appreciation for the meaning and importance of life. They were very young when they passed away. I did not have a chance to see them over thirty years before departing this world. Their memories live forever. I owe many thanks to my family, brother, and sisters, especially to my mother and father who believed in me even when I struggled.

My many thanks and appreciation to Dr. Robert Appelman (aka Dr. Bob), Clinical Professor, and Director of Technology at the Department of Instructional Systems Technology, Indiana University who was my advisor throughout my entire graduate program. As my mentor, he continued working with me throughout the time until the completion of this research and the finalization of my dissertation. Dr. Appelman is the reason I hold an advanced degree. He believed in me, continued working with me unconditionally, and provided me with all the necessary technological and pedagogical skills to fulfill my graduate program. Additionally, he always welcomed me to his home for occasional lounging. His lovely wife, Rebecca Appelman (aka Becky/my adopted sister) made me feel like at home and made me an honorary Hoosier. I will never forget her kindness and Hoosier hospitality.

I am obliged as well to Dr. Curtis J. Bonk (aka Dr. Jay), Professor in the Department of Instructional Systems Technology, Indiana University, overseeing my progress. I am grateful for his untiring support and mentorship which gave a new life to my education. His timely advice made it possible for me to complete my degree from a distance. Dr. Bonk is another person who

helped me attain an advanced degree. His courses were very challenging, but he made me a better writer and showed me how to multitask in 100 plus different ways. Dr. Jay is very generous and known for his hospitality. He often invited his students and colleagues to his home for intellectual discussion and occasional sports events.

The inspiration for doing video game research came from Dr. Thomas Gillespie the founder and ***Director, of the Masters in Immersive Mediated Environments (MIME) at Indiana University, currently Associate Professor, Department of Information Technology, South University***. Dr. Gillespie encouraged me to join several other Video Game player "geeks" to attend the Game Developer Conference in San Jose, California in 1992. The Game Developer Conference experience and along with the advanced degree program at the Instructional Systems Technology Department, Indiana University influenced my research greatly. Thom has been a great mentor and a friend. He was an inspiring and motivating individual who helped me develop my individual identity and become a free thinker.

I was also very excited to have Professor Lee Sheldon, Associate Professor, ***Master's in Immersive Mediated Environments (MIME) at Indiana University, who at the time was an Associate Professor, Department of Information Technology***, is currently in the Department of Language, Literature and Communication, Co-Director Games and Simulation Arts and Sciences, Rensselaer Polytechnic Institute. He was very kind to accept my invitation to join my dissertation committees. Lee's experience with video games and Non-Fiction character-driven storytelling, Television and Films has given my dissertation and research a new life. His expertise with the gaming industry provided me an inside scoop and the necessary lingo to make my dissertation worthy of reading.

The members of my dissertation committee, Robert Appelman, Curtis Bonk, Thomas Gillespie, and Lee Sheldon, have patiently and unconditionally given me their time and expertise to improve my research study and my dissertation. I thank them for their contribution and support. To the Instructional Systems Technology department, who assisted, advised, and supported my research and writing efforts over the years, I am grateful to the entire Instructional Systems Technology faculty and staff.

I am grateful to my all time favorite person, Dr. Ingrid Graves, my best friend and research partner. Ingrid never gave up on me. Without her unconditional support, I would have never finished my dissertation. Additionally, Ingrid's family shared their memories and experiences with me during many happy occasions. To Dr. Bret Smoker, M.D. (Ingrid's brother), who generously shared his home in Santa Fe, New Mexico for holidays and family gatherings. I send many thanks to Christopher Graves, Ann Klas, and Kurt Smoker, who accepted me as one of their own. Their generosity and kindness is truly humbling.

I must especially thank Dr. Hassan Danesh who has been a great friend and mentor for over twenty years. His dedication to my school and personal life is second to none. Hassan was the person who introduced me to the Instructional Systems Technology program. Without his friendship I would not have been able to maintain my sanity as I chose my graduate program.

I must acknowledge the friendship and support I received while staying in Bloomington, Indiana and Spearrfish South Dakota. I must thank my dear friends, Eva Bruce, Joey Bruce, Ted Brown, Bob Carteaux, Dennis Ellis, Robert Fischler, Susan Funke, Thomas Gabriel, Siobhan Harper, Rich Loose, Erik Novak, Dr. Devrim Ozdemir, Scott Taylor, John Wardrop, Michael Wood, Sonny, and Jamie Kirkly. I need to express my gratitude and deep appreciation to Dr. Thomas Schwen, who admitted me to the Instructional Systems Technology department and

mentored me in throughout the program. Professor Elizabeth Boling, Dr. Theodore Frick, Dr. Michael Molenda, and Dr. Charles Reigeluth consistently encouraged me to finish my degree by adding fresh perspectives to the way I looked at the field of Instructional Systems Technology.

ABSTRACT

This study, based on experiential play methodology was used to explore student engagement while playing *Medal of Honor (2002)* and *Call of Duty (2003).* It identifies some of the key issues related to the use of video games and simulations during the training phase of game play. Research into the effects of gaming in education has been extremely widely varied and limited in terms of the methodological rigor incorporated. An *Experiential Mode Framework* (EMF), a newly designed micro-analysis methodology of student engagement during game play (Appelman 2005 & 2007b), was used for data collection and analysis. This study sought to determine if there is a consistent pattern between the manner in which a *Novice* and *Expert* player engage with a particular game. This was accomplished through observation at a micro level while players learned, strategized, and performed as they entered into new gaming environments. The results of this study are limited. However, the data analysis conducted here demonstrates the player's ability to problem solve through difficult obstacles using navigational strategies in virtual spaces. It also reveals distinct player abilities to manipulate alternatives or information within the game. *Medal of Honor* and *Call of Duty* training components provided explicit instructions needed to play the game. Although results were skewed by time constraints and convenient sampling, it was found that while the game instructions were redundant, some players did not necessarily attend to spoken or written instructions which were critical components of the training session and often crucial for successful completion of milestones (objectives).

TABLE OF CONTENTS

APPENDICES

CHAPTER 1: INTRODUCTION

Video gaming is now an industry that is appealing to more than just stereotypical computer geeks (Annetta, Murray, Laird, Bohr, & Park, 2006; Graves & Ziaeehezarjeribi, 2008). The shift in the culture of video gaming has moved beyond entertainment and into gaming as a serious learning endeavor in health, science, military, and corporate training. Video games have had a major impact on the world economy (DeMaria, 2007). According to Pew's (2010) research survey, among Millennials, the only significant difference, according to age, is the number of postings to an online profile;

- More Millennials posted to an online profile in the previous 24 hours (37% vs. 26%).
- More young men than women played video games (37% vs. 18%) and watched a video online (39% vs. 26%) in the 24 hours prior to the survey.
- More women posted a message to someone's online profile (37% vs. 28%).
- There were very few differences by race and ethnicity; however, more white Millennials (61%) sent or received an email in the previous 24 hours than did blacks (47%) or Hispanics (45%). (p. 36).

Consider for a moment that more than a third of all video gaming software purchased in 2006 was intended for adults and half of the members in massively multi-player online games are now women (Simpson, 2005). Research is beginning to establish the cognitive complexity of learning to become members of a gaming community. As Bielaczyc and Collins (1999) state, learning communities develop more than just "content knowledge and skills" and deliver learning process in different ways that have all the components of *plans, goals, and assumptions.* While the understanding among most in the gaming industry is that not all games are suited for

the classroom (Aldrich, 2005), educators are now beginning to take note of the important elements of traditionally identified leisure video games which hold the potential to be carefully embedded in the classroom curriculum. Thiagarajan (2003) points out that "many people are desperately seeking research evidence to prove that training games are more effective than traditional strategies" (p. 2), and that the incorporation of games into classroom pedagogy has potential to improve instruction for students who do not learn through traditional instruction. Is this really the case? Perhaps the answer to whether training games are more effective than traditional didactic instruction can be found by examining the empirical research of a few studies and capitalizing on both the findings and limitations. For the most part, video games contain challenging educational rules with repetitive content which supports the acquisition of problem-solving through cognitive-based activities. Becker (2007) has even claimed that video games are "a new instructional technology with exciting potential."

To begin to understand what makes "gaming" compelling for educators, it is important to understand the esoteric language that surrounds descriptions of game play as well as the games themselves. A glossary of these macro descriptions is provided at the end of this study to facilitate the reader's understanding of the new and complex domain of game-based instruction/learning. Prior to this study, the micro variances between game play and the specific interactions with the attributes of a game have been lost in methodological approaches. In other words, the granularity of focus in previous studies (Barab,et.al., 2007; Hickey, Moore & Pellegrino, 200; Horwitz, Schwartz, Kindfield, Yessis, Hickey, Heidenberg, & Wolfe 1998; Macaulay, 2003; Reime & Moyer 2005; Rosas, Nussbaum, Cumsille, Marianov, Correa, Flores, Grau, Lagos, López, López, Rodriguez, & Salinas, 2003; Squire, 2004; Steinkuehler, 2004) seems to produce small results. As each player navigates through a game, a myriad of decisions

confront the player, some of which are posed by the game itself, while individual decisions are more cognitive in nature. Simply put, the player is always reacting to the components of the games. A short list of game concepts are discussed in the following sections.

ATTRIBUTES

In many video games player interface characteristics such as graphic and cinematic realism, imagination, interactivity, challenge, conflict, creativity, abstraction, music, language, and within-game structure contribute to player's engagement. Fictional and non fictional games have similarities. Important non-player controls such as sound track, background voices, cinematic themes, and narrative are generally consistent with real world situations. Historical characters may emerge at timely intervals (*Civilization III*) to both influence the aesthetic nature of game play and support the cognitive function of the player. For instance, *Medal of Honor* and *Call of Duty* contain realistic drill and practice which simulate actual training in the United States military. The commander in *MOH* and *COD* provided verbal prompts to assist the player with the nuances of using the keyboard (spacebar used to jump over fence, press [C] to crouch). Well designed drill and practice simulations use the action of the game to engage learners. According to Squire (2003)

> The strength in high-fidelity simulations lies in their ability to produce particular situations consistent with other situations in which learners are expected to participate . . . . low fidelity simulations are also used when the emphasis is on developing a conceptual understanding because they allow students to interact with complex systems while reducing or eliminating extraneous variables. (p. 5)

STRATEGIES

DeMaria (2007) notes that strategies used for "resource management, long- and short-range planning" provided players some ability to monitor the expiration of time, to achieve a quick recovery by restarting the game, or avoid elimination within the game. Video games vary in this structure of game play. Some video games are structured in an extremely linear manner which clearly moves a player through specified goals or objectives. For instance, the training portion of *Medal of Honor* and *Call of Duty* contains highly structured guidance which moves players through a training session. Even though these two games are "highly structured," this does not mean the games are sequenced in the same manner. Many games provide information or instruction to the player which affects the player's strategy. By tracking the information flow within a game, while also monitoring the player's game play, it may be possible to identify cognition through shifts in player strategy.

PLAYER EXPERIENCE

The strategies players used are dependent on prior experience with game play. *Novice* players may not be familiar with game conventions such as using the forward and backward buttons to move through the game. They tend not to notice subtle cues such as written objectives randomly displayed on the screen or may not listen to verbal instructions at the beginning of a play session. With many complex attributes in a game, *Novice* players may suffer "cognitive overload" which holds the potential to impede progress. *Expert* players are generally able to multitask and demonstrate familiarity with components of a game even if they have never played a specific video game before. *Expert* players transfer prior game experience and conventions to unfamiliar settings. According to VanDeventer and White (2002), the acquisition of expertise involves two key factors, vast knowledge of and extensive varied experience in the field. They

add, “The process of becoming an expert generally requires hundreds and usually thousands of hours of practice and study, however experts in any field share a set of common characteristics” (VanDeventer & White, 2002, p. 29). *Expert* players are comfortable and excel in their own domain, solve problems quickly with fewer errors, possess good short-term and long-term memory, have better analytical skills than their *Novice* counterparts, and have strong self-monitoring skills. *Novice* players solve problems at a very superficial level which places them at a disadvantage in an unfamiliar domain.

Learning in the context of this study, relates to that which involves the ability to obtain appropriate skills to complete a level, objective, or goal within a game, and to become more proficient over time. Reiber, Smith, and Noah (1998) claim that self-regulated learners find learning goals intrinsically motivating, are able to self-monitor, and make corrections to the learning process so learning can go on. This study poses questions related to the key aspects of players, the design of games, and the impact game play has on learning.

From a more theoretical view, noting the learning that happens within gaming and simulations is more than that which is explained through constructivist theory, Jonassen (1999) states that “the key to meaningful learning is ownership of the problem or learning goal, …[and]. must provide interesting, relevant, and engaging problems to solve” (p. 219). The unique learning that happens in simulations and games is more than easily recognizing symbols or icons (Kress, 2003), identifying with or becoming a member of a discourse community (Gee, 2003), and most certainly it is more than simply doing what works.

FIDELITY

Alexander, Brunye, Sidman, and Weil (2005) discuss three types of fidelity within a simulation and this type of video game; physical fidelity, psychological fidelity, and functional fidelity. *Physical fidelity* includes creating an environment which closely emulates "visual, auditory, vestibular, olfactory, and proprioceptive" real world conditions. *Psychological fidelity* is the degree to which the simulation replicates the psychological factors such as stress and fear experienced during landing of an aircraft or conducting surgery. *Functional fidelity* includes the realistic experiences within a game or simulation which prepares a player to function outside of the game such as learning to follow orders from a commander.

Well-structured games and simulations provide a student with a complex interface of symbolic ideas and goal directed activities. As such, this study examines the key contributing factors and strategies used by middle school students when using the basic training section of *Call of Duty* and *Medal of Honor*. In order to determine the types of learning that occur in an informal virtual gaming environment, this study was structured to answer the following research questions.

RESEARCH QUESTIONS

1. What are some key attributes in the video games *Medal of Honor* and *Call of Duty* that facilitate learning?
2. What are the key strategies players need to learn to reach the goals within the video games *Medal of Honor* and *Call of Duty*?
3. What differences between novice and expert players impact learning while playing the video games *Medal of Honor* and *Call of Duty*?

CHAPTER 2: REVIEW OF THE LITERATURE

Given current trends in gaming, Bonk and Dennen (2004) stated that widespread use, video games have become integrated, in some fashion, into school curriculums. Due to such trends are in response to the fact that schools are attempting to find avenues for the improvement of educational teaching methods, engagement, problem solving, meta-cognition, and critical thinking skills. While video games themselves may not provide all the solutions in the learning process, video games have become a tool to enhance and develop learners' ability to interact cooperatively, improve analytical skills, and provide solutions to problems. With this increasing need for performance improvement of occupational skills utilizing simple game design, educators and the gaming industry have shifted their focus to more interactive and multimodal delivery solutions. However, current solutions are based more on game-play and less on how learning takes place.

LAWS OF LEARNING

Within a learning framework, Thiagarajan (2003) discusses seven laws of learning:

1. *Law of Reinforcement*-Participants learn to repeat behaviors that are rewarded.
2. *Law of Emotional Learning*- Events that are accompanied by emotions result in long-lasting learning.
3. *Law of Active Learning*-Active responding produces more effective learning than passive listening or reading.
4. *Law of Practice and Feedback*- Learners cannot master skills without repeated practice and relevant feedback.
5. *Law of Previous Experience*-New learning should be linked to (and build upon) the experiences of the learner.

6. *Law of Individual Differences*-Different people learn in different ways.
7. *Law of Relevance*- Effective learning is relevant to the learner's life and work (p. 3).

From Thiagarajan's (2003) principles of learning it is possible to begin forming key factors and strategies which could guide researchers in their quest of video games as being a legitimate media for instructional purposes. Gee (2003) points out the potential for learners or novices, within games, to be mentored into a new affinity group through interaction and practice. Video games hold the potential to positively reinforce certain types of learning for players. Aldrich (2005) notes that some people do not necessarily learn from computer games, but instead they *"learn how to learn."* Gaming has the potential to engage with players simultaneously at both the *"intellectual and tactile level."* This multiple method of engaging students within learning situations has lead researchers to identify a new type of "subject/player" who takes gaming seriously and is willing to invest extensive hours toward improvement of skills and understanding. Schleiner (2001) claims that "within techno-culture and disseminating out across class, ethnic and geographical barriers, younger generations into their late 20s, are devoting increasing amounts of recreation time to addictive computer games" (p 221). Clearly, the ability to actively engage players in the acquisition of skills, not generally seen as academic, has the potential to inform pedagogy of the future. The need to refocus studies on gaming may need to begin with a close examination of what learning is happening during a game and which factors motivate students to return again and again despite repeated failure. The culture of gaming creates an environment where, while mistakes are a necessary component of learning, success tends to have immediate consequences.

How Video Games Facilitate Learning

Greenfield, Camaioni, Ercolani, Weiss, Lauber, and Perucchini (1994) claim frequent gaming is said to help users adjust to a computer-oriented society. Additionally, Turkle (2005) notes that,

> there is nothing mindless about mastering a video game. The games demand skills that are complex and differentiated. Some of them begin to constitute a socialization into the computer culture; you interact with a program, you learn how to learn what it can do, you get used to assimilating large amount of information about structure and strategy by interacting with a dynamic screen display (p. 67).

The mere fact that players are compelled to log extensive amount of time with one game tends to support Prensky's (2003) conjecture of "learning by doing" or Appelman's (2007) notion of "experiential learning." However, the learning games provide is not the only compelling dimension of video game play. Games can provide immediate reinforcement of correct behavior or actions. Unfortunately, playing video games is one thing; selecting an engaging video game that promotes meaningful learning is another.

Simulations have elements, which allow the learner to make costly mistakes without serious repercussions. For instance, the use of a *first person perspective* or the act of role playing seems to be key to continued engagement. Perhaps this is because students are more willing to make mistakes playing the role of characters which do not suffer repercussions of failure compared to real-life instances such as getting a poor grade or public scrutiny. Some student's hesitancy to take risks in real classroom situations may diminish as students move into a virtual learning environment (Graves, 2008). Choosing the role of a fantasy character can be empowering for the players and provide the confidence and flexibility to move beyond what a

traditional classroom would allow. As Gee (2008) notes, "good games offer players a set of challenging problems and let them practice these problems until they have routinized their mastery" (p. 1025). Gee also noted that, in games, mistakes become an integral component of learning. For instance, students who routinely forget to turn in classroom assignments or fail to engage in traditional classroom activities may experience more success within a virtual learning environment where the potential for success is based on both trial and error. In this context, mistakes (error) then become a vital component of the culture of learning.

GAMING CONVENTIONS

In action and adventure computer games, images and action tend to be more important than words. This shift increases the development of representational skills from the verbal to iconic, with players now manipulating images to create action in the game mechanics and conventions to achieve specific goals. In this manner, players develop the spatial awareness and the cognitive skills which are crucial to many computer applications and real world scenarios. For instance, some games foster strategic thinking, multitasking, and social competence; which are valued skills in a workforce both present and future. Learners growing up in the digital age (digital natives) are far more experienced and able to process information rapidly than were their predecessors (digital immigrants), and may become bored if they are expected to remain sedentary and non-participative at school (Mumtaz, 2001; Prensky, 2001). Prensky (2001) expands on this by explaining how brain structures and thinking patterns have significantly changed as a result of digital technology.

Teachers can increase their additional pedagogical options by looking at the modeling of actions and strategies within games as well as the types of learning required for students in this new era of experiential trial and error learning. Perhaps the instant feedback and problem solving

found in video games allows students to stay focused, bolstering participation. Perhaps what compels people to play video games is that video games can be used differently by different people. Clearly video games can provide "communities of practice" where groups of people share expertise and passion within socially constructed learning (Lave & Wenger, 1991). Game players, as a community, interact with each other and improve their abilities through collaboration and teamwork. At the very least, games and simulations must be as successful as traditional classroom activities to become viable alternatives to classroom instruction. According to Annetta, Murray, Laird, Bohr, and Park (2006) in 2002, the *serious games* "movement prompted partnerships among educators, the military, corporations, medical fields, and video game designers. This movement embraces the power of video games to attract, engage, connect, and teach game players critical content in the games' respective focus area" (p. 16). Noting the crucial learning which occurs during video game play, researchers are beginning to understand how elements of educational games, can be carefully embedded in classroom curriculum. For instance, an eighth grade English teacher, Brock Dubbles, has been using video games for over five years to teach literary elements to urban students (DeRusha, 2006). Here the game can be used as a method for collaboration and reflection in the face-to-face classroom. How does one transition from old epistemology to a new integrated learning context?

According to Jenkins (2009), "augmented-reality games represent one potential application of distributed intelligence to the learning process . . . . A classroom designed to foster distributed cognition encourages students to participate with a range of people, artifacts, and devices" (pp. 69-70). From a "distributed cognition" perspective, new learning may lie with games which the private sector has already developed. Rieber and Noah (1997) comment that online games are now featuring environments that are robust enough to support many types of

learning. For instance, many popular games such as *Call of Duty* and *Medal of Honor* employ multimodalities. In the training portion of both of the games, learning is facilitated through clearly defined objectives which are listed on the screen and highlighted as the objectives are accomplished. These instructions are contextually supported through the voices of the military training commanders. The educator of tomorrow will think to integrate games and simulations from the beginning. Barab, Dodge, Tuzun, Job-Sluder, Jackson, Arici, Job-Sluder, Carteaux, Gilbertson, and Heiselt (2007) have created a virtual environment named *Quest Atlantis* which has effectively integrated itself into many schools across the globe. While becoming part of the *Quest Atlantis* community requires additional support and time from teachers, in order for some students to receive meaningful engagement in a virtual space.

Historical Perspective of Research on Simulations and Games in K-12

Research into the effects of gaming in education has been increased in the past several years. While even large-scale interventions seem to produce small results (Barab, et.al., 2007; Hickey, Moore & Pellegrino, 2001; Horwitz, Schwartz, Kindfield, Yessis, Hickey, Heidenberg, & Wolfe 1998;; Macaulay, 2003; Reime & Moyer 2005; Rosas, Nussbaum, Cumsille, Marianov, Correa, Flores, Grau, Lagos, López, López, Rodriguez, & Salinas, 2003; Squire, 2004, Steinkuehler, 2004) Thiagarajan (2003) points out "many people are desperately seeking research evidence to prove that training games are more effective than traditional strategies" (p.2) because traditional learning contexts do not necessarily engage contemporary students (Annetta, et.al., 2006)). So what evidence is currently available to support the use of video games in traditional school settings? While only a few research projects that are grounded in rigorous methodology have been implemented, the results of these are inconclusive. More

rigorous micro-analysis methodologies and protocols can help to overcome some of the obstacles or uncertainties in these studies and add finer granularity to observational data.

Although the potential for successful integration of simulation and games into the classroom has been established, scant empirical research has been conducted that clearly measures the potential for long-term learning. Eight examples of the use of technology will be highlighted below that show learning outcomes in math, reading, social studies, and even genetics. In some cases, the notion of simulations or games has been stretched to its limit, but the decision to include them came from their diversity of research agendas and methodologies.

INTERACTIVE MULTIMEDIA

Macaulay (2003) investigated the effects of multimedia[1] on the learning performance of non-English speaking "third world children." Performance scores of 36 (f=20, m=16) five-six year olds were recorded before and after using multimedia or no multimedia. Nonparametric testing[2] was used to compare groups. The students who used multimedia scored significantly higher on math than their peers. Macaulay (2003) found that a "heightened state of interest was more pronounced in the multimedia group" (p. 192). In this case, if independent and dependent variables such as culture had been taken into consideration, the author felt this study may have provided useful answers to the connection between culture and the effectiveness of multimedia/simulated learning. Continuing on with studies in developing countries, the next study builds a stronger case for supplemented instruction using a larger pool of students.

---

[1] Learning applications were designed to integrate sound, text, images and animation teaching adding and subtracting. Difference between experiment and control group was the multimedia not the content.

[2] Wilcox on Matched Pairs Test

HANDHELD OR PORTABLE DEVICES

Rosas, et.al. (2003) employed GameBoy™ as their educational medium. Five games[3] were designed by the researchers to align with the first and second year curriculum. Using pre and post-testing, positive results were found with respect to increased math, spelling, and reading comprehension. Important for my study was the fact that Rosas, et. al (2003) found gaming had a longer impact on students' preference for gaming over other classroom activities. In other words, students in Rosas study would rather play video games than do class work. Rosas et al. (2003) conducted research using both quantitative and qualitative methods to evaluate the effectiveness of video games and simulations on discrete learning outcomes, and they attempted to control for variables through both external and internal validity measures and triangulation. Employing contemporary approaches to formal program evaluations, they determined academic improvement for low income (SES) students who played the video games.

Using a sample of 1,274 students, from economically disadvantaged schools in Chile, Rosas et. al. (2003) targeted discrete mathematical and reading skills. Students were supplied with handheld "Game Boy" devices and allowed to engage with the technology for at least 20-40 minutes each day. Participants consisted of first and second grade elementary students, 30 school teachers and directors of 6 schools in Santiago de Chile. Three of the schools were located in an urban area and three in rural. In 2002, the sites were selected from schools participating in a government reform program for low achieving students. Schools were paired according to similar indicators, General Educational Achievement[4], SES, Rural or Urban, and Level of

---

[3] *Magalú, Hermes, Tiki-Tiki, Roli, Hangman*

[4] Measured through a nation achievement test entitled SIMCE.

Vulnerability[5]. Students were divided by groups and randomly placed in an experimental group (EG) or an internal group/control group (IC). Students in the same type of school at the same educational level were put in an external control group[6] (EC). This study showed an unexpected variable of increased attendance. The researchers had difficulty deciding whether the increase in school performance was due to the use of *GameBoy* or the fact that the *GameBoy* was used as an extrinsic motivation for increased attendance. The next study will discuss Web-based manipulatives.

VIRTUAL MANIPULATIVES

An example of the positive effects of simulations in a third grade classroom can be found in a study conducted by Reimer and Moyer (2005). This Web-based program[7] intervention employed virtual manipulatives[8] to support understanding of fractions in the regular classroom. This two-week project was conducted in a school with a diverse student population[9]. Pre and post testing measured the conceptual knowledge using a paired t-test. Using the pre and post-tests, an attitude survey, and interview data, the researchers found that over half of the students showed "significant" gains with a relatively small sample size (n=19). The virtual manipulatives supported completion of classroom assignments and provided immediate feedback.

According to the students who participated in this study, virtual manipulatives were faster and easier to use than paper and pencil. Additionally, attitude questionnaires revealed students

---

[5] Measured by the Ministry of Education of Chile

[6] Groups in the different schools where the GameBoy devices were not introduced

[7] Dynamic visual applet designed to express abstract concepts.
http://nlvm.usu.edu/en/nav/frames_asid_102_g_1_t_1.html

[8] National Library of Manipulatives http://matti.usu.edu

[9] Caucasian, Hispanic, African American, Asian and Middle Eastern

enjoyed learning mathematics on the computer more than the regular classroom activities. Advantages resided with the ability of students to move at an individual pace. Based on reported results, this Web-based virtual manipulative improved the scores for over half of the students on conceptual knowledge. Four students showed no changes and five scores decreased. Although this study had a low sample size, was limited in scope and cannot be generalized, it is an example of positive introduction of simulations into the classroom. If this study were to be continued, significant enhancement of methodology would need to be implemented. Inclusion of more classrooms and a control group, would have added to the validity of the study. There was also concern that two weeks was not long enough to measure the effects of a change in learning.

Horwitz, Schwartz, Kindfield, Yessis, Hickey, Heidenberg, and Wolfe (1998) studied the effects of the implementation of *GenScope*™ into molecular biology and population genetics units in both urban and suburban high schools in two different regions of the United States. Among the 27 classrooms[10] (n=428), modest gains were realized with the implementation. Many gains had validity issues because the *GenScope*™ implementation team made adjustments to materials. These problems seemed to have been alleviated in a follow-up study conducted by Hickey, Kindfield, Horwitz, and Christie (2000) in secondary science classrooms. This follow-up study in three more classrooms yielded dramatic reasoning gains they had been seeking by addressing issues found in prior *GenScope*™ project (Horwitz et.al., 1998). These issues were facilitated by supplying students with new laptops establishing valid comparison classrooms, refinement of the *GenScope*™ curriculum, and refining formative and summative assessments

[10] 24 classrooms were GenScope; 2 classrooms were used as comparisons non GenScope.

with familiar icons[11] to scaffold reasoning into summative assessments. Although reasoning gains were found, more work is needed to establish realistic implementation guidelines.

Continuing on with simulations, Hickey, Moore, and Pellegrino (2001) conducted a large scale study in 5th grade classrooms using grants from the American Educational Research Association underwritten by the National Science Foundation and the National Center for Educational Statistics. The math curriculum was designed by the *National Council of Teachers of Mathematics* (NCTM) in 1998. *Jasper* was designed to give students the opportunity to explore a variety of mathematical activities that would increase the students' higher order thinking.

In this study, Hickey et al. (2001) used *The Adventures of Jasper Woodbury*[12] to supplement math based problem solving in the curriculum. They sought to measure the motivational experiences, motivational beliefs, and mathematical achievement scores on the Iowa Test of Basic Skills (ITBS). Additionally they looked for comparative results between High and Low SES classrooms for 328 students. Four way ANOVAs were used to compare *Jasper* groups to comparison groups measuring improvement on motivation and mathematical achievement. Math scores between 3rd and 5th grade were unstable. Higher scores were reported from the Low SES control relative to the Low SES Jasper School showing negative impact using the *Jasper* program. Although this study was comprehensive and allowed for multiple variables,

---

[11] GenScope dragons were used to simulate genetic conditions.

[12] Excerpt from *The Adventures of Jasper Woodbury* website, "The Jasper laserdisc adventures are unique in that they present a believable story that has interesting characters, a complex and important challenge, and extensions to a variety of curricular areas. To solve the challenge, the students use problem-solving skills, mathematics concepts and skills, and the laserdisc to find information that was presented as part of the story. The laserdisc provides instant access to any part of the story and perfect image clarity when an image is frozen on the screen." http://peabody.vanderbilt.edu:16080/projects/funded/jasper/intro/Jasperintro.html

there are few relevant findings here related to the actual impact on the students from the use of this program. According to Bransford (2006), the research team did find the need to move away from a linear model to a more interactive non-linear model and from simpler to smarter activities that simulate real life situations.

The most closely aligned studies which specifically target the learning which occurs during the use of video gaming are four studies conducted by Barab et. al. (2007), Squire (2004), Steinkuehler (2004), and Swan (2008). Squire's (2004) initial work involved integrating *Civilization III* as the basis for examination of two design experiments used to support a unit on world history. Case studies were conducted on 33 students ranging in grades from 6 to 9, both male and female. The researcher used qualitative and design methodologies to examine the "intersection between gaming practices and the culture of formal schooling" (p. 97). Most useful for this analysis were the relationship of games in formal learning environments and the effects of games on learning. According to Squire (2003):

> the importance of how games fit within the overall educational environment: how and why you play a game, who you are and who you hope to become, and how playing the game allows you to participate in social practices. When games are used in the military, they are not used in isolation from other learning activities; recruits go through boot camp, where they are exposed to military values and become soldiers. Games are used in conjunction with real-world simulations (like rifle ranges). Learning is guided by more experienced members of the military community, and the meaning of these activities is negotiated through social interactions (p. 9).

Additionally, the conceptual understanding which emerged as each student interacted with *Civilization III,* affected the manner in which students interpreted historical events. Squire (2004) suggests the use of simulation games in history education can be beneficial, keeping in

mind the unsolved challenges of integrating complex problem-solving in games and provide scaffolding based on the student's progress through *CIV III* within the classroom. He also provides an example of a naturalistic way of conducting rigorous research.

Of interest is also extensive work conducted by Steinkuehler (2004, 2005, 2006) and Steinkuehler, Black, and Clinton (2005) where she and her colleagues examined the type of learning found within massively multiplayer online games (MMOG). Her work shows that players learn with, and rely primarily on, the mentoring of others. Texts and manuals play a backup role only as players run into problems. Thus the text then becomes an "as needed support" not a preliminary knowledge base. She notes that, "gamers transform design curiosities into empirical questions by collecting data (in spreadsheets), building mathematical models based on that data, and then placing those models in competition with one another to see which can most accurately predict (read: exploit) the system (i.e. minimizing)" (p. 7). Steinkuehler also notes that players within MMOG's are routinely working "at the edge of their ability and stay engaged for extended periods of time". This need to be within or at the "edge of ability" may be in direct alignment with a student's "zone of proximal development" (Vygotsky, 1978) which is the cognitive distance between a child's "actual development level as determined by independent problem solving and the level of potential development as determined through problem solving under the direct guidance or in collaboration with more capable peers" (p.86). In a video game, conventions may serve as "more capable peers." Vygotsky (1978) also notes that "every imaginary situation contains rules in a concealed form. We have also determined the reverse-that every game with rules contains an imaginary situation in a concealed form" (p. 86). Game conventions may facilitate this progression.

In work directly aligned to classroom content, Barab et al. (2007) designed and implemented an integrated game in a 3D multi-user virtual environment called *Quest Atlantis (*QA), which specifically allows players to navigate through worlds that contextually align with quests. Much like online (MMO) and Wii games, in Quest Atlantis, students choose an identity and engage in a series of quests intended to teach content such as environmental science, water quality, global awareness, issues around diversity, as well as civics to name only a few. Preliminary results show sustained engagement in multiple fifth grade contexts. Results from Barab, et al. (2007) demonstrated that students made personal connections to characters in the story, which linked science concepts to that which were occurring in the real world. Students were expected to collect data, submit reports, and create graphs, with teacher support and encouragement, to "carefully examine their solutions from multiple vantage points." While the students demonstrated the ability to engage in "high quality socio-scientific reasoning," Barab, et. al. (2007) also noted that students demonstrated "episodes of flawed reasoning" and "inconsistency between evidence-based conclusions and proposed solutions" (p. 74). While "flawed reasoning" should not be the goal of a learning situation, misconceptions during the learning process may precipitate on-demand formative feedback.

The academic gains found in this study were directly related to the inclusion of *Quest Atlantis* into the curriculum. With evidence that *Quest Atlantis* (Barab, et. al., 2007) can increase student understanding in science, social studies, and reading, teachers should also understand that the inscription and inquiry model embedded in *Quest Atlantis* also allowed students to become fully immersed in an interactive environment. Academic gains may be linked to the factor of engagement, which may not necessarily occur through the use of "traditional word problems." Increases in students scores is a compelling reason to include multimodalities in the

curriculum. However this posits the question regarding what evidence there is for the use of video games that have not necessarily been designed to support education? Even though this study shows some gains in student's individual activities in the classroom, findings cannot be generalized beyond the narrow population of the "gifted students" who participated in the study. While Barab's et. al. (2007) research contributes an innovative approach to a discovery of methodology in a multidisciplinary community; his framework did not include the needed foundation to sufficiently answer the research questions of the present study.

At this juncture, there is a need to return to theoretical works which help to answer the research questions of the present study. Swan (2008) served the purpose of shifting the learning paradigm from simple cause and effect to an organic paradigm with a "consistent connection of game components with the player as (an) agent" (p. 192). He recognized the player as an active participant in a "portable chain of events; the ability to select or plan an appropriate course of action and the ability to effectively carry out the course of action" (p. 193). Swan (2008) also noted that players "need knowledge, experience, sound judgment, creativity, and performance ability" to successfully participate in a video game. Moreover, Swan (2008) established the organic nature of learning when he states, "The living agent is not just a constructor of knowledge nor is the agent . . . the agent is a co-creator of a reality" (p. 194).

Critique of Methodology from Studies on Gaming and Simulations

There has been an increase in simulation/gaming in both school and home environments. Simulations can help learners understand how to run a business, build a town, create an empire, or fly an airplane. In order to successfully measure the type of learning which occurs in simulations and games, the methodology should incorporate both quantitative and ethnographic data. For instance, Squire (2006) and Steinkuehler (2006) employed ethnographic methodology

to substantiate claims with measures that allowed the researchers to control for outside influences or at the very least explain them.

Results from one study build on the next, while mistakes seem to be alleviated if one learns to effectively *plan* sound methodologies, assessments, and data analysis. For instance, Hickey et al. (2001) modified and added instruments to allow for multiple variables found during the study[13]. While longitudinal studies provide clearer and more rigorous results, they require a significant investment of time and, in most cases, funding. Moreover, the design of the games and simulations were closely *aligned* with curricular activities or standards. Allowing the data to determine real improvement required the *measurement of discrete skills*, such as performance on formative or summative assessments in math and science. Confounding the Rosas et al. (2003) study was the unexpected variable of increased attendance. The researchers had difficulty deciding whether the increase in school performance was due to the use of *GameBoy* or the fact that the *GameBoy* was used as an extrinsic motivation for increased attendance.

Alternatively, using the Experiential Mode Framework (Appelman, 2007) which utilizes a micro-level data analysis of game play action, one is more likely to produce more accurate answers to research questions in terms of quality and scope. In addition, these studies encouraged the author to examine the underlying issues assumed by the use of both qualitative and quantitative designs. The use of interdisciplinary endeavors seems to be at the heart of most of the successful studies (Hickey, 2000, Hickey, 2001; Horowitz, 2000; Rosas, 2003; Squire, 2004). Successful integration into the K-12 setting may depend on the specific academic needs of a

[13] The authors found that during the implementation period some teachers were following *Jasper*™ instructions and curriculum more closely than others. Although this should have been expected, the research team made a conscious decision to be up front about this variable and include this in the data analysis.

particular population. According to Annetta, et.al., (2006) using technology for the "Net Generation" is a common practice in everyday life, however the use of technology in "The K-12 arena in particular-often lacking the technology that students expect in the classroom-has faced an uphill battle to engage these students" (p. 16). Presently, urban and "at risk" students in the United States and "third world" countries seem to benefit the most from the introduction of games and simulations into learning, although gains were realized in one high SES setting (Squire, 2004). Specific types of populations realized academic gains because the video games introduced in the studies were an alternative to traditional didactic instruction.

According to Barab, Warren, and Ingram-Goble (2006) many schools are still looking for results that will have direct impact on federal mandates but not on the degree of affective culture found in the pedagogy of schools. While notions of the efficacy found in the play of some games is informative, seldom does having fun playing games motivate a principal to incorporate a game into a curriculum. However, some effects of whether the learners feel in command, whether they find the training to be helpful and easy to learn, and whether they feel the time they spent for basic training supports their tasks does impact the manner in which future teaching should be conducted. As such, careful methodology and procedures should help to overcome some of the obstacles or uncertainties research has experienced to date. Because only a few sound research projects have been implemented, results are inconclusive. Given the current situation in research, there is only a limited amount of evidence that games and simulations can have effects in classroom learning.

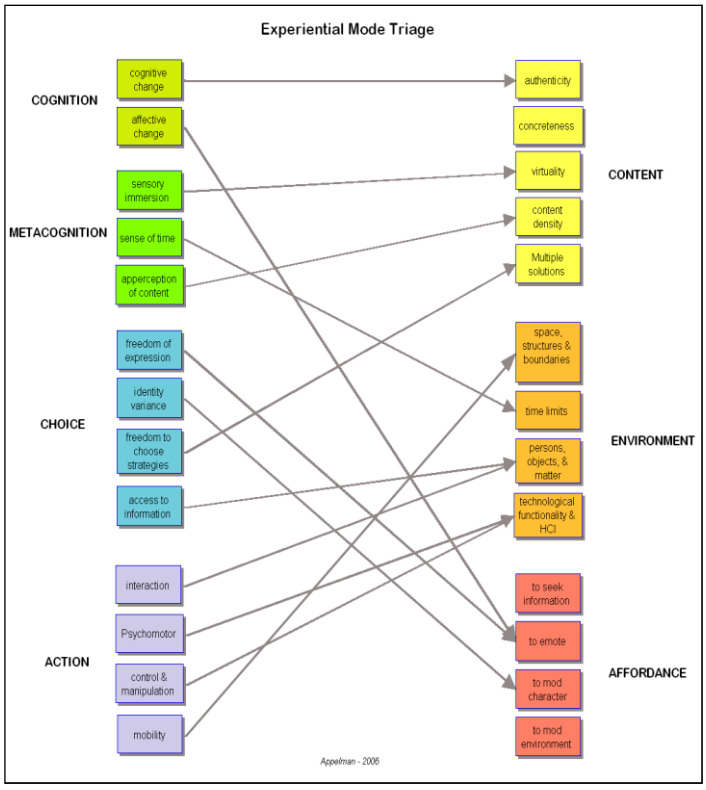
EXPERIENTIAL MODE FRAMEWORK

While some of the research into games and simulations is based on well-established methodology, Swan's (2008) study suggested the need to integrate a qualitative component into

the methodological paradigm of this study. Adding the qualitative component allows the methodology to take into account aspects such as the player strategies and metacognition, while the observation techniques allow for quantitative measures such as player task, learning objectives, or content density. Therefore, the Experiential Mode Framework (EMF) (Appelman, 2007; Kolb & Fry, 1975), where the player is at the center of agency, decisions, and cause and effect, emerged as a methodology that would most likely answer the research questions of this study. In the EMF, Appelman (2007) uses four categories of player experience; (1) *cognition, (2) metacognition, (3) choice,* and (4) *action* which interact with three categories of game structure; *content, environment,* and *affordances* (See Figure 2.0 for one possible set of interactions)

Figure 2.0 Experiential Mode Framework (EMF) (Appelman, 2007)

Player experience(PX) Game Structure (GS)



Methodology incorporating the Experiential Mode Framework (Table 2.0) uses a four-phase model, which is predicated on a thorough *preplay analysis* of both the player and the game. In the second phase of this model, qualitative and quantitative data are collected. After the *data capture* phase, *game play analysis* is intended to disclose gaming patterns that identify the "complex blending of player skill, chosen strategies, entwined with the affordance of the game environment itself" (p. 4).

Table 2.1. Experiential Mode Framework Methodology (Appelman, 2007)

Preplay Analysis	Analysis of both the player and video game Gather demographic data on player Choose an appropriate game for study
Data Capture	Game play action is video recorded Post game interviews Observation
Game Play Data Analysis	Descriptive, pattern, and ethnographic analysis
Summative Conclusions	Use the patterns identified in data analysis to answer research questions.

The EMF Methodology is integrated with Yin's Case Based Methodology (Appelman, 2007; Yin, 1994) and is more likely to "reveal mental states, along with the choices and actions the player perceives to have, and then couple these to the content and affordance within the environment of the game structure, (and thus) a strategy for game analysis methodology can be defined through this lens" (p. 4).

A condition of engaging in EMF methodology hinges first on a *pre-play analysis* of both the player and the games. Within this framework, the research must first begin by assessing a

game based on the proposed research questions, and a thorough analysis of games, which are used.

Criteria for Selecting the Appropriate Video Game

Focusing back on answering the research questions, it was determined that Elaboration Theory (Reigeluth, Merrill, Wilson, & Spiller, 1980) provided a foundation for the selection of a game. Table 2 describes those conditions used to provide a "holistic alternative" for selection of the two games in this study.

Table 2. 2. Reigeluth's Elaboration Theory (Becker, 2007)

Elaborative Sequence	The game contains tasks which move learner from simple-to-complex, general to detailed that are applied under different conditions based on theoretical, procedural, and conceptual frameworks. This transfer of knowledge is essential before the true "game" begins.
Learning Prerequisite Sequences	Within the game, the player must attain mastery of basic skills prior to engaging in play. The game should group cognitive strategies in a manner, which allows the player capacity to attain a set group of mastery of skills at increasingly more complex levels.
Summarizers	Well-designed games allow the player to focus on a single lesson along with a display of progress. The player learns to engage in metacognitive awareness by focusing on progress of both micro and macro level components.
Synthesis	The player builds on knowledge from engagement in a specific game structure. Often the game embeds repeated practice in order to become proficient with a skill needed to be competitive or progress at higher levels of the game.
Analogies	A well-designed game contains approaches or tactics similar to other games thus allowing the player to transfer understanding of the game structure from one context to the next.
Cognitive Strategies Activators	A well-designed game requires that a player must learn to solve a condition for success.

Learner Control	A well-designed game contains instructional components, which provide players with options from which to choose. Player experience entails numerous options in order to provide a seemingly individualized experience.

For instance, Reigeluth (1999) explains that one of the components of a well-designed game is based on "the simplifying conditions method (SCM) sequencing strategy [which] enables learners to understand the tasks holistically and to acquire the skills of an expert for a real-world task from the very first lesson" (p. 433). While these seven principals provide the foundation for a well-designed game, Merrill (2002) suggests that most effective learning situation takes place when learners engaged in task-based activities, which concur with many current instructional models. Merrill's First Principles of Instruction (Table 2.3) had to be an additional consideration in examining various aspects of the research questions and developed a holistic view of interpretation during *pre-play analysis.*

Table 2.3. Merrill's (2002, pp. 43-59) Five Principles of Instruction

Demonstration Principle	Learning is promoted when learners observe a demonstration.
Application Principle	Learning is promoted when learners apply the new knowledge.
Task-Centered Principle	Learning is promoted when learners engage in a task-centered instructional strategy.
Activation Principle	Learning is promoted when learners activate relevant prior knowledge or experience.
Integration Principle	Learning is promoted when learners integrate their new knowledge into their everyday world.

Appelman (2007) further emphasizes that during the *Preplay Analysis* phase using the EMF methodology, game selection involves the examination of three primary categories of game structure. They are content, environment, and affordances (Table 2.4.).

Table 2.4. Attributes of Game Structure (Appelman, 2007, p. 4)

Content	The game's story; the context and the amount of information available within the game and the degree of abstraction of the content, authenticity, and variation
Environment	Virtual spaces and boundaries; the objects, functionality, capabilities, and time (second) limits imposed by the game
Affordances	Abilities made available within the game for the player to change, manipulate, and seek alternative information

While examining the *content* of a video game for inclusion in a research project, attention should be given to the type of back-story and quality of media provided to the player. According to Paddock (2010), "One of the areas where *Medal of Honor* (*MOH*) has always excelled is in story and creative game play." In addition to a compelling back-story and graphic design, the *environment* and *affordances* found in *MOH* contained maps, which could be used for "cooperative, combat or objective-based games." *MOH* was especially compelling for this study because the weapons available are true to the munitions found in any soldier's hands during The War, and you have everything from grenades and pistols to large rifles and even mounted machine guns! . . . A strong H.U.D (heads up display) helps to increase playability, and a compass system for objectives prevents screen clutter. As new objectives are added to your list, a set of points appear on the compass, and you'll see both the direction you need to move in and

your distance from the objective, as tracked by how far apart the two points are on the edge of the compass. (Paddock, 2010[Website])

Using Merrill's Principals of Instruction (2002), Reigeluth's Elaboration Theory (Reigeluth, et.al., 1980), Yin's Case Based Methodology (1994), and Appelman's Experiential Mode Framework (2007), the training sessions found in *Medal of Honor* and *Call of Duty* emerged as learning environments which met the criteria for this study. While the high quality graphics and story line were important, the multimodal nature of the training sessions simulated real-world combat training helped player's cognitive and problem-solving skills. Furthermore, the context included auditory instruction and written objectives and feedback from Training Instructors with a compass provided alternative tools to navigate the unfamiliar terrain of the video game.

The basic training sessions prior to "play" systematically prepared the players to practice and attain skills needed to successfully engage in the "missions." For instance, *Medal of Honor* and *Call of Duty* training required players to become familiar with the use of visual and aural cues (compass, list of objectives, course map) and listening skills by responding to oral instructions from the drill instructor and comments from other "soldiers." The training session included "task-centered" learning, which required that the player transfer abilities and skills from the training into the combat situation. Furthermore, these two games are particularly suited for this study because *Medal of Honor* and *Call of Duty* contain all seven essential characteristics of elaboration theory have nearly identical content and objectives (See Table 2.2).

Medal of Honor and *Call of Duty* have identifiable instructional elements for learning complex cognitive tasks which guide the players sequentially to finish each objective before moving on to the next. As Reigeluth (1999) emphasized, "since the learners start with a real

version of the task from the beginning, this method (the elaboration theory) is ideally suited to situated learning, problem-based learning, computer-based simulations, and on-the-job training" (p. 433). It is also expected that the player will do more than simply follow instructions. *Call of Duty* and *Medal of Honor* (see Appendix B) video games have the potential to allow students to describe individual meta-cognitive skills, strategic thinking, analytical interpretation, problem solving, and adaptation to new learning environments. Additionally these two games contain result oriented environments that are challenging, but have the potential to engage player for an extended time, connect to the game information and instruction through experiential learning in a multitask environment.

Examination of Learning in Digital Learning Context

As educators examine the use of digital learning contexts, prior learner experience must be taken into account. According to the Pew (2010) research survey, "three-quarters of Millennials have created a profile on a social networking site, compared with half of Xers, 30% of Boomers and 6% of Silents. There are big generation gaps, as well, in using wireless technology, playing video games and posting self-created videos online." As education policy and theory continues to shift instructional paradigms, and incorporate new pedagogy into classrooms, video game designers and instructional designers should take into account that many students respond more positively to cognitively challenging environments. When classroom activities do not provide challenging and entertaining conditions for learning, educators may continue to struggle to engage a number of students who have high expectations of their media in all settings. As one of the participants in this study commented, "when a story line is lame, you get really bored and I don't want to spending any time with it." If educators seek to enhance academic learning through the use of video games, five attributes of the game: content, the

required task, the affordances within the game, the cognitive engagement of the player, and the game environment (see Figure 5.1) need to be considered when employing the use of video games to support learning.

Using high expectations associated with learning objectives and goals may encourage student learning approximations with corrective, positive feedback. This study extends the expectations and responsive elements found in Cambourne's (Yellin, Blake, & Devries, 2008) learning model. Therefore, a teacher will need to be able to assess learning to determine if the gaming simulation or experience is accomplishing class learning objectives/goals, so the teacher can provide corrective, encouraging feedback. The automaticity of gaming may allow corrective feedback with encouragement directed toward and individualized learning situation for the student. In this situation, the teacher is as a facilitator, mentor who can provide feedback through a game or simulation.

The second part of Cambourne's (1988) learning theory student responsibilities, correspond directly with the remaining three critical elements for integrating video gaming in the classroom. According to Cambourne's learning theory, students bring *employment*, *responsibility*, and *approximation* to the learning task in a classroom. Students have the *responsibility* to commit (i.e., *employ themselves*) to the learning as they are provided opportunities to learn. A student has the ultimate decision to take *responsibility* for learning by choosing to spend the required time and energy to engage in learning difficult assignments. *Approximation* describes the process students must be willing to take risk in exhibiting current understanding of a content concept or skill. Nine requirements surface from this literature review that aid learning in a digital context.

1. **Full Participation.**

Video games should allow students to interact, design, and become a full participant in experiential learning not simply take on the perspective of a voyeur. For instance, a student should be able to appreciate historical events from the perspective of all sides, identify geography or understand how to multiply fractions using real scenarios. In a more advanced situation, students should be able to simulate occupations or incorporate the knowledge base required to effectively participate in a profession and transfer that experience into a real world situation.

2. **Multiple Avenues for Learning.**

Using Cambourne (1988) as a foundation for engaging instruction, classrooms should include numerous and varied opportunities to learn a new skill or content concept. Video games should provide for multiple entry points based on a student's knowledge in both content and ability to take advantage of aspects of the game. With the incorporation of multiple outcomes, students learn to solve problems based on their unique knowledge base and understand concepts such as cause and effect. For instance, if a farmer over fertilizes a field, inhabitants of environments downstream will be affected.

3. **Compelling story line and more quests.**

Video games should contain compelling story lines with fully developed characters, which provide entertaining conditions for learning that match or exceed those of media available to the student. For example, World of War Craft is an ideal collaborative learning environment with multiple quests where players share ideas and belong to a community who reflect on some of the common goals such as; frustrations, emotions and celebration of success at the same time. Organic distribution (collaboration) players working together to learn the game, like a virus, the sum of the group's endeavor is greater than simply working together. Each player may have a

unique set of skills which used in collaboration with others in the group creates an exponential trajectory of learning/understanding.

4. **Propel Students Toward Inquiry and Discovery/Experiential Learning.**

Video games should be able to expose students to understanding which is based on experience (play) to provide an opportunity to become "experts" with a discipline through the use of realistic contexts that facilitate inquiry and exploration (Kebritchi & Hirumi 2008). Additionally, strategically placed video- gaming in the classroom allows students to make approximations of their best learning at the time of assessment. Gaming furnishes learning environments allowing discovery of new worlds, skills, and concepts. *Novice* players may need more time (minutes and hours) and opportunities (practice) to successfully learn a gaming convention such as navigation through the use of keystrokes. A thoughtful game design should anticipate the player's need for more time (hours) to process both the written and the oral instructions on the screen. More time may be necessary due to the myriad game tasks required to be executed within the game environment such that most *Novice* players cannot predict or anticipate these tasks due to the lack of prior experience and lack of familiarity with game conventions.

5. **Provide Appropriate Levels of Challenge**.

Video games should be differentiated in a way that allows students to perform and interact on the "edge of ability" (Steinkuelher & Chmiel, 2006) and stay engaged for extended periods of time (hours) to become increasingly accomplished with a subset of skills valued by the student without a feeling of redundancy. These skills must hold "currency" (Squire, 2004) outside of the classroom context. The most powerful assessment application of gaming revolves around gaming's ability to provide levels of challenge that matches a student's ability at a given time. The amount of practice and varied experiences with a concept or skill in a game provides

general support for a student to learn, using the student's choice and curiosity as motivators to take risk to engage again and again in a challenging learning task.

6. **Support Student's General Learning.**

Video games should improve the observable learning of all students (Stein, 2004) especially those who struggle to perform well using direct instruction or those who simply need more practice with a concept. Moreover, video games provide students with the ability to use metaphor to connect understanding across disciplines. For instance, an eighth grade English teacher, Brock Dubbles, has been using video games to teach literary elements to urban students for over 5 years (DeRusha, 2006). One of Mr. Dubbles' students explained the experience with *Sonic the Hedgehog*, "It's much like the Oddessy, Sonic has to get home just like Odesius." Additionally, Dubbles uses video games to "effect point of view and writer's purpose for their audience." Effectively integrating games into the classroom requires an understanding of more than just the game. For example, a game integrated into the curriculum requires a specific task or learning outcome. While gaming can enhance metacognitive skills (Gee, 2003) improvements in learning can be found through careful structuring of the classroom. Students within a carefully designed experience are able to "build connections between the disciplinary content and other narratives" as well as transfer understanding of "inscriptions" across content areas (Barab, Sadler, Heiselt, Hickey, & Zuiker, 2007). Currently, "gamers" expect all interesting learning to include a novel or "fresh" way to present instruction or information to hold their attention for longer than a few minutes. In some traditional or didactic teaching contexts, which include direct instruction, students may benefit from games that provide immediate formative feedback (indication of success), an important factor for many struggling students. Some students may also prefer to attain information, knowledge, and understanding through experience or

"communities of practice" (Lave & Wenger, 1991) found in many online games or simulations. Learners are accustomed to learning which includes immediate feedback within real-time situations. For instance *Civilization III* provides players the opportunity to live history (Shaffer, Squire, Halverson & Gee, 2005).

7. **Long Lasting Effect on Player Engagement Through Video Games**

Learning through video games can have a long lasting effect on player engagement, social skills, cognition, and, metacognitive abilities, in support of real world problem solving activities. Experiential learning, through meaningful play, holds the potential help students become active participants in collaborative endeavors. Designing a video game with careful attention to micro-level outcomes can create learning experiences which teach difficult concepts such as how to negotiate political, financial, and environmental crises. As McGonigal (2010) noted,

> *in game worlds and in game environments we have these really sophisticated ways of working with other people and figuring out what each others' strengths are, putting together a team where everybody has something important to contribute, coordinating globally in a virtual environment. The idea is to make games that take those sophisticated ways of collaborating and apply those to real-world problems.*

8. **"Proliferation" of Video Games in Different Learning Environment**

Sophisticated video games can be tested side-by-side with *Serious Games/educational games* in a traditional setting and develop strategies on how to bridge the experiential learning gap between traditional instruction and the *NET* generation.

As McDaniel and Vick (2010) stated,

> *the proliferation of games and their penetration into so many different areas of contemporary society obviously has profound implications for the entertainment industry, but this phenomenon also presents unique new opportunities for understanding the mechanics of teaching, training, and persuading with networked gaming technologies (p. 5)*

9. **Develop Relevant and Alternative Activities to Traditional Learning**
New learning environments, such as Quest to Learn (Q2L) (Salen, 2007) provide students with activities which support "excellence in the skills and literacies necessary for college and career readiness." As Salen (2007),

> *the overall curriculum is rooted in mathematical practices and the use of smart tools, with an explicit intent to innovate at the level of how students are assessed in context. Most importantly, teachers work with students to build individual and academic competencies and enrich youth identity development within contexts that are relevant and meaningful.*

Gee's (2008) suggestion that students should be "failing early and failing often," supports one player's comments, "when you make a mistake in the game no one is going to make fun of you." Several of the players pointed out their fondness of using an *Avatar* or alternative identity found in first person shooter games. This alternative identity may provide players/learners with even greater agency. As an alternative to traditional learning or classroom environments, "mistakes" become a natural component of play. In many games, players are allowed another "life" or may regain their "health" or return to a previously established "safe port" in order to remain in the game. If a student fails a mission, the commander does not send a note home to parents, he simply asks the player to try again or motivates one to remain engaged using the language of the game (e.g.,"OK, soldier, try that again").

Most importantly, the battle field components of *Call of Duty* and *Medal of Honor* were not part of this study. These games had the potential to supplement a World War II social studies unit (traditional learning environment) through the use of realistic, artifacts, engagement, and historical representation of WWII, simulated discussions with fictional characters of the period, and individual enough for all participants to find some challenges in the initial phases of the game.

The following chapters will present a study that incorporates a micro focused methodology using a detailed game play analysis to answer my research questions. The description of data collected and its analysis will be equally detailed, and will be followed by a recognition of limitations, findings, and conclusions**.**

CHAPTER 3: METHODOLOGY

In order to answer the following research questions, an adaptation of Yin's (1994) Case Based methodology was combined with Appelman's (2007) Experiential Mode Framework (EMF) creating what I will be calling the EMF methodology. This methodology constitutes a micro-analysis adequate to answer the following research questions.

THE RESEARCH QUESTIONS ARE:

1. What are some key attributes in the video games *Medal of Honor* and *Call of Duty* that facilitate learning?
2. What are key strategies that need to be learned by players to reach goals within the video games *Medal of Honor* and *Call of Duty*?
3. What differences between *novice* and *expert* players impact learning while playing the video games *Medal of Honor* and *Call of Duty*?

PRELIMINARY EXPLORATORY RESEARCH

The first phase of the EMF methodology began with *Pre-play Analysis* of both the players (n=14) and the games, which were assessed by the researcher based on the proposed research questions, and a thorough analysis of games under consideration. Appelman's pilot study (PIE07) was employed to determine the viability of using EMF methodology to answer my research questions.

PRE-PLAY ANALYSIS

As earlier noted in Chapter Two, *Medal of Honor* and *Call of Duty* were found to have nearly identical instructional elements for learning complex cognitive task, which guide the players sequentially to finish each objective (or milestones) before moving on to the next. These milestones provided the study with identification of a linear player trajectory of engagement which identified when players reached the training objectives, as well as quantifying the game

environment and affordances. Milestones were also used to group and identify key combination strategies that incorporated actions such, forward, backward, jump, grab objects, and sideways (lateral moves), that the player used to navigate through the training course.

Each Milestone served as a data point around which answers to the research questions could be generated. Additionally, using Milestones as data points allowed for quantitative measurement and trends to emerge regarding the manner in which students reacted to multiple modalities of instruction within the video game. Table 3.1 provides an example of the milestones found in both of the training sessions.

Table 3.1. Game Milestones

Medal of Honor (MOH)	*Call of Duty (COD)*
Milestones	Milestones
M1 Look at 4 towers. Using the mouse, look at each of the four towers	**M1** Look at signs. To complete this task, the participant must center the participant's screen on each of the five signs. A beep notification says that you have successfully looked at the sign. Using the mouse, look at each of the four towers.
M2 Step forward, backwards, left, right. Using the [w], [s], [a], and [d] to move in their directions	**M2** Approach sign indicated by the compass. After being instructed, look at the compass to see which sign it is referring to. Then, walk up to that particular sign to complete this task. Using the [w], [s], [a], and [d] to move in their directions
M3 Approach tower indicated by the compass. Using the compass, determine which tower you should approach by seeing where the star is located compared to each of the towers.	**M3** Go through gate. Walk down the fenced isle and approach the gate on your right. Proceed to walk through it.
M4 Jump over wall. Walk towards the wall from the tower and use the [space] to jump on the boxes (crates) and then over the wall.	**M4** Go through tubes. Press [c] to crouch. Press the [Ctrl] key to crawl through the tubes. At the end of the tubes, stand up by pressing [c] again. Walk towards the wall from the tower and use the [space] to jump on the boxes and then over the wall.
M5 Crawl under barbed wire. Using the [Ctrl] button duck [d] and walk under the barbed wire.	**M5** Jump over fences. Approach each fence and press the forward [W] and the [space] to jump over the fence.

M6 Climb the ladder. Continue down the aisle and approach the ladder. Walk up to the ladder and press the forward key to climb the ladder.	**M6** Crawl under barbed wire. Press [ctrl] to go prone under the barbed wire. Once you reach the end, hit the [Ctrl] to stand up.
M7 Descend the ladder. Walk on the other side of the block and approach the ladder that is going down. Press the [e] key to grab the ladder and press backwards to descend.	**M7** Climb over the wall. Approach the wall and get behind one of the ladders. Press forward to start climbing the ladder. Once you get to the top, press forward [w] and grab key [F] to descend down over to the other side.
M8 Pick up an explosive. Approach the explosive that is sitting on a crate and press [e] to pick it up.	**M8** Go through the door. Proceed through the door on your left to reach the next part of the training.
M9 Place Explosive on the tank. Approach the tank and wait for the instruction to be completed. Once it approaches the rear of the tank and places the explosive on it using the [e] button.	**M9** Pick up M1A1 Carbine and ammo. Press the use key [F] to pick up weapon. Hit [F] while close to ammo in order to pick them up.
M10 Open the door to the next area. Approach the doors on the other side of the tank and try to open the door. The first door that is tried will not open because it is locked. Open the second door and walk through it.	**M10** Shoot target twelve times. Using the left mouse button, aim the crosshair at the target and shoot it 12 times.
M11 Pick up first aid. Walk up to the first aid and pick them up. All you have to do is walk towards it	**M11** Go to next area and pick up Springfield rifle. Walk over to the next area and use [F] to pick up the rifle and ammo. Shoot target 4 times. Using the right mouse key, look down the scope of the rifle and fire at the target 4 times using the left mouse key.
M12 Pick up gun and shoot target 3 times. Approach the gun and ammo on the table to pick them up. Approach the window where the target is located and shoot the target three times	**M12** Go to next area and pick up Thompson and ammo. Walk over to the next area and press [F] to pick up the next weapon and ammo. Shoot weapon at target 10 times. Using the left mouse key, fire 10 rounds at the target.

M13 Go to next room and pick up the sniper gun and ammo and shoot target 3 times. Walk to the next room and approach the table with the gun and ammo on it. This action will help to pick them up. Approach the window where the target is located and look down the barrel. Using the right mouse key. Shoot the target 3 times.	**M13** Switch weapon and shoot target 3 more times. Using the number keys, switch weapons and shoot the target three more times using the left mouse key. Press to [1] for next weapon. Press [2] to select previous weapon. Press [4] to switch to your grenade.
M14 Go the next room and pick up grenades. Walk into the next room and approach the table with the grenades on. Press 5 to select a grenade Press 1 for a long throw Press 2 for a short throw Throw a grenade into each of the concrete box	**M14** Go to next area and pick up grenades. Walk over to the next area and use [F] to pick up all of the grenades.
M15 Throw grenades into holes. Using the left mouse key throw the grenades into the holes.	**M15** Approach the wall and throw grenades in the holes. Using the left mouse key, throw the grenades into the holes. Holding down the left mouse key longer will throw the grenades farther.
M16 Go to next room and grab turret and destroy target. Using the [e] button grab the turret and shoot the target as many times as it takes to destroy it. Approach the MG42 stationary machinegun and press the use take command of the weapon. Destroy the target with that machinegun.	**M16** Pick up explosives-Walk over to the next area and pick up the explosives using the [F] key.
M17 Exit-Walk through the next door to exit from the training session.	**M17** Plant explosives on cinder block-Walk down into the area where there is a cinder block and press [F] key to plant the explosive on the cinder block.
	M18 Exit-After hearing the instructor saying that you are done with the training, walk through the gate right behind the tower where the instructor is located. This will exit the training.

ESTABLISHMENT OF IDEAL PLAY TIME

After selection of the two video games, *Ideal* game play time (seconds/minutes) (see Table 3.4 and 3.5) was established by having the researcher (who could be considered a *Novice* player in the beginning) play both *Call of Duty* and *Medal of Honor* until reaching a ceiling on the fastest time (seconds/minutes) between each milestone. In some cases this required game play of a level as many as possibly fifty times or more (who could be considered an *Expert* player following this much practice). The fastest time (seconds/minutes) for each milestone was logged into the *Ideal* play chart. The reasoning for this procedure was twofold. In order to understand how to analyze the data, the intricacies of the game conventions found in *Call of Duty* and *Medal of Honor,* the researcher had to be able to articulate and interpret the difficulties of player experience (e.g. using the [Ctrl] key to crouch under the barbed-wire) to engage in a dialogue with players during the post-play interview.

Secondly, to identify a comparative playtime (seconds/minutes) baseline, a normal playtime trajectory needed to be established. For instance, if the *Ideal* player spent fifty seconds on a particular milestone, an *Expert* participant would be expected to complete the milestone within a few seconds of that time.

PARTICIPANT SELECTION/CATEGORIZATION

Because a propensity of students between the ages of 13-18 routinely play video games (Rideout, Roberts, & Foehr, 2005), this study ensured an equal number of males and females were included in the study. Participants were recruited based on convenient sampling gathered from students already involved in university sponsored field-trips. Players included 6 males and 8 females (n=14) who chose to play two first-person shooter video games, *Medal of Honor* and

Call of Duty. All sessions and post-game interviews were videotaped and participants were not compensated for their participation.

The questions posed in this research were answered through the use of both qualitative and quantitative methodologies, to include timeline versus milestones accomplished during playtime. Additionally, a rapid sorting of the participants was conducted asking the players to fill out demographic sheets prior to participation. Participants are ranked based on the following criteria.

a. Participants were sorted according to hours-per-day playing video games. If over 5 hours per week, the participant was identified as *Expert*. For those participants who reported playing less than two hours per week, they were identified as *Novice* participants.

b. Using the demographic sorting technique, participants who reported playing any of the games in the study (*MOH* and *COD*), were also sorted as *Expert* and *Novice* if they reported playing "little to none" in response to the question, "Which of the following type of games do you prefer to play most?" (see Appendix C).

c. If the participants met both criteria in [a] and [b], they were scheduled to play *MOH* and *COD*. If participants did not meet both the [a] and [b] criteria, participants were asked if they would "like" to play.

FACILITIES

Gaming, video recording, and interviews were conducted at a large Midwestern university. All of the gaming and interviews were performed in a controlled environment specifically setup for *Game Play Analysis.* This facility is a standard two-area usability testing facility with an observation area separated by a sound baffle window. Participants used a PC, Pentium IV with a keyboard, mouse, and microphone to complete the test sessions. All sessions were recorded onto DVD formats.

Data Collection Procedure

During the *Game Play Data Capture* phase, each student first answered a survey to establish the participant's background (Demographic Data, Appendix C). Next, students were videoed as they engaged with the two listed video games (*MOH & COD*) to determine how and why participants respond to instructions and prompts within the basic training sections of the games. These data were used to reveal the type of cognition and learning needed to precipitate a specific action on the part of the player.

Player Demographics
(see Appendix B)

To define the player, data was gathered on:

- Age
- Gender
- Ethnicity
- Education level
- Handedness
- Game Platform Preferences
- Game Platform Ownership
- Game Purchasing Habits
- Days per Week of Game Play
- Hours per Day of Game Play
- Mode of Play (PC, Console, On-line)
- Specific Game and Over-all Genre Favorites
- Percentage of play alone, team play, competing with others

Quantitative and qualitative data was collected based on the following protocol.

- All the participants were given an informed consent statement to read and sign which describes the nature and purpose of the research study including the rules for their involvement.
- Data were collected through direct observation and field notes, in addition to multiple cameras aimed at participants during playtime.
- All playing sessions were recorded on DVD for post-game review and data analysis.
- Talk-out-loud protocol was applied during the playing time.
- After the introductory protocol and administration of the informed consent statement, the participants were observed by the researcher who facilitated the remainder of the session from an observation room.
- All players were simply asked to listen to and follow instructions from the games. The average time of completion during preplay analysis was 10 to 15 minutes.
- Participants were not provided with any instructions or training prior to beginning their task other than that the monitor was not allowed to help the participant.
- Participants did not receive assistance from monitors, other than technical, such as restarting the video game when it did not load correctly.
- During the performance of the tasks, the researcher made observational notes regarding player action. This data served as a qualitative component of the post play interviews.

After completion of the testing session for each participant, the researcher conducted post-play interview videotaped for the purpose of using the transcripts for the qualitative component of the case study. These transcripts were used to determine player rationale as they move through the training session of the video game. During the post play interview, participants were asked to describe what they were thinking during a particular action or difficult part of the game. Additionally, participants were asked to explain their thought processes as they attempted to solve a problem found within the game (e.g., I noticed that you had difficulty climbing over the wall, how did you figure it out- how to go over the wall?).

TASKS

The testing session lasted between 10 to 20 minutes. The facilitator began the session by cuing (clicking the mouse) the beginning of the training session in each game (*MOH* and *COD*) while explaining to participants that the facilitator is not allowed to help the player.

POST-GAME PLAY INTERVIEW

Immediately after game play data capture, participants were taken to a private interview area with a round table, four chairs, and a video camera set up. The interviewers explained that the video recorder would be used to help remember what the participants said. Participants asked questions about their experiences during game play (see Appendix D).

POST-PLAY ANALYSIS

During the third phase of the EMF, Using strict observation protocols and quantitative measures, plus interviews with players pre, during, and post game play, leads to a blended post-positivist inquiry methodology. The best fit for this type of analysis is a multiple case study approach described by Robert K. Yin. According to Yen, each instance of game play, or each

classroom experience, is considered a separate case. Comparison of multiple players, or comparison of multiple classroom experiences would in turn be defined as being a multiple case research methodology (Yin, 2003).

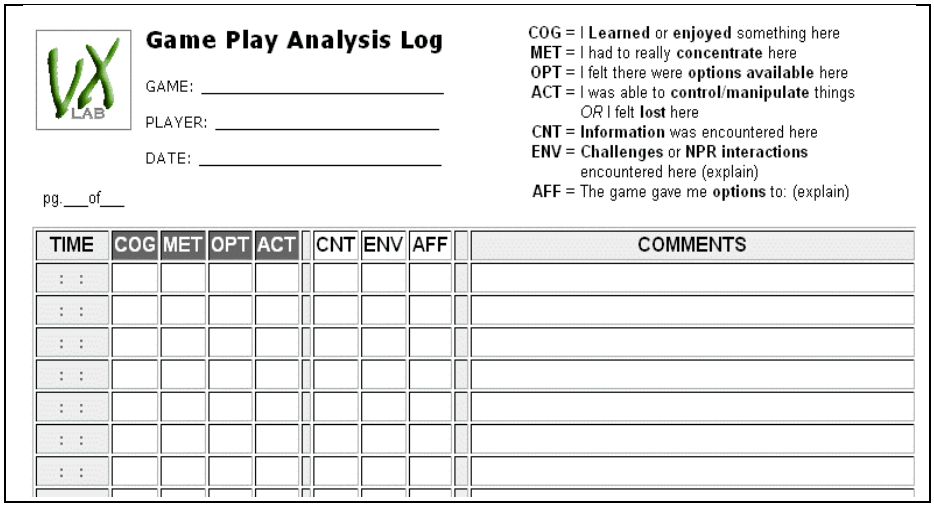
The focus on each experience as a separate case is the key difference from traditional experimental design approaches, where each player's data would be aggregated under a criteria that generates a statistically produced number to compare to other criteria. In this case-based approach, the pattern of one experience is compared to the pattern of another experience using the same criteria in both to define each pattern. Pattern analysis results in the conclusions drawn from the study being the goal, and not significance from a statistical point of view.

According to Yin, a proper case study methodology begins with a theory and/or a proposition, follows a descriptive analysis of specific events from a wide range of inquiry techniques, and the evaluation results in models and patterns that describe each case. These patterns and models may then be compared to produce a more generalizable model or pattern. This methodology seems to fit Game Play Analysis very well, not only because it lends itself to a direct observation methodology, but also because it lends credence to every player's interactive session, rather than attempting to aggregate them into an overall number or general pattern.

The goal is to accurately describe each session driven by an inquiry theory or proposition using a standard set of criteria. The Experiential Mode Framework provides these criteria, and covers both the structural attributes and student perceptions.

Game Play Analysis (Appelman, 2003 & 2007a) the demographic data to describe players according to multiple categories such as *Novice* and *Expert* player in order to determine the time spent playing game and the milestones they accomplished.

Figure 3.1. Game Play Analysis Log Sheet (Appelman, 2007)



Game Play Analysis Log

GAME: _____

PLAYER: _____

DATE: _____

pg.___of___

COG = I **Learned** or **enjoyed** something here
MET = I had to really **concentrate** here
OPT = I felt there were **options available** here
ACT = I was able to **control/manipulate** things *OR* I felt **lost** here
CNT = **Information** was encountered here
ENV = **Challenges** or **NPR interactions** encountered here (explain)
AFF = The game gave me **options** to: (explain)

TIME	COG	MET	OPT	ACT	CNT	ENV	AFF	COMMENTS
: :								
: :								
: :								
: :								
: :								
: :								
: :								

Next, using the video data, player performance will be analyzed using a modified version of *Game Play Analysis Log Sheet* (Figure 3.1.). Notice that time markers are correlated to the following subcategories (see Appendix A):

1. Cognition (COG) – involves the thinking process. During game play, participants tend to express cognition through verbal expression. What students say during game play will be recorded on the log sheet.
2. Metacognition (MET) –involves the cognitive ability of players to regulate or manipulate the learning process in response to perception or feedback. This is extremely difficult to measure without discussing with players. Because of this, the researcher took notes during game play to prompt a discussion during the post-game play interview.
3. Choice (OPT) –includes the player's perception of access to options, variables, or information during game play.
4. Action (ACT)– encompassing the player's perception that they can do things such as interact with objects and elements within the game, that they have a degree of control of these objects and elements, that they have a degree of mobility to move through the

> virtual environment, and that the control interface, in concert with the player's strategic reasoning, allows their psychomotor capabilities to effect change (Appelman, 2007, p. 15).

Appelman (2007) further describes that there is a correlation between player experience and game structure in which game designer can create game structures that promote different learning experience. The following categories can influence player cognition and navigation throughout the game playtime.

The 3 primary categories of game structure are:

1. **Content** – the "compelling storyline," the context, the amount of information available, the degree of concreteness or abstraction of the content, the authenticity, and its variability.
2. **Environment** – the virtual spaces and boundaries, the objects within these spaces and their functionality capabilities, plus any time limits imposed by the game.
3. **Affordances** – encompassing the abilities made available within the game for the player to change, manipulate, and/or to seek alternatives or information (Appelman, 2007, p. 15).

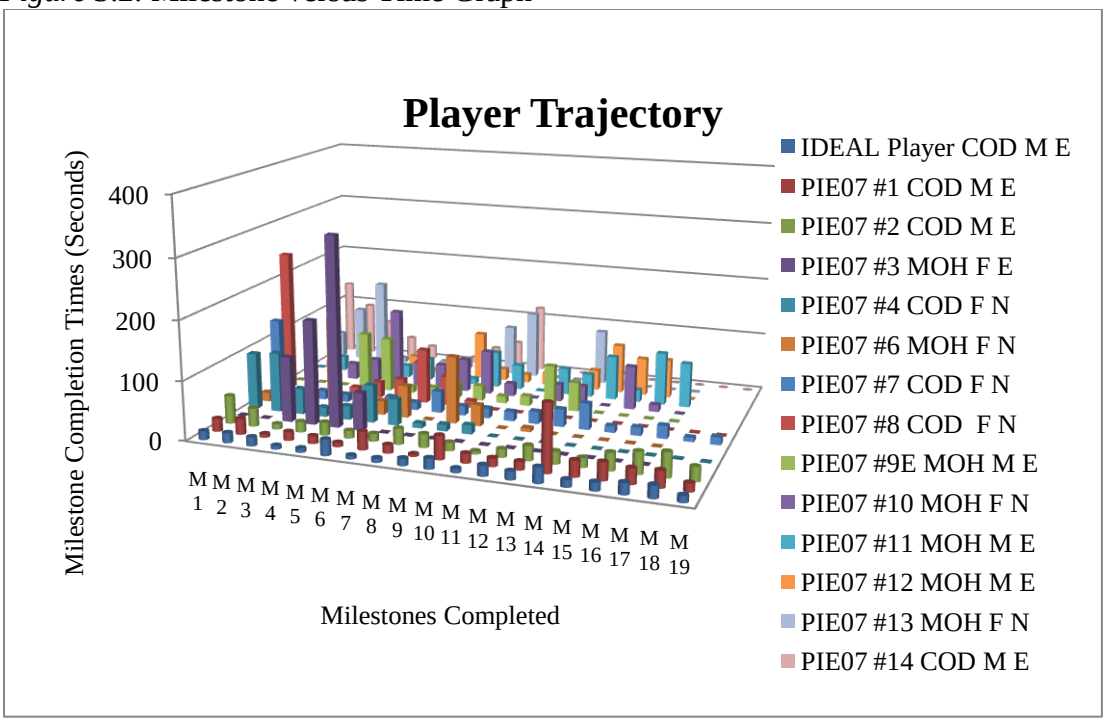
During the fourth phase of the EMF, *Post Game Interview Analysis* will include a qualitative description of a player's experience, as described during the post-game interview with each participant for recall purposes to answer my research questions. This analysis also includes two steps of quantitative data collection. The first step targets the capture of immediately evident data within all category columns, and especially the times between milestones (Appendix G). The second step is a more micro analysis that targets specific data from the first analysis deemed of interest by the researcher (Appendices H-J).

Lastly *Summative Conclusions* were based on the final data analysis and pattern of a particular attributes or interpersonal characterizations identified by the researcher. These summative conclusions are used to determine some of the key factors and strategies that facilitate learning during gaming by first examining the video data, along with time markers, to record the achievement of an individual learner's goal. For instance, in *Medal of Honor*, players are asked to unload a certain amount of rounds at a target before they can continue to the next task in the military training. In another game scenario, the player must place an explosive on a tank, while remaining at a safe distance before it detonates. Some students have not necessarily been trained to do some military training as *Novice* players. As such, the specific problem solving abilities will become a component of the answer. After this, demographic information was used to compare *Expert* (number of hours played per day) to *Novice* (played less or not played at all), (see Table 3.0) play as well as post play interviews to determine the use of gaming conventions and pre-game knowledge, which may have assisted players with accomplishing their tasks/goals.

The framework for player analysis is used to compare "milestone versus time" to identify student progress. In order to answer my research question about the differences in game play between *Novice* and *Expert* players, using Appelman's data for my pilot study, Figure 3 demonstrates that player PIE07#11 has accomplished tasks of the game similar to the *Ideal* play, but has taken longer time. Player PIE07#5 has accomplished *milestones* one through six in a similar time period as #11 and *Ideal* but while attempting to accomplish Milestone M7 had the time elapsed after six to seven minutes of attempting to accomplish one goal. This difference in game play approach can be further explained through the use of detailed descriptions of player actions through the use of the *Game Play Analysis Log Sheet* (Figure 3.1). The next graph illustrates the player action time versus number of milestones completed, which is compared to

ideal player time. The *Ideal* player time provides the researcher an additional reference, which is critical for examining and comparing other player's actions.

Figure 3.2. Milestone versus Time Graph



In Figure 3.3, as each milestone is finished, one can engage in analysis of student actions. In this manner, key strategies and factors of game play can be examined. What are some key strategies employed by students to reach the goals of the games? What type of observable information/knowledge within the game assists the learner in reaching the goals of the games? How important are game conventions in the strategies the players use to reach the goals of the games? A *log sheet* (Table 3.1.) was used to identify the way in which player actions were coded based on the milestones or tasks they accomplished in addition to talk-out-loud for recall purposes (cognition), metacognition, game option, and action. An attempt was made to record all verbal comments, physical actions and responses to game conventions. For instance, as a

participant viewed an objective as it appeared on the video monitor, that player stated, “I don’t get it!” or “How am I supposed to get over the wall?” To examine the clarity of data entry, a time marker identified the captured discussion and talk-out-loud or any dialogue during the playtime. For example, the data was coded and sorted based on participants’ actions during the playtime. Each participant was coded in a numerical format to protect their identity, while using different list for data categorization based on players actions. Furthermore, the four categories listed in Table 3.1. were recorded based on each player’s dialogue during playtime either on cognitive or metacognitive categories, where game option/choice were for selection of information (the degree of control within the game or access to variables and information), in addition to game action (interaction with objects and elements within the game) when player jumped over the wall or threw a hand grenade into a window.

Table 3.2. Example of Game Play Analysis Log Sheet

Game: Medal of Honor **Player ID PIE07 #11** **Platform: PC**						
Time Marker	Cognitive	Metacognition Sensory information (Strategy)	Game Information (Auditory)	Game information (Visual)	Player Action	Milestone Completed
0:05			It’s time to commence field training. Pay attention and you might even stand a chance on the battlefield	Use your mouse to look at each of the 4guard towers! An objective has been added		**M1** Look at towers
0:07	"Heh, I want a gun."		First I want you to use your mouse to look at each of the 4 towers.			

.08	"Give me a gun!"			Press w to move forward!		
0:11			Good, now press your forward key to move in the direction you are facing.	Press s key to move backward.	Player looks in tent.	
0:15	"Give me a gun!"					
0.16			Press your backwards key to move back	Press a to move left and d to move right.	Walks toward close gate	
0.18					Backs away from gate	
0.27			Press strafe left to move left and strafe right to move right.		Moves left	
030					Centers in middle of road facing gate	
0.32	"this is fun"					
0:36			Objectives are displayed on screen for the first time.			
0:45				Oral instructions from game's commander.		
0:46	"Um, yeah. OK."				heard oral instructions from instructor	

0:47			Using these 4 keys to cover with the mouse is critical to your success against the enemy.		Begins to move past tent toward tower	
0.56						**M2** Approach tower using compass
0:57				Objective displays on screen.		
1:07		"I got to get over this wall and I don't know how."				
1:10					Moves over to stack of crates.	
1:13		"Press the jump dude."				
1:15		"Awesome. I'm, gettin' it."				

INITIAL PHASE OF STUDY

The initial phase of this study was conducted in 2007 and used to evaluate the protocols, as well as further refine the procedure, clarity, and appropriateness of the steps used in this methodology. The first round of play contained similar protocols that were subsequently refined. Changes were made to alleviate difficulty with the data recording. According to Ericsson and Simon (1993), there are similarities between thinking and talk-out-loud during which players verbalize thought at the end of a milestone. For instance, earphones were not included in order to

promote participants talk-out-loud. The researcher elected to include post-play qualitative interviews in order to gather data specifically related to the research questions as well as for recall purposes. While the pilot data provided similarities in game play pattern and introduction to game play analysis using the three comparison bars (see Figure 3.3), this study included 14 participants (8 female, 6 males), which were compared to the IDEAL player.

PARTICIPANT SELECTION

The criteria for identifying *Expert* and *Novice* players in this study are parallel to those found from the *National Research Council* (2001), when they described several key principles of experts' knowledge on "how experts differ from novices" in the following manner,

1. Expert notice features and meaningful patterns of information that are not noticed by novices.

2. Experts have acquired a great deal of content knowledge that is organized in ways that reflect a deep understanding of their subject matter.

3. Experts' knowledge cannot be reduced to sets of isolated facts or propositions but, instead, reflects contexts of applicability: that is, the knowledge is "conditionalized" on a set of circumstance.

4. Experts are able to flexibility retrieve important aspects of their knowledge with little attentional effort.

5. Though experts know their disciplines thoroughly, this does not guarantee that they are able to teach others.

6. Experts have varying levels of flexibility in their approach to new situations. (NRC, 2001, p. 31)

Table 3.3, Delineates how *Expert* and *Novice* players were bifurcated.

Table 3.3. Protocols for Participant Selection *Medal of Honor* and *Call of Duty*

Expert	Novice
Players who engage with video games 2 hours or more per day.	Players who engage with video games 1 hour or less per day.
Expert players demonstrate familiarity with video game settings. (e.g. game options, hardware, controllers, keyboard).	Novice players demonstrate little familiarity with video game settings (e.g. game options, hardware, controllers, keyboard).
Expert players are knowledgeable of the game they play and are familiar with the game settings and special effects.	Novice players demonstrate little to no familiarity with video game user interface or game settings.
Expert player demonstrate ease of use with a video game environment and easily adjust to the game user interface.	Novice players tend to be apprehensive interacting with the game settings or hardware.
Expert players move quickly through the game environment and adapt understanding gained from other video games for success with the new one.	Novice players may use extensive game playtime to adapt to a video game environment (i.e. obstacles).
Expert players know and can easily figure out how to restart and reset the game when the game console or computer system freezes and crash.	Novice players tend to be timid and remain puzzled/helpless and frustrated. In some cases, they immediately ask for help when the game console crashes.
Advance players use technical terms for describing the games convention.	Novice players tend to use non-technical terms for describing games convention.

To identify the difference between *Expert* and *Novice* players, I used demographic data completed by the participants before the playtime. For instance, Table 3.4. illustrates the demographic delineation of players and including of columns for self-reporting of *Expert* and *Novice* categorization.

Table 3.4. Identifying *Expert* and *Novice* Players

Player ID	Gender	Age	Ethnicity	Grade Level	Expert Players (# hours per day)	Novice Players (# hours per day)
2 Eric	M	14	W	8	3	
3 Jennifer	F	13	W	7	6	
4 Jamie	F	13	Asian	7		0-1
6 Courtney	F	13	W	7		0-1
7 Rebecca	F	14	W	8		0-1
8 Susan	F	15	African American	10		0-1
9 Tavis	M	13	W	7	3	
10 Liz	F	14	W	8		0-1
11 Rashid	M	14	African American	9	2	
12	M	13	W	7	2	

Michael						
13 Heather	F	14	W	9		0-1
14 Cody	M	15	W	10	5	
15 Felicia	F	14	Hispanic	9		0-1

COMPARISON CHART OF PLAYERS

In order to draw a comparison between ideal versus *Novice/Expert* players, tables are created for both (*MOH*) and (*COD*) to identify players activities in which participants' playtime and number of accomplished milestones were recorded to see if there is a pattern between ideal and *Expert/Novice* player. Table 3.5 and Table 3.6 are used to identify patterns during playtime for further analysis. This comparison between *Medal of Honor* and *Call of Duty* provide additional pattern how instructional engagement may different in a similar game.

Table 3.5. Comparison Chart of Player Ideal Performance in *Call of Duty (COD)*

Events	Ideal Times	Player 1	Player 2	Average	Median	Percentage of Completion
Look at 5 signs	:15	7:50	1:05	4:26	4:26	100%
Approach sign indicated by the compass	:32	9:28	3:45	6:36	6:36	100%
Go through gate	:47	9:43	4:20	7:01	7:01	100%
Go through tubes	:53	n/a	4:30	2:15	2:15	100%
Jump over fences	1:00	n/a	4:58	2:27	2:27	100%

Crawl under barbed wire	1:27	n/a	5:37	2:17	2:17	100%
Climb over wall	1:33	n/a	6:35	3:16	3:16	100%
Go through door	1:40	n/a	7:10	3:35	3:35	100%
Pick up M1A1 Carbine and ammo	1:52	n/a	7:30	3:45	3:45	100%
Shoot target 12 times	2:10	n/a	n/a	0:00	0:00	0%
Go to next area and pick up rifle and ammo	2:17	n/a	n/a	0:00	0:00	0%
Shoot target 4 times	2:35	n/a	n/a	0:00	0:00	0%
Go to next area and pick up Thompson and ammo	2:49	n/a	n/a	0:00	0:00	0%
Shoot target with Thompson 10 times	3:15	n/a	n/a	0:00	0:00	0%
Switch weapon and shoot target 3 more times	3:27	n/a	n/a	0:00	0:00	0%
Go to next area and pick up grenades	3:41	n/a	n/a	0:00	0:00	0%
Approach the wall and throw grenades at holes	4:00	n/a	n/a	0:00	0:00	0%
Pick up explosives	4:21	n/a	n/a	0:00	0:00	0%
Plant explosives on cinder block	4:32	n/a	n/a	0:00	0:00	0%
Exit	4:51	n/a	n/a	0:00	0:00	0%

Table 3.6. Comparison chart of Player to Ideal performance in *Medal of Honor (MOH)*

Milestones	Ideal Time	Player1	Player 2	Average	Median	Percentage of Completion
Look at 4 towers	:20	:14	:26	:20	:20	100%
Step forward	:25	:26	5:00	3:03	3:03	100%
Step backward	:28	:28	5:02	2:45	2:45	100%
Step Left	:32	:30	5:04	2:47	2:47	100%
Step Right	:33	:32	5:06	2:49	2:49	100%
Approach tower indicated by the compass	1:14	1:03	6:09	3:36	3:36	100%
Jump over the wall	1:29	1:32	6:45	4:08	4:08	100%
Crawl under the barbed wire	1:38	1:47	7:15	4:31	4:31	100%
Climb ladder	1:48	2:03	7:40	4:51	4:51	100%
Descend ladder	1:52	2:14	7:55	5:04	5:04	100%
Pick up explosive	2:00	2:41	8:19	5:30	5:30	100%
Place explosive on the tank	2:18	3:10	n/a	1:35	1:35	50%
Approach doors	2:35	3:25	n/a	2:42	2:42	50%
Try to open first door	2:38	3:30	n/a	1:45	1:45	50%
Open second door	2:42	3:32	n/a	1:46	1:46	50%
Pick up first aid	2:44	3:41	n/a	1:50	1:50	50%
Pick up Colt45 and ammo	2:46	3:45	n/a	1:42	1:42	50%
Shoot target 3 times	3:26	4:22	n/a	2:11	2:11	50%
Go to the next room and pick up Thompson and ammo	3:33	4:32	n/a	2:16	2:16	50%

Shoot target 20 times	3:54	5:01	n/a	2:30	2:30	50%
Go to next room and pick up Springfield sniper and ammo	4:04	5:08	n/a	2:34	2:34	50%
Shoot target 3 times	4:23	5:57	n/a	2:58	2:58	50%
Go to next room and pick up grenades	4:35	6:18	n/a	3:09	3:09	50%
Throw grenades into 3 holes	5:05	7:34	n/a	3:47	3:47	50%
Go to next room and position turret	5:10	7:43	n/a	3:51	3:51	50%
Destroy Target	5:17	7:56	n/a	3:58	3:58	50%
Exit	5:20	8:37	n/a	4:17	4:17	50%

Stake (1995) notes “Interpretation is a major part of all research….but the function of the qualitative researcher during data gathering is clearly to maintain vigorous interpretation. On the basis of observations and other data, researchers draw their own conclusions” (p. 9). The intention of this study is to determine specific pattern of "learning" within games, which engages students for long periods of time despite the fact that mistakes are numerous. In some classroom environments, mistakes are characteristics to be avoided. Within video-game based learning, mistakes become an integral part of learning.

CHAPTER 4: DATA ANALYSIS

As Stake (1995) notes, the use of case studies for the examination of human behavior at the granular level, "is a search for patterns, for consistency, for consistency within certain conditions" (p. 78). This study will seek to determine if there is a consistent pattern between the manner in which a *Novice* and *Expert* player engages with a particular game by observing, at a micro level, the way players learn and perform as they enter into a new gaming environment.

Again, asking the research questions,

1. What are some key attributes in the video games *Medal of Honor* and *Call of Duty* that facilitate learning?

2 What are key strategies that need to be learned by players to reach goals within the video games *Medal of Honor* and *Call of Duty*?

3. What differences between *novice* and *expert* players impact learning while playing the video games *Medal of Honor* and *Call of Duty*?

This chapter will first delineate the trajectory of *Expert* and *Novice* players interfacing with *Medal of Honor* and *Call of Duty*. Then the data analysis will examine common threads and trends with player completion times on individual milestones.

As earlier noted in Chapter Two and Three, *Medal of Honor* and *Call of Duty* were found to have nearly identical instructional objectives that required the learning of complex psycho-motor and cognitive tasks. These tasks were most often required to be sequential in nature, and the players were guided by visual and audible cues to finish each objective before moving on to the next. Table 3.0 provides an example of the milestones found in both of the training sessions. It is presented again here because patterns mentioned will refer to these milestones.

Table 4.1. Game Milestones (Side-by-Side comparison)

Medal of Honor (MOH)	Call of Duty (COD)
Milestones	Milestones
M1 Look at 4 towers. Using the mouse, look at each of the four towers	**M1** Look at signs. To complete this task, the participant must center the participant's screen on each of the five signs. A beep notification says that you have successfully looked at the sign. Using the mouse, look at each of the four towers.
M2 Step forward, backwards, left, right. Using the "w", "s", "a", and "d" to move in their directions.	**M2** Approach sign indicated by the compass. After being instructed, look at the compass to see which sign it is referring to. Then, walk up to that particular sign to complete this task. Using the "w", "s", "a", and "d" to move in their directions.
M3 Approach tower indicated by the compass. Using the compass, determine which tower you should approach by seeing where the star is located compared to each of the towers.	**M3** Go through gate. Walk down the fenced isle and approach the gate on your right. Proceed to walk through it.
M4 Jump over wall. Walk towards the wall from the tower and use the "Space Bar" to jump on the boxes and then over the wall.	**M4** Go through tubes. Press 'c' to crouch. Press the forward key to crawl through the tubes. At the end of the tubes, stand up by pressing 'c' again. Walk towards the wall from the tower and use the "Space Bar" to jump on the boxes and then over the wall.
M5 Crawl under barbed wire. Using the "Control" button duck and walk under the barbed wire.	**M5** Jump over fences. Approach each fence and press the "spacebar" to jump over the fence.
M6 Climb ladder. Continue down the aisle and approach the ladder. Walk up to the ladder and press the forward key to climb the ladder.	**M6** Crawl under barbed wire. Press "Control" to go prone under the barbed wire. Once you reach the end, hit the "spacebar" to stand up.
M7 Descend ladder. Walk on the other side of the block and approach the ladder that is going down. Press the "e" key to grab the ladder and press backwards to descend.	**M7** Climb over wall. Approach the wall and get behind one of the ladders. Press forward to start climbing the ladder. Once you get to the top, press forward to fall over to the other side.
M8 Pick up explosive. Approach the explosive that is sitting on a box and press "E" to pick it up.	**M8** Go through door. Proceed through the door on your left to reach the next part of the training.

M9 Place Explosive on tank. Approach the tank and wait for the instruction to be complete. Once it is approached near the rear of the tank and place the explosive on the tank where the ghost icon is used as an indicator of placing the explosive by using the "E" button.	**M9** Pick up M1A1 Carbine and ammo. Press the use key ('F') to pick up weapon. Hit 'F' while close to ammo in order to pick it up.
M10 Open the door to the next area. Approach the doors on the other side of the tank and try to open the door. The first door that is tried will not open because it is locked. Open the second door and walk through it.	**M10** Shoot target twelve times. Using the left mouse button, aim the crosshair at the target and shoot it 12 times.
M11 Pick up first aid. Walk up to the first aid and pick them up. All you have to do is walk towards it.	**M11** Go to next area and pick up rifle. Walk over to the next area and use "F" to pick up the rifle and ammo. Shoot target 4 times. Using the right mouse key, look down the scope of the rifle and fire at the target 4 times using the left mouse key.
M12 Pick up gun and shoot target 3 times. Approach the gun and ammo on the table to pick them up. Approach the window where the target is located and shoot the target three times.	**M12** Go to next area and pick up Thompson and ammo. Walk over to the next area and press "F" to pick up the next weapon and ammo. Shoot weapon at target 10 times. Using the left mouse key, fire 10 rounds at the target.
M13 Go to next room and pick up the sniper gun and ammo and shoot target three times. Walk to the next room and approach the table with the gun and ammo on it. This will pick them up. Approach the window where the target is located and look down the barrel. Using the right mouse key. Shoot the target 3 times.	**M13** Switch weapon and shoot target 3 more times. Using the number keys, switch weapons and shoot the target three more times using the left mouse key.
M14 Go the next room and pick up grenades. Walk into the next room and approach the table with the grenades on the table.	**M14** Go to next area and pick up grenades. Walk over to the next area and use "F" to pick up all of the grenades.
M15 Throw grenades into holes. Using the left mouse key throw the grenades into the holes.	**M15** Approach wall and throw grenades at holes. Using the left mouse key, throw the grenades into the holes. Holding down the left mouse key longer will throw the grenades farther.
M16 Go to next room and grab turret and destroy target. Using the "E" button grab the turret and shoot the target as many times as it takes to destroy it.	**M16** Pick up explosives-Walk over to the next area and pick up the explosives using the "F" key.

M17 Exit-Walk through the next door to exit from the training session.	**M17** Plant explosives on cinder block-Walk down into the area where there is a cinder block and press "F" key to plant the explosive on the cinder block.
	M18 Exit-After hearing the instructor saying that you are done with the training, walk through the gate right behind the tower where the instructor is located. This will exit the training.

The following descriptions and classification of players were derived from the demographic data during the *Pre-Play Analysis*, in the first phase of data collection. Table (4.2) categorized and ranked each player as *Expert* and *Novice* based on the number of hours each player spent in play per day. According to the National Research Council (2001) "Understanding expertise is important because it provides insights into the nature of thinking and problem solving….experts have acquired extensive knowledge that affects what they notice, and how they organize, represent, and interpret information in their environment" (p. 31).

This data was then analyzed based on the player *Novice* or *Expert* status, and familiarity with the game being tested which was incorporated into the pattern analysis on that follows.

Table 4.2. Identifying *Expert* and *Novice* Players

Player ID	Gender	Age	Ethnicity	Grade Level	Expert Players (# hours per day)	Novice Players (# hours per day)
1 Colby	M	13	W	7	3	
2 Eric	M	14	W	8	3	
3 Jennifer	F	13	W	7	6	
4 Jamie	F	13	Asian	7		0-1
6 Courtney	F	13	W	7		0-1
7 Rebecca	F	14	W	8		0-1
8 Susan	F	15	African American	10		0-1
9 Tavis	M	13	W	7	3	
10 Liz	F	14	W	8		0-1
11 Rashid	M	14	African American	9	2	
12 Michael	M	13	W	7	2	
13 Heather	F	14	W	9		0-1
14 Cody	M	15	W	10	5	
15 Felicia	F	14	Hispanic	9		0-1

MEDAL OF HONOR EXPERT PLAYER TRAJECTORY

Post-game play data analysis revealed that some *Expert* players struggled with the PC game conventions such as keyboard setting, game fidelity, and navigation tools. For instance, Jenifer and Tavis initially had difficulty with the [w] key for moving forward, [s] for moving

back, [a] left, [d] moving right, and [ctrl] for crouching. This initial difficulty may have been due to the fact that standard interfaces for most contemporary video games include a game controller or joystick (Figure 4.1)

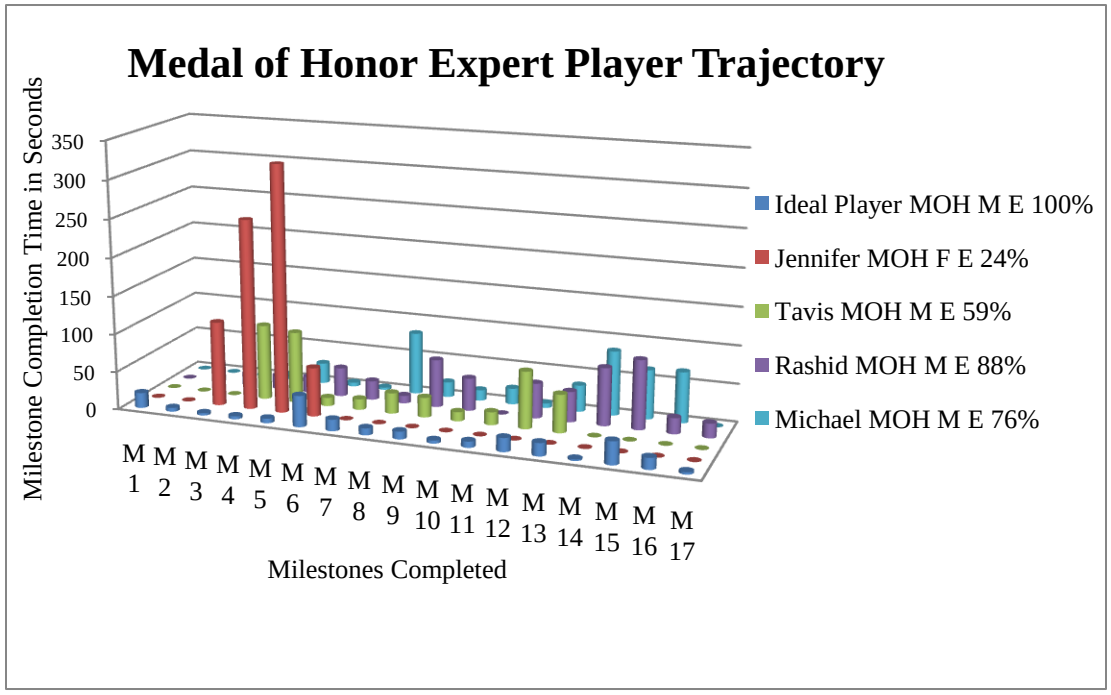
Figure 4.1. XBOX 360™ Game Controller

rather than the standard keyboard (Figure 4.2) which was used for this study. According to Jennifer's pre-game play demographic questionnaire, she reported that she was more accustomed to an XBOX 360™ game controller. This underscores the importance of the control interface since Jennifer's *Post-Game Play Interview* about her experience with other games she noted, "Oh, yeah. I have (played) *Call of Duty* before."

Figure 4.2. Standard Dell™ Keyboard

Expert player Jennifer (with a completion percentage of 24%) (Figure 4.3) struggled with milestones (M3-M6), which did not allow her to complete the remaining milestones (M7-M17) in the allotted time. According to the *Game Play Analysis Log Sheet*, at M4, when Jennifer arrived at the crates (M4), she stated, "Um. I'm not sure what to do here."

Figure 4.3. Medal of Honor Expert Player Trajectory



After Jennifer successfully jumped over the wall (M4) Jennifer exclaimed, "Oh my God." Additionally, during the *Post Game Play Interview* Jennifer revealed her metacognitive game strategy during M4 when she stated, "I needed to stay calm in a way to complete it (objective). That's real." When asked why she looked disoriented (M9: place explosive on the tank using the [e] button), Jennifer disagreed with the interviewer's interpretation of her actions as disoriented when she noted, "No, I was getting cover." When asked by the interviewer, "What were you thinking when you threw the hand grenade into the concrete (hole) (M 14)? Jennifer calmly

responded that, "Um-yes it (finding the correct trajectory for throwing the grenade into a hole) was kind of difficult because it was bouncing out." When asked if playing other games helps with solving problems in *MOH*, Jennifer stated, "Yes." The fidelity and affordances between *MOH* and the "real world" allowed Jennifer to utilize her rudimentary understanding of physics to strategically adjust how she threw a hand grenade into a bunker in *MOH* training session. The cognitive reciprocity between the video game and the "real world" allowed this *Expert* player to make a connection between prior experiences and the virtual space. Although Jennifer did not complete all of the milestones, she remained engaged during the game play action and expressed her enthusiasm for video games during her *Post-Game Play Interview* when she calmly answered, "Oh, yeah it was fun." When asked by the researcher, "Did you enjoy playing the video games?

Rashid, an *Expert* player with an 88% (n=15) (See Figure 4.3) milestone completion rate, was able to demonstrate the metacognitive transference of his own understanding during the following segment of the *Post-Game Play Interview* centered on the use of weapons inside the *MOH* training session.

Researcher: Another thing I noticed is you are really, really accurate with guns. Why do you think you are accurate with guns?

Rashid: Because I hunt a lot.

Researcher: You hunt a lot. OK what has that got to do with -I know- but I want you to tell the camera. What has that got to do-

Rashid: If you hunt you learn how to aim -um- because if you miss, it's gonna cost you.

Researcher: What do you mean by costing?

Rashid: Like you could lose a game or something. And if that's your last chance you'll have to start all over again. So, you just be accurate the first time.

Researcher: Yeah, but how do you get- how are you accurate?

Rashid: You just have to learn how to dial up right - on the handgun you have to put a - just right - and if it's a machine gun, you have to aim low because they kick up - Yeah - you have to aim low with the machine gun 'cause it kicks up. It will kick up right - You have to aim it [the gun] just below it [the target] it'll aim - it'll kick up just a little bit and it won't -you have to aim it [the gun] just below it [target] it'll aim - it'll kick up just a little bit and it won't-

Researcher: Which one kicks the most, of the three?

Rashid: [The] machine gun. (thinking) well maybe the rifle. (.) Probably the high powered rifle.

Researcher: Oh. OK.

Rashid: But it's [high powered rifle] more accurate because it's got a scope.

Researcher: So. You knew how to go back and forth between -one thing I noticed is that it is really easy to go back and forth between the scope and open sighted so you knew that pretty well. You've done that with the other=

Rashid: =I've shot with shotguns and then I have a rifle so.

Rashid used what he knew about real world experiences with guns and the physical fidelity of virtual weapons and the "cost" of loosing inside a video game. He readily assumed that the weapons in the video game were similar to the one he had used for hunting. His active metacognition was evident when he determined that "the high powered rifle" kicks the most and will "kick up just a little bit." This observation may also be due to the physically fidelity (realism) of the rifle within *MOH* (i.e., after the player fires a round with the *Springfield 03*, the screen action replicates the "kicking motion" of a real rifle). Although Rashid was an *Expert*

player, his *Game Play Analysis Log Sheet* revealed he was more focused on acquiring a weapon, "Give me a, gun." than following instructions from the commander. He also noted that, "big guns are fun to shoot in the game". Perhaps, as an *Expert* player, Rashid's idea of engaging with a virtual space was focused and goal oriented. He may have understood that the first order of business in a video game is to compile a quick inventory of the video game affordances (Give me a gun).

Michael, an *Expert* player (Figure 4.3), completed 76% (n=13; M4 through M16) of the milestones and was quick to adapt to the keyboard. During Michael's *Post Game Play Interview*, when asked, "How did you like the controls and the keyboard?" he answered, "I am used to the arrow key but once you get used to this (pointing to keyboard) - right there - then you can pretty much do it (use the keyboard) without lookin'. I had to –it took me a minute to get used to it though." His quick adaptation to the keystrokes may have been due to his ability to attend to both the oral and written instructions on the screen or the physical fidelity between *Medal of Honor* and many other video games. Again, during his *Post Game Play Interview*, he noted, "The voice would remind me to look up there (written instructions), but I would have to read it because he (the commander) he'd tell you to click the pick up button and the pick up button happened to be an [e] and you had to read it. . . ." Listening to instructions was not the only game convention Michael attended to for successful completion of the milestones of the game.

Michael's play trajectory, which close mirrored that of the IDEAL time, may have been due to the fact that he was able to effectively employ the compass. The compass (Figure 4.4) in *Medal of Honor* consists of a compass with N, S, E, W; an arrow which indicates the direction the player is currently facing; and two ball bearings which moves closer together as the player advances toward an objective.

Figure 4.4. Compass in Medal of Honor

During the *Post Game Play Interview*, Michael reflected on whether the compass was useful,

> **Researcher:** What did you think of the game compass map? Did it help you at all?
>
> **Michael:** Yeah because when I finally started – I just turned around until the arrow (on the compass) was facing it and I just walked straight.

Both Michael (76% milestone completion rate) and Rashid (88% milestone completion rate) were the two *Expert* players who were able to effectively combine what they had learned outside of the game with the affordances of the training session. Additionally, the prior experience playing video games may have contributed to their ability to move through the training part of the game as quickly as they did. Data revealed that some *Expert* players skipped various Milestones because in *Medal of Honor,* the game's convention does not require players to complete Milestone 1 through Milestone 2 in order to advance to the next level. However, player must finish milestone M3 which is "Approach the tower indicated by the arrow on the compass," otherwise, the net on the wall next to the crates would not collapse in order to jump forward over the crates. While two *Expert* players demonstrated minimal action, and even

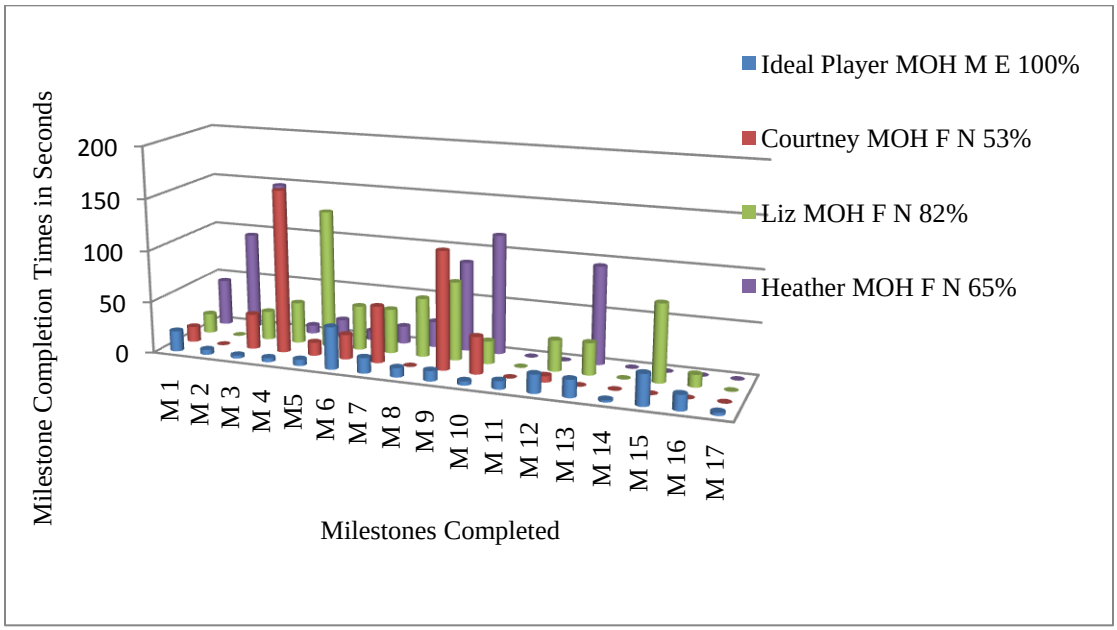
skipped M1-2, *Novice* players often struggled with different components of the training session and demonstrated excessive action.

Medal of Honor Novice Player Trajectory

The *Novice* play trajectory (Figure 4.3) revealed several areas of player divergence.

For instance, Courtney struggled to complete Milestone 4; Liz engaged in extended play time as she learned to crouch during M5; all three players became disoriented after climbing and descending the ladder in M6; Courtney, Liz, and Heather used extended time learning how to pick up and place explosives during M8 and M9; and Heather had difficulty completing M10 and 13. None of the *Novice* players completed all of the Milestones in the allotted time. According to Courtney, during the *Post-Game Play Interview*, "It is hard to listen, read the words and while moving during the game at the same time."

Figure 4.5. Medal of Honor *Novice* Player Trajectory



MILESTONE 4

For instance, *Novice* player Courtney (n=9; 53% milestone completion rate) had similar difficulty scaling a pile of crates as Jennifer, an *Expert* player (n=4; 23% milestone completion rate) on Milestone 4 (Table 4.1).

Table 4.3. M4: Jumping over Pile of Crates.

Player	Seconds
Jennifer (Expert)	249
Courtney (Novice)	158
Liz (Novice)	40
Heather (Novice)	8

Because Courtney, one of the *Novice* players, had a similar milestone completion rate as Jennifer (see Figure 4.3), an *Expert* player, on Milestone 4, further analysis of the specific Milestone was in order. The increased time interval may be due, in part, to the fact that climbing the crates required a combined keystroke of [w] for forward and [space bar] to jump. The narration simply instructs the player to press the "forward" and "jump" key to climb the crates. At the crates milestone (M4), the game convention assumes the player knows what key combinations are needed to complete this task because the key combination is flashed on the screen for a few seconds after the narration is completed. Because the player did not have sufficient opportunities to learn to use the forward [w], backward [s], right [d], and left [a] keys, adding a new key combination may have distracted the player from making the connection between the oral and written instructions for use of this particular aspect of this game's convention.

At the beginning of the *Medal of Honor* training, the commander specifically instructed the player by stating, "You have a new objective now complete it. Press the jump and forward keys to jump up on this pile of crates." The narration was so quick that all three of the *Novice* and one of the *Expert* players had difficulty with the oral instructions. During the *Post Game Play Interview*, when asked by the researcher, "When you stopped the game, what were you thinking?" surprisingly, Jennifer the *Expert* player answered, "Um, I need to figure out how to get over this wall." The common problem for most *Novice* players in *MOH* was how to use the key combination in order to advance through the training part of the game.

Figure 4.6. Medal of Honor Milestone 4: Jump up on Crates

In this milestone (M4), when the commander stated, "Press the jump and forward keys to jump up on this pile of crates." Liz could not determine where the *jump* key was on the keyboard. The oral instructions did not match the keyboard functions (there is no key labeled jump on the keyboard). The information, which would have supported players, was provided textually in the written instructions (flashed on screen for a few seconds). Data revealed that the

relationship between the oral instructions, written instructions, and players action seemed quite indirect. Each objective was specific in the type of learning which took place and the affordances in the game which players must employ. This difference was expected because the training session should have prepared the player to use different conventions to successfully complete or engage with *Medal of Honor* "missions." While Liz was tenacious, she still struggled with the next milestone.

MILESTONE 5

Novice player Liz (n=13; 82% milestone completions rate), spent more time learning the game conventions for M5 (133 seconds) than M4, which was to crawl under a set of barbed wire fences (Figure 4.7).

Figure 4.7. Medal of Honor Milestone 5: Duck under Barbed Wire

The difficulty Liz experienced during Milestone 5 was complicated. The game conventions at this point have shifted. No longer was the player using keystrokes to simply move forward, backward, and side-to-side. The *Novice* has learned, with some difficulty, to coordinate

the space bar (jump) + w (forward). While Liz seemed to cognitively adapt to the challenge of climbing the crates, she struggled with the barbed-wire fence. At Milestone 5, a delay between the narrative and written instructions shifts from simple instructions to player action which required that the player be cognizant of the instructions and simultaneously attended to both the written and oral instructions. The player was cued using the following directives,

> **Commander:** Press the duck key and then move forward to pass under the barbed-wire.
>
> **Screen Display:** Press d duck (fades in and out quickly)
>
> **Commander:** Press the duck key again to stand up. Look up and press the forward key and you will climb the ladder. Press the use key to grab a ladder from above or below.

Again here, there was no clear indication of what the *duck* key was after the split second written instructions have faded out. In other words, when the player becomes confused or does not remember what key to use, there was no method to retrieve that information. (See Appendix E and F for list of key controls). Even the ideal player struggled with the duck [d] key function. The ideal player ignored the oral and written instructions and employed the *ctrl* key (instead of the [d] key) to crawl under the barbed-wire fence. *Novice* players either did not hear the instructions on how to *duck* or they did not follow the information on the screen. The redundancy of instructions was intended to provide the player additional game options to overcome difficulties with instructions. While Courtney remembered crawling under the barbed-wire fence, during the *Post Game Play Interview*, and was able to adequately articulate the oral instructions from the commander,

‘Cause at first (the narrator) told you when you come to an objective, crawl under the fence. It told me how to duck, go under there, and it told me how to go up the ladder, down the ladders . . .she was not necessarily able to apply the oral instructions during game play action.

MILESTONE 6

All three *Novice* players seemed to become disoriented after completion of the descend action on the ladder (Figure 4.8). This disoriented action may be due, in part,

Figure 4.8. Medal of Honor Milestone 6: Climb Ladder

because players had not yet learned to use the *forward* [w] key in conjunction with the *use* [e] key to grab the ladder to correctly ascend. The oral instructions from the commander state, "Look up and press the forward key to climb the ladder." Simultaneously, the displayed written instructions for climbing the ladder stated, "Press the forward key [w] to climb the ladder." As the player moves to follow the oral instructions (for moving forward), the commander then instructed the player to "Press the *use* key to grab a ladder from above or below (Display: Press the use [e] key to grab the ladder from above or below). The difficulty players found with this milestone may be that the player action did not match the use key instructions from the commander. After the commander instructed Courtney to, "Look up and press the forward key to climb the ladder," she successfully did so without needing to press the *use* [e] key to ascend the ladder. After Courtney successfully climbed the ladder, the commander's

instructions asked her to press the *use* key to grab the ladder. Courtney's player actions did not reflect that she had heard that specific instruction. Perhaps Courtney did not anticipate more instructions while she was still in the process of climbing the ladder.

Figure 4.9. Compass Display After Courtney has Jumped off Ladder

Moreover, the player did not have to press the use [e] key to ascend the ladder. The *Novice* players were not as able to coordinate their efforts, or did not hear the instructions, and jumped down without properly descending the ladder. This action resulted in lowering the player's health level, as evidenced by a red tint appearing on the compass (Figure 4.9). A lowered health level is not critical in the training session, but may be important as the player advances into combat (during *Medal of Honor* missions).

MILESTONE 8

All three *Novice* player actions had extended time with Milestone 8, which asked the player to pick up an explosive by pressing the [e] button. The *Novice* players may not have been able to metacognitively comprehend a connection between the commander's oral and written instructions for completion of the task (remember that all of the *Novice* players skipped the grab function [e] of descending the ladder). Instructions for completion of Milestone 8 are as follows,

Commander: Approach the explosives and press the use key to pick them up.

Screen Display: Use key is [e].

Commander: Notice that an image of the explosives has appeared in the upper right hand corner of your view. This shows you the items in your inventory. The other image represents the radio through which we are communicating. A red transparent image of the explosives has appeared on the tank.

Perhaps the *Novice* players found this task (Figure 4.10) cognitively difficult because the commander has moved away from simple instructions to providing information on how to view the inventory. The commander talked about placing the explosive after extraneous information to the task, "This shows you the items in your inventory. The other image represents the radio through which we are communicating." At this juncture, learning to view the inventory was not cognitively relevant to successfully placing the bomb on the tank.

MILESTONE 9

Courtney, Liz, and Heather all had difficulty placing explosives on the tank (Table 4.2). Courtney, in particular, walked around the tank as though she did not understand how to place the explosive on the tank. The training provided a *ghost icon* on the tank, which guided player to the correct placement of the explosives. The player must be close enough, recognize and be able to react to the optimal conditions for this to occur. Although during Courtney's *Post-Game Play Interview*, she did remember "the things that were written- he would say things like explosive key and it would be [e] and I'd have to read it. . ."

Table 4.4. Milestone 9

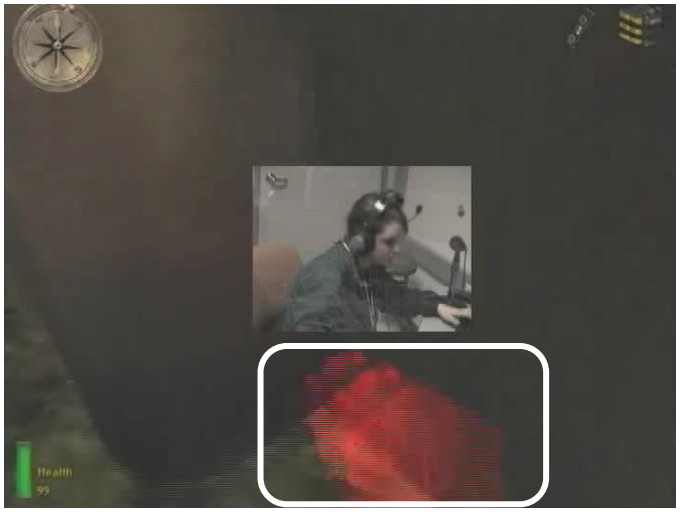
M9	Seconds
IDEAL	10
Courtney	114
Liz	76
Heather	87

In this segment of the *Game Play Analysis Log Sheet*, Courtney attempts to plant the explosives 4 times. During the first attempt, Courtney listens to the instructions from the commander, and takes twenty seconds to approach the tank and press the *use* [e] key to place the explosives on the tank. After Courtney thought she had placed the explosives, she "ran for cover" behind the crates where she had just picked up the explosives. She turned around and waited 5 seconds for the tank to explode. While still waiting for the tank to explode, she looked at a jeep inside a protective cover, then at a stack of barrels seeming to still be waiting for the tank to explode.

Figure 4.10. Medal of Honor Milestone 9: Place Explosives on Tank

Realizing that the tank has not exploded, she pressed the *tab* key to display the *Mission Objectives* (Figure 4.10) and returns to the tank. She then used the forward [w] or jump [space bar] function 3 times to plant the explosives.

Figure 4.11. Explosives Indicator (Red Ghost Icon)



Finding no results, she immediately moved further along the side of the tank to see if there was another place to plant the explosives. As she moved around the back of the tank, the red ghost icon (indicates correct placement for explosives) became evident (Figure 4.11). After Courtney moved close enough to the red *ghost icon* on the tank, she successfully planted the explosives on the tank. As the ticking sound of the time clock begins, she instinctively ran for cover near a set of doors (Figure 4.12) at the entrance to the weapons training area, which contained the next Milestone.

Figure 4.12. Door at the Entrance of Weapon's Training

When asked if Courtney had ever played *Medal of Honor* with the keyboard, Courtney responded,

I thought it'd be kinda' like the XBOX (I'm) kind of used to the one on that. . . I just kind of knew what forward and backward was and how to switch -and there's two controllers. [There's] one's to move it and ones to move around so I thought if this one's [moving right hand] the mouse and this one's the [moving fingers on left hand] (I) pretend that was that. They weren't that difficult to learn because they weren't all together.

Although Courtney took longer to place the explosives on the tank, her cognitive ability demonstrated what she understood about "finding cover" within a game environment. The "finding cover" action indicated her ability to either follow oral instructions from the commander or the need to protect her player from explosives from other video games. She was also able to recall and effectively used the *Mission Objective* key. While the "plant the explosives" player action was extended compared to the IDEAL player completion time, she did learn to do so. As such, Courtney demonstrated that mistakes were simply a normal component of the learning process.

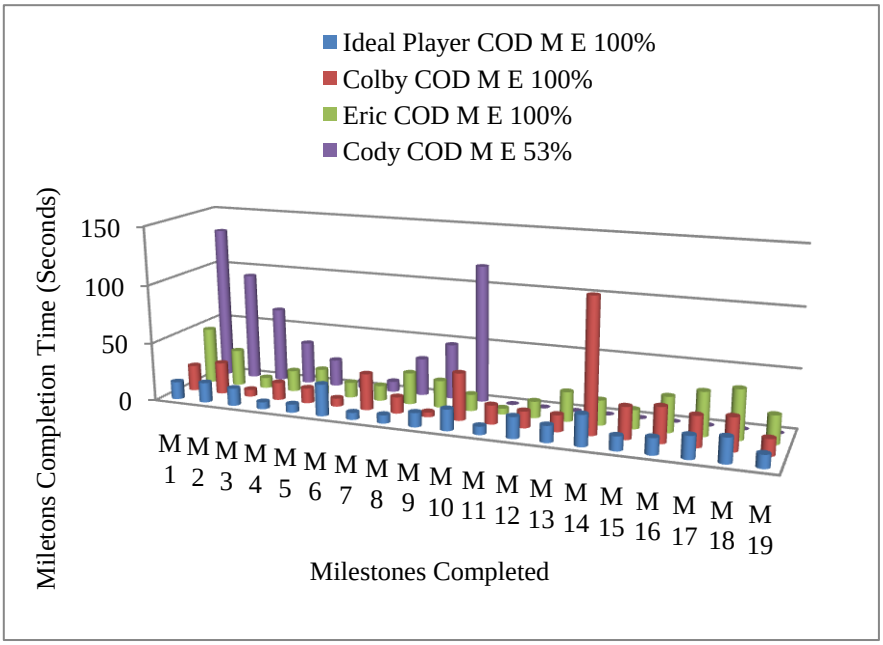
The intricacies of successfully completing the training session found in *Medal of Honor* were not unlike that of the training session found in *Call of Duty*. Next, *Expert* and *Novice* player trajectories are discussed during the training session of *Call of Duty.*

CALL OF DUTY EXPERT PLAYER TRAJECTORY

The *Call of Duty* training session was different than *Medal of Honor* in several ways.In *Medal of Honor*, the first two milestones (looking at towers and approaching the tower using the compass) did not require completion of the first two objectives in order to advance through the

training session. After the player approached the tower a wire net above the next milestone (wall) collapsed which allowed the player to move on through to the next objective. In this manner, the *Call of Duty* training session will not allow the player to advance until each milestone has been completed.

Figure 4.13. Call of Duty Expert Player Trajectory



For example, an *Expert* player spent extended time on M1 (Figure 4.13 looking at signs) and M9 (pick up M1A1 Carbine). The time spent on these two milestones, was more than likely, one of the reasons Cody (with a 53% completion rate) did not systematically (sequentially) complete the remaining portion of the training session in the allotted time. For Cody, looking at the signs did not seem intuitive, perhaps because he had not yet learned to listen to Lieutenant Foley, the training commander.

Figure 4.14. Position of Signs during *Call of Duty* Milestone 1

Cody's difficulty, with M1, seemed surprising because the instructions for *Call of Duty* tended to be more visible than *Medal of Honor*. For instance, instructions for completing each milestone and the narration of the commander were displayed in the center of the display screen with the compass placed at the bottom left hand corner (Figure 4.15).

Figure 4.15. Call of Duty Compass

The instructions tended to remain on the screen longer with a font that was more visible (larger and brighter) than *MOH*. Another explanation for player action delay (Cody) could have been due to the low-resolution video card and slower system (processor) in the computer, which may not have allowed the player to clearly read the instructions yet. Another explanation could have been the extensive amount of written information displayed on the screen may have added to the difficulties some of the players encountered while playing video *COD*.

As expected, Colby and Eric had similar trajectories to the IDEAL play time with 100% completion rates (Figure 4.13). Although Colby demonstrated extended time completing M14 (Switch weapon and shoot target 3 times using the left mouse key), he did complete all of the

Table 4.5. COD Milestone 14

M14	Seconds
IDEAL	26
Colby	113
Eric	21

objectives. There was no data in either the *Game Play Log Sheet* or *the Post-Game Play Interview,* which indicated why Colby had difficulty with M14. Perhaps, Colby simply enjoyed shooting his weapons and lost track of time.

Eric, an *Expert* (100% completion rate; n=19), revealed important information about successful game-play actions. Figure 4.14 reveals that, of the *Expert* players who chose *Call of Duty,* Eric was the player who most closely mirrors the ideal player trajectory. Further data from the *Post-Game Play Interview* revealed some of the reasons why Eric, an *Expert* player was able to complete 100% (n=19) of the milestones. Eric's prior experience allowed him to problem-solve his way through challenges at specific milestones. According to Eric, "I am used to arrow keys . . . I mean you can figure out without looking at the keys. It took me a minute to get used to

it (the keyboard functions)." Not only was Eric able to employ *fidelity of function* between the keyboard and a game controller, he was also capable of multitasking. As Eric notes, "The voice reminded me 'Look to up there,' but I had to read it and look up there - because he tells you (the commander) 'click the pickup button' - and the pick up button happened to be [e] and I had to read it." Eric also knew that mistakes were part of the learning process and that starting over might remedy periods of disorientation during the rifle training.

Figure 4.16. Call of Duty Rifle Training Area

Researcher: Ok- um. Why did you stop in one area and you weren't sure where you were going and went back?

Eric: I just went back and restarted again, try another path, just went back and restarted, so I find it which way goes with it.

Researcher: What caused you to do that?

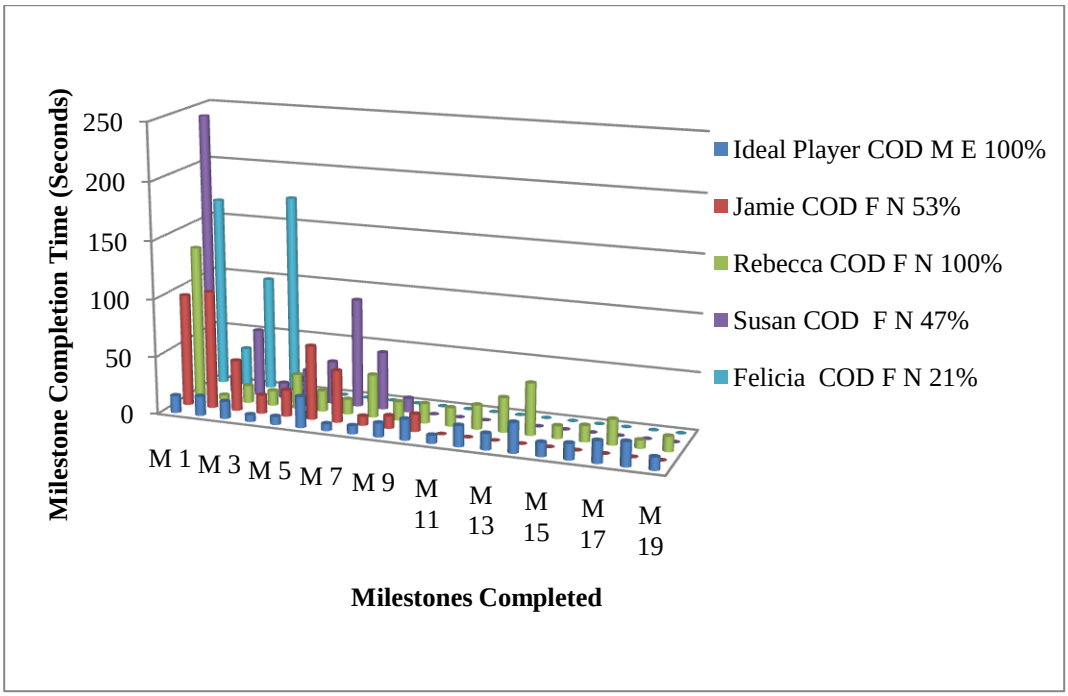
Eric: I - I thought I went to the wrong way because there was no exit to the next place and I went to the next exit so I tried another exit.

Eric demonstrated his capacity to metacognitively negotiate unknown settings when he stated, “I thought I went the wrong way because there was no exit to the next place.” Most importantly, Eric internalized the restart nature of games when he discussed the manner in which he negotiated losing his way when he said, “I just went back and restarted again, tried another path. . .” It appeared his *Expert* understanding of games, in general, allowed him to thoughtfully retrace his steps. In some cases, restarting the video game may help players to reorient themselves and regain the control of the game play action. Starting over is not the only method through which players negotiate game conventions. In the next section *COD Novice* player trajectories are explained.

Call of Duty Novice Player Trajectory

As with one *Expert* player (Cody), all *Novice* players had difficulty with M1 (look at 5 signs), Jamie (53% completion rate: n=10) M2, Susan (47% completion rate: n=9) played up to M9 but struggled on M1, M3, and M6, Felicia (21% completion rate: n=4) stopped on M4, Rebecca (100% completion rate (n=19) was the *Novice* player who most closely mirrored the IDEAL play trajectory (Figure 4.17). No specific pattern emerged from the *Call of Duty Game Play Log Sheet* or *Post-Game Play Interviews.*

Figure 4.17. Call of Duty Novice Player Trajectory



Each player trajectory held unique play patterns with learning the intricate ways to negotiate the training course. For instance, Jamie's time ran out at M10 while she was shooting the target with the M1A1 Carbine. Susan's time ran out at M9 after she picked up the M1A1 Carbine.

Felicia, the player with the lowest completion rate, technically followed instructions from Lieutenant Foley, but did not complete the firing range. For instance, at M9, Felicia picks up the M1A1 Carbine but only fires the weapon three times when the verbal and written instructions asked her to "hit the target six times."

Figure 4.18. Call of Duty Grenade Practice Area

After Felicia randomly shot at targets, she then moved to the area with the grenades (Figure 4.18). As Felicia moved to the grenade table, where Lieutenant Foley asks her to, "Throw grenade into one of each of these openings before you rock and fire," she picked up a grenade, missing the opening of the target and then made several attempts to throw the grenades into the concrete barrack holes. Unfortunately, none of the trajectories Felicia selected results in an effective throw. Greater *Physical fidelity* within the game (feedback from the Lieutenant) would have allowed Felicia an opportunity for improvement. Perhaps Felicia's extended time with the grenades was due to her *Novice* experience. For instance, learning to bounce an object in just the correct manner takes practice and extended time, time which was not available to Felicia.

In *Call of Duty*, looking at the five signs (M1) seemed to be universally difficult for the four *Novice* players. Successful player action required a certain distance for the commander to state, "OK, close enough." Susan, a *Novice* player, with a 47% (n=9) completion rate, did not determine this optimal distance between her position and the signs in order to hear the "beeps"

which indicated completion of M1. Again, in *Call of Duty*, if the player did not finish this first Milestone, the affordances of the game will not engage the next player action. When used correctly, the compass (Figure 4.19) was an important tool for navigation through the training course.

Figure 4.19. Call of Duty Compass

First the compass acted as an objective locator. According to the instructions from Lieutenant Foley, "As you approach your objective your star (in the compass) will move to the center." While Lieutenant Foley provides instructions, the compass has a circular halo emanating from the center of the star. Foley continues, "In addition, the location of your current objective is marked by the star on your compass." As the player moves toward the next objective, the star moves accordingly. During M2, the player must coordinate action with the compass in order to move toward a sign. The white triangle next to the compass indicated which position the player (as a soldier) was in. For instance, when the player used the [c] keystroke to move into the crouch position, [ctrl] was used to move into the prone position, and [space] to jump, the position of the image (the soldier in the triangle) changes based on the selection of keystroke.

Jamie, a *Novice* player with a milestone completion rate of 53% (n=10) had some difficulty with M1 and M2 which are to look at the signs and approach one of the signs using the compass. Before M1, the commander says, "OK, Listen up. Private Martin, you are on the obstacle course and doing weapon's training today. Before starting the obstacle course, read each of these important signs. Do what they tell you." After the player looks at a sign, there was an audible "beep, beep" which signals completion of M1 which helps player to continue with the rest of training session.

Novice player Rebecca, with a 100% milestone completion rate (n=19) seemed able to attend to and follow the instructions from Lieutenant Foley. After completion of M1, the commander (Figure 4.20) stated, "Good. Now check your objectives. You'll notice that your current objective is highlighted. In addition, the location of your current objective is marked by the star on your compass." When the star on the compass was in the correct position, the commander continues with his instructions. "That's it, close enough. You will notice that objective is checked off and you now have a new one. OK. Martin, open the gate and run the obstacle course. Go! Go! Go!"

Figure 4.20. Position of Lieutenant Foley after M2

Rebecca seemed to attend to two ball-bearings on the compass (See Figure 4.20) in order to determine the correct pathway through the training session. During the *Post-Game Play Interview,* Rebecca reflected on the time she spent completing objectives, "Um. It made me think that maybe I didn't do something right. And then I just -it made me feel like sort of disappointed in a way but not really. Because then I finally did finish it. And it made me happy that I did finish it." At this juncture, Rebecca seemed satisfied with what she accomplished during the training session of the game.

M3 OPEN GATE

Jamie, Susan, and Felicia had difficulty finding the gate (Figure 4.21), which allows the player to begin the confidence course. This difficulty may have arisen because the commander did not provide specific directions or feedback for the gate (the player determines the correct direction for the gate by attending to the compass) and background noise from other trainees yelling.

Figure 4.21. Milestone M3: Open Obstacle Course Gate

Perhaps, the commander's instructions (game conventions) could have assisted the players to overcome some of the difficulties they encountered during the playtime. This is related to Vygotsky's (1978) "zone of proximal development" (ZPD). A ZDF is the cognitive distance between a child's "actual development level as determined by independent problem solving and the level of potential development as determined through problem solving under the direct guidance or in collaboration with more capable peers" (p.86). This implies that if a game system could monitor and identify when a player needed help at reaching a goal, it would in fact be calculating the ZPD of a player and could then offer guidance.

In part, the manner in which instructions are presented in *Call of Duty*, neither allowed a player the flexibility to miss one obstacle and go to the next milestone nor provided players with immediate feedback with what the player must do in order to advance to the next milestone. For instance, if a player did not identify the correct method for opening a gate (M3), the player was not able to progress any further. At the gated entrance to the concrete tubes (M4), Felicia

demonstrated an observable level of frustration and repeatedly paced back and forth seeming to look for the next objective. Observational notes, during the *Game-Play Log Sheet,* revealed that Felicia first attempted to open one gate at the end of a road and did not use the compass to determine which direction she should move to find the correct gate, which was just out of the view (Figure 4.21). The game convention of having multiple gates to open may have added *cognition and metacognition* to engage the player in problem-solving or critical thinking, for Felicia, the game convention reduced her propensity to advance through the training course. The *game environment* with real world scenarios allows players to employ tactical strategies, which may help soldiers in the battlefield where split-second decisions may save a soldier's life. However, a lack of clear instructions for Felicia simply cost her time and increased her disappointment. If Felicia had unlimited time at her disposal, the outcome of her training session may have been different. Practice and time is an important component of both *COD* and *MOH*.

TRENDS IN DATA

As a final point, data revealed no direct relationship between both *Novice* and *Expert* player actions on specific milestones in both *MOH* and *COD.* While *Expert* players tended to mirror the ideal game play, several *Novice* players were able to complete the training sessions quickly as well. In both *MOH* and *COD, Novice* players did not necessarily understand how to follow instructions from the commanders or were able to use the compass to navigate. For instance, several *Expert* players ran out of time during *MOH* due to extended player action during milestones M4 and M8. Similarly, *Novice* player action revealed extended playtime with milestones M4, M5, and M9. The delay between oral and written instructions may have influenced completion rates. In *COD*, both *Expert* and *Novice* players spent extended time with milestones M1 which may have been due to the large amount of information presented during

the onset of the training session. Three of the four *Novice* players spent extended time with milestones M2, M3 and M4, in *COD*. Although both *MOH* and *COD* have many similar objectives and key functions (Table 4.4), the completion rates were unique to each player.

Table 4.6 . Keystrokes Needed to Complete Milestones in *MOH* and *COD*

Milestones	MOH	*COD*
1	Use your mouse to look at each of the four guard-towers.	Use your mouse to read each of these important signs.
2	Press [w] to move forward! Press [s] key to move backward Press [a] to move left and [d] to move right.	Press your Move Left key [A] to move left Press your Move Right key [d] to move right Press you Move Forwards [w] to move forwards Press your Move Back key [s] to move backwards
3	Press [tab] to see your list of objectives (upper left-hand corner of screen)	Press [tab] to see your objectives (upper left-hand corner of screen)
4	Approach the tower indicated by the arrow on the compass.	Approach the sign indicated by the compass star.
5	Press [space] to jump. Press left [ctrl] to duck. Press left [ctrl] to stand up.	Press [c] to crouch. Press [space] to jump. Press [ctrl] to go prone.
6	Press [e] key to grab a ladder or grab explosives etc.	To pick up weapons. Look at it and press use [f].
7	Throw a grenade into each of the concrete box	Throw a grenade into one of each of these opening before you. Rock and fire!
8	Press [e] on the red door to exit the firing range	Well done. Keep your weapons with you and clean at all times. You are dis:smissed.

In an attempt to establish a consistency between *Expert* and *Novice* player's action times for MOH and COD within the games, the data is categorized based on player's action mean times on similar milestones which players exhibited fewer patterns of consistencies in each milestone as established in Table 4.7.

Table 4.7. Mean Comparisons Times in Seconds on Similar Milestones

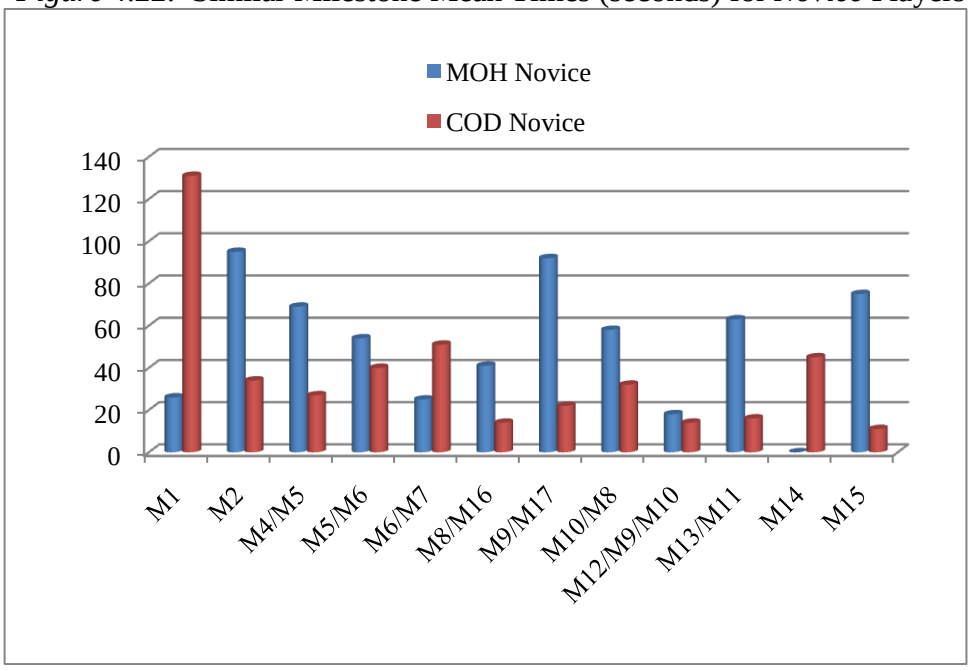
MOH			COD		
Milestones	Expert*	Novice*	Milestones	Expert*	Novice*
M1	0	26	M1	67	131
M2	25	95	M2	50	34
M4	93	69	M5	19	27
M5	116	54	M6	9	40
M6	30	25	M7	18	51
M8	40	41	M16	30	14
M9	36	92	M17	32	22
M10	23	58	M8	24	32
M12	42	18	M9/M10	41	14
M13	42	63	M11	11	16
M14	81	0	M14	67	45
M15	43	0	M15	22	11

*time reported in seconds

Figure (4.22) presents a comparison between similar milestones Mean times for *Novice* players in *MOH and COD* which exhibited differences between similar milestones. Given the similar nature of these milestones, the result is "strikingly different." The data revealed that players seemed to encounter different level of actions which may have caused to react to each

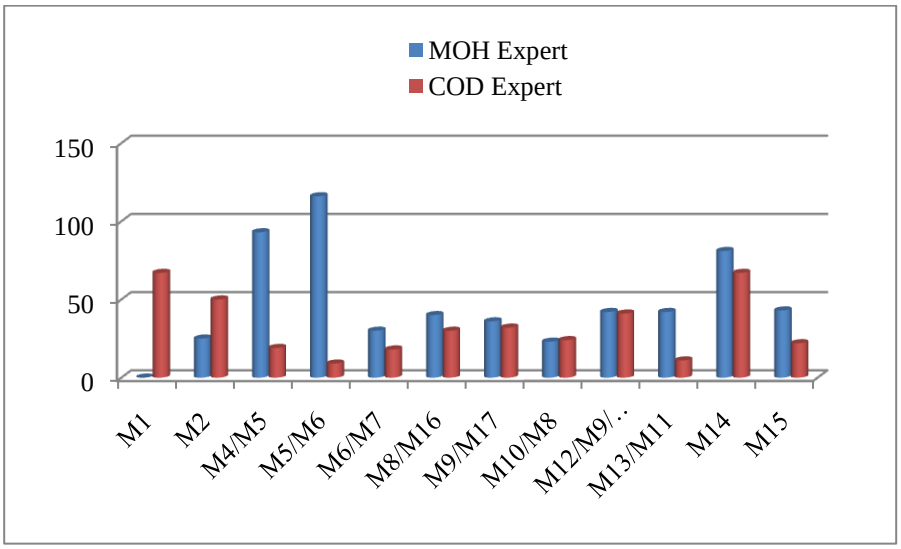
milestone based on the game fidelity such as; jump, climb, crawl, crouch, throwing, and planting explosives during play action time.

Figure 4.22. Similar Milestone Mean Times (seconds) for *Novice* Players



Expert play mean times (Figure 4.22.) between *MOH* and *COD* exhibited three Milestones with similarities; M9 (*MOH*)/M17 (*COD*) placing explosives, M10 (*MOH*)/M8 (*COD*) passing through a door, M12 (*MOH*)/M9 (*COD*) pick up gun and shoot (Figure 4.23)

Figure 4.23. Expert Mean Time (seconds) Comparison Between *MOH* and *COD*



Placing explosives mean times between *MOH* and *COD* was 36 and 32 seconds respectively. Opening/passing through doors had similar mean times between *MOH* and *COD* which was 23 and 24 seconds. Picking up a gun and shooting mean times were similar between *MOH* and *COD*, 42 and 41 seconds, respectively. Similarities in players shooting mean times, may have been due, in part, because placing explosives and shooting a gun had differences in fidelity between games which player had to acquire different weaponry by analyzing information on the screen while paying attention to the game. Simultaneous actions may have inhibited players consistency among *Expert* players in *MOH* and *COD*. These differences were centered on the manner in which the narrative and written information in each game instructed players to place explosives and pick up guns that may have inhibited player to use multiple inputs to take corrective action.

More intriguing than patterns of similarity, were the different *Expert MOH* mean times for the milestones (M5/M6), which required players to crawl (duck) under the barbed-wire fence. Video data revealed that *Expert* players had longer completion rates (Figure 4.23) in *MOH* than

in *COD* (*MOH* 116: *COD* 9). In *COD*, as the player approached the barbed-wire fence, other soldiers were in the screen allowing the player to recognize the need to duck and crawl under the fence. Additionally, in *COD*, the instructions remain on the screen longer than in *MOH*. As discussed earlier, in *MOH* "there was no clear indication of what the *duck* key was after the split second written instructions have faded out." While game-play action mean times held some patterns, these patterns exhibited fewer player consistencies in each milestone. Players seemed to respond metacognitively based on a discovery method by playing with the rules of the games as they advanced through each milestone.

The unique trajectory of completion for each player has major implications for instructional and game designers, which requires further study. While the potentials for interactivity among players may differ, consistency of games convention (key combinations Ctrl+ W to crawl and move forward or static visualization, soldier in prone position, compass) may exhibit different results. The next chapter will discuss the summary of research questions, conclusions and implications, limitations, and future directions and reflections.

CHAPTER 5: DISCUSSION AND CONCLUSIONS

The immersive learning environments used in this study engaged players as they strategically explored simulated military training. Using the Experiential Mode Framework (EMF) methodology (Appelman, 2007; Yin 1994) facilitated the micro-level examination of intricate decisions players made in reaction to instructions within the game. The manner in which players responded to instructions then, assisted with answering the three research questions which were the focus of this study**.**

RESEARCH QUESTIONS

1. *What are some key attributes in the video games Medal of Honor and Call of Duty that facilitate learning?*

As Reigeluth's Elaboration Theory (Becker, 2007) noted, a well designed game requires that a player must learn to solve a condition for success. Post-game play analyses revealed that most players were able to employ cognitive engagement strategies to explore solutions to complete the objectives. To better understand how players managed to overcome some of the challenges and attributes within the game, I shifted my focus on Courtney, who was not initially able to plant explosives on the tank in (*MOH)*. Courtney strategically moved away from the tank to shield herself from a perceived impending explosion, a common reaction found with most players. After not hearing the sound of an explosion, Courtney returned to the tank to determine why the explosives were not detonated. Using a combination of text-based and oral instructions, sounds, and images within the game, Courtney was able to successfully complete milestone (M9) "plant explosives". Different sequencing and/or timing of these attributes may have improved or even hindered Courtney's success.

Learner Control

Learner control, or the ability to make choices in the game, allowed players the opportunity for an individualized experience with the *content* of the training session such as how to acquire increased health using the First-Aid kit or communicating with the commander through the use of a walkie-talkie. Similarities with other video game conventions provided Rashid the background knowledge to strategically apply the game affordances. While Rashid was focused on acquiring guns, he was also able to employ his prior experience with military hardware in conjunction with instructions from the commander to easily move through the weapons training area in *Medal of Honor* (*MOH*). His observed confidence with video game play was a direct consequence of his ability to apply previous knowledge toward a current task.

Audible and Visual Attributes

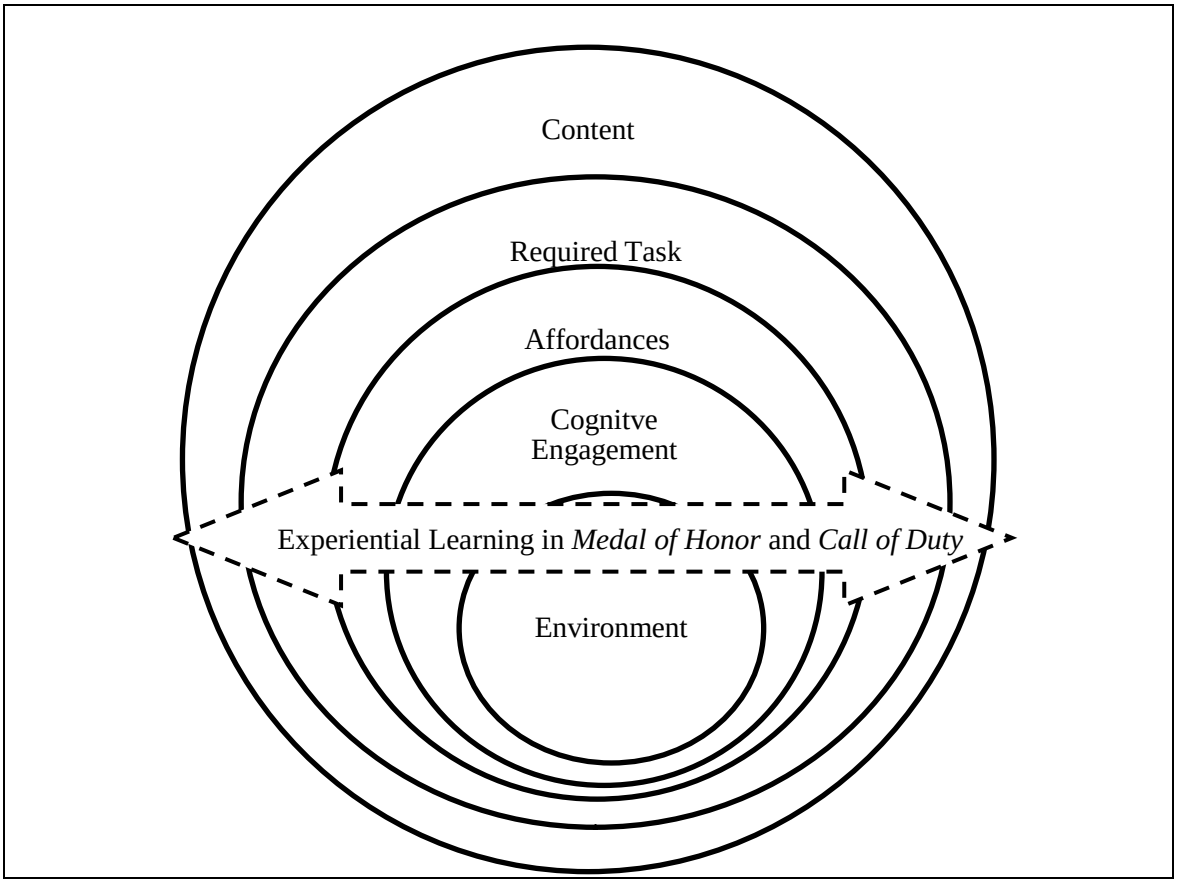
While audible game attributes (instructions from the commander) were employed to teach affordances in each game, visual attributes such as the compass and keystrokes combinations, also presented instructional information and allowed for a varied player experience depending upon which attribute was attended to by the player. Through an experiential lens, players learned how to employ problem solving during the training sessions. For instance, throwing a grenade required players to employ a trajectory in concert with specific key combinations by pressing number [1] on the keyboard for a long trajectory, and pressing [2] for a short trajectory. Through a socio-cultural interaction with the training commander, players reacted to the entertainment component of the training course. For example, the commander in *COD* sarcastically addresses the trainees that this is not, your aunt Fanny's dance, or Martin good to see you, they got your sorry butt here too. Huh? Hey, good luck, Move it ladies."

CONTENT DESIGN

Players were exposed to the environment of military training through exposure to the culture of military training. While the designer of *Call of Duty* did intend the video game to support and incorporate elements from war movies, many aspects found in the training session attempted to portray military culture accurately. Players were expected to crawl under a fence with the sound of bullets whizzing across one's head while a commander barked orders. Both *Call of Duty* and *Medal of Honor* simulated the psychological aspects of military training. This entertainment-induced energy seemed to motivate players to remain engaged despite some obvious apprehension from players as they advanced through the course. In short, the "hype" and drama of video games support players' motivation to "learn." As Rashid casually noted, mistakes "will cost you." Courtney was able to address her own learning within game play with her straightforward comment, "You just have to learn to do it." While, entertainment may have been a motivating factor, affordances also helped with cognitive function.

Call of Duty and *Medal of Honor* effectively combine important learning aspects from Reigeluth, Merrill, and Appelman (Figure 5.1) to create multiple opportunities for learning wherein affordances are used to cognitively engage a player in realistic content and environment.

Figure 5.1. Attributes of Effective Instructional Game Structure



The presentation of information within the game was intended to guide players through the game play action. However, just because it was presented did not mean that the player cognitively processed the meaning of the information, nor were all of the game conventions evident within the environment to all players.

GAME CONVENTIONS

Standard game conventions (described below) were incorporated in both *MOH* & *COD* with the assumption by the game designers that the game play would progress in a "normal" fashion. This study demonstrated that not all conventions used in the game were equally effective for every player.

Game Conventions, which facilitated learning

1. Visual representation of player actions. (e.g., icon of prone position displayed when player is in the prone position.)
2. Game conventions tended to force incremental movement through the training sessions. List of objectives moved players in a linear trajectory in the training session. In several cases, player action was blocked when certain objectives had not been completed.
3. Static visualization, the compass, guided players toward objectives. Instead of pressing the [tab] key to find a list of objectives, Courtney used the action of centering the ball bearings on the compass to determine objectives.

Game conventions which limited player actions

1. Lack of clear oral and text-based instruction in milestone (M4) of *MOH*, "jumping over the crates" confused several players. For example, when the commander said "Press the jump and forward keys to jump up on this pile of crates" most players did not understand the need to employ keyboard control functions introduced earlier training session where players learned the following movement.

   Press [w] to move forward

   Press [s] key to move backward.

   Press [a] to move left and [d] to move right

2. Some instructions were not always specific enough for some players. For instance, Eric became confused while attempting to complete milestone (M1) in *COD* which was to look at five signs (see Appendix J). After looking at one sign, hearing an audible "beep, "Eric moved on to try to open a gate. At that point, the data seems to suggest, Eric did not seem to remember earlier instructions from the commander, which asked the player to "look at five signs." Eric spent time wandering around in front of the gates, because Eric did not understand he would not be able to move on in the training session until he had completed looking at all of the five signs. At this point, the session should have included feedback for incorrect actions. While trial

and error can be used as an effective method for learning, extended time may have frustrated or discouraged some players from learning. Players were only given a response after successful completion of an objective.

While there were game conventions which might have limited player response, there were game attributes that provided each player with the ability to navigate through the training session.

Some Typical Player Responses to Game Attributes

The following description is a detailed account of how a player responded to the game attributes found in *Call of Duty*. As the training began, Lieutenant Foley introduced himself by stating; "Alright. Listen up, Private Martin. You are on the obstacle course and doing weapon training today." In response to

1. Player moved toward the first sign, which indicated in objective (M1), player cognitively responded to oral instructions.
2. Lieutenant Foley continues, "Before starting the obstacle course read each of these important signs. Do what they tell you."
3. Player moved toward the first sign and the audible beep seemed to indicate successful completion of first objective.
4. After hearing a first beep, which may have indicated successful completion of the objective, the player positioned the "first person perspective" in front of a second sign. Hearing no audible "beep" to signal successful completion of this part of the objective, then, the player moved the game perspective to the right in the screen where there were more signs.
5. After hearing a second "beep" the player began looking around the scene by moving toward additional signs.
6. While the player was cognitively engaged listening for beeps, there was no indication at which distance a player must "read" the signs.

7. Not understanding what to do next, the player made a 360 degree turn, and then moved to the left and right wandering around other signs. Data indicated the instructions in the game may have created confusions for the player. The player was technically "reading" the screen/signs not understanding he must approach the signs at a certain distance to receive a "beep" signal.

8. After hearing an audible "beep," the screen displayed a visual prompt "Press [tab] key to see your objectives." After this visual prompt, a small green text, "Objective updated (in green after each sign is read)," appeared on the lower left-hand side of the screen above the compass. The player may have understood the written response to mean he had successfully completed the first objective.

9. Player then moved to the left of the screen where a pathway leads to a gated obstacle course. After the first unsuccessful attempt to open the first gate, player attempted to move forward again.

10. At this juncture, player decided to use the [Tab] key which displayed the Mission Objectives on the screen.

11. Player realized the last objective was not checked.

12. Player then moved back to the signs, and "read" each sign waiting for an audible "beep" for each sign. At this juncture player seemed to realize he must approach all of the sign before moving to next objectives.

13. Oral instructions from Lieutenant Foley then state, "Press your Move Left key [A] to move left, Press your Move Right key [D] to move right, Press your Move Forwards [W] to move forwards, Press your Move Back key [S] to move backwards."

14. After player successfully moved in the correct direction, Lieutenant Foley then stated, "That's it. Close enough. You will notice that the objective is checked off and you now have a new one."

After the players learned to follow oral instructions from Lieutenant Foley, refer to the Mission Objectives [press Tab] key, use keyboard functions for movement, follow compass, the game then allowed the players to move on to open the gate.

2. *What are key strategies that need to be learned by players to reach goals within MOH & COD?*

Key strategies players needed to learn to successfully meet the goals of the military training sessions fell into five categories, which were: (1) *rules of engagement, (2) experiential learning, (3) keyboard control functions, (4) on- demand list of objectives, and (5) functional fidelity.*

RULES OF ENGAGEMENT

Micro-level data analysis revealed, as players learned to respond to oral instructions, they were more likely to complete objectives. For example, during milestone (M11), Courtney a *Novice* player, approached the First-Aid bench with no player response. As Courtney seemed to contemplate the game objectives, she then made a quick move toward the First-Aid bench, after the commander stated, "Pressing [e] will cycle through your inventory. Remember private, if you get hurt, grab one of those health kits and use it. Don't be a hero. They will save your life." The Game Play Log Sheet revealed that between time markers :37 and :55 seconds (see Appendix J), Courtney paced back and forth, using a trial and error strategy to find objectives until she heard comments from the commander.

For both *COD* and *MOH*, using the [Tab] key to verify objectives on the screen confused some players. Additionally, until players attended to the oral and written instructions from the commander they tended seem confuse players. As players learned to navigate through the game objectives, milestone completion rates increased. For example, Jamie, Eric, and Courtney seemed confused by the instructions from the commander during milestone action, which was to look at signs. Between time markers: 37 seconds and 1:05 minutes, Jamie hesitated to look at additional signs because a small

green text appeared on the screen stating, "Objective Updated." In both games, this text was intended to teach the player where to look to determine if Mission Objectives had been updated.

Eric's Game Play Log sheet pattern analysis revealed he had to simultaneously listen to the commander and correctly interpret written instructions on the screen. Furthermore, Jamie had to learn to use the [Tab] key before she could verify objectives. The learning which took place during this period of cognitive load was crucial for successful completion of milestones. This distraction was also problematic for Courtney. During M1, if player had pressed the [TAB] key to reveal the list of objectives, she would not have expended extensive time in an attempt to align the star position on the compass while looking at the signs. While learning to employ game conventions was important, experiential learning was also a legitimate strategy for learning in both games.

EXPERIENTIAL LEARNING

Novice players in both games were able to work their way through difficult objectives. As some players advanced through the training session who did not receive reinforcement through commander feedback or "beeps," players tended to shift gaming strategy to a trial and error. In *MOH* combining the jump and forward keystrokes required repeated trial and error. Perhaps it was because several *Novice* player actions revealed extended milestone completion rates, *Post-Game Play* interviews revealed player disappointment at the end of the play session.

For example, (Appendix J) the micro analysis of the *Game Play Log Sheet* revealed the manner in which Courtney used trial and error strategy to set explosives on a tank.

1. After descending the ladder at M7, Courtney made a 120 degrees turn facing the ladder again. Not understanding how to use the [Tab] key to verify objectives,

Courtney remained confused until the commander stated, "Approach the explosives and press the use key to pick them up. Noticed that an image of the explosives has appeared in the upper right corner of your view. This shows you the items in your inventory." After the commander's announcement, written instructions displayed on the screen, “Press [e] to get the explosives.
”

2. After hearing instructions from the commander Courtney made another 120 degree turn in the direction of the crates where the explosive was.

3. After pausing for three seconds, the commander's comments continued, "Items you need to use or destroy to complete your mission will also pulse red."

4. A visual cue of a red ghost icon appeared on the tank and player moved close enough to the crates to automatically pick up explosives.

5. As the sound of an engine running drew Courtney's attention to the tank, she walked along the side of the tank bumping the side in an attempt to place the explosives.

6. After several attempts to place the explosives on the tank, the commander stated, "A red transparent image of the explosives has appeared on the tank."

7. The commander continued with his instructions, "Press the use key while near the image to plant the explosives on that tank."

8. As she observed the "Pulse Red," on the tank, she moved close enough for the explosives to be placed on the tank.

9. As soon as the explosives were successfully placed, the image and sound of a ticking clock began. "Move away from the tank to avoid being injured."

10. Written instructions on the upper left-hand corner of the screen appeared, indicating successful completion of the objective, "An objective has been completed.”

11. The commander stated, "Press the use key to open doors. Some doors might be locked. The sound will clue you in."

While the use of trial and error strategy was successful in several cases, players also needed to understand and become familiar with keyboard control functions as well.

KEYBOARD CONVENTIONS

Game conventions seemed to be an important factor in the successful completion of the training sessions in *COD* and *MOH.* For example, *Expert* players were able to use background knowledge of game controllers to quickly adapt to a standard keyboard to navigate through the game. Those *Expert* players, who understood, had experience with, and were able to transfer understanding of game controllers to the PC keyboard functions, were also able to navigate through the game objectives. *Expert* players had faster milestone completion rates because they were able to quickly adapt to alternative key functions and combinations for speedy access to game objects. Players who understood shortcuts and keystrokes combinations were able to quickly manipulate and adapt to the games conventions.

One *Expert* player stated he knew how to judge for trajectory of a bullet because he had been hunting with his father and knew that "if you miss, it'll cost you." When asked what the "costs" were he replied, "You just have to be accurate the first time or you may have to start the game all over again." *Expert* players were more likely to take advantage of alternative player actions by using keystroke combinations to complete objectives. For instance, using the forward key [w] in conjunction with the [Ctrl] key, the player is able to more easily switch from a standing position to prone stance.

Some *Expert* players were more prepared to listen to and follow instructions because players took the time to adjust the monitor settings and volume control before play action time in the game. *Novices* were more apt to ask for help from the lab researcher when they encountered technical difficulties such as advancing through objectives. Cody became confused enough that the researcher chose to restart the video game to allow him to listen to instructions from the

commander. Moreover, *Expert* players were able to take advantage of the game convention to "leap over" a level or spend minimum amount of time to advance through the milestones.

On Demand List of Objectives

In both *Medal of Honor* and *Call of Duty*, those players who chose to use the objectives function (list of completed and upcoming training objectives) were more likely to complete milestones. While Courtney seemed lost, her repeated player action of using the Mission Objectives allowed her to regain control over the training course.

Medal of Honor and Call of Duty Fidelity

As with many video games, *MOH* and *COD* provide predefined rules which restrict player's mobility, by using shift and control key to go prone or crawl, pressing [e] or [f] to hold and grab objects or use the shift key for melee in face-to-face combat, and activating scope [right click mouse] to have a better view of the target. The predetermined limitations were able to assist *Novice* or unfamiliar players step-by-step through important game functions; however, several game conventions distinguish some behaviors and fail to reinforce others.

Functional Fidelity

Most notably, *COD* contains a linear trajectory which limits progression through milestones when players do not respond to instructions either written or oral. For instance, players were not able to open a gate into the training area until all four signs had been successfully read and the player demonstrated successful navigation using the compass. In both *MOH* and *COD*, players were allowed to successfully move past milestones M6 and M7 (*MOH*) and M7 (*COD*) if they had not learned to use the grab key, as instructed by the commander, to successfully ascend or descend a ladder. This grab function becomes essential for successful

completion of later milestones. This was the first time the game affordances did not hold consequences for successful progression.

In *MOH*, if the training session had been consistent with instructions, it would have provided a more successful path for the *Novice*, both ascending and descending the ladder before progressing on. Descending the ladder did not require the player to successfully press the use [e] key, but the ability to grab the explosives with the use [e] key was essential for successful completion of the subsequent milestone (M8). For instance, in *MOH*, players were not required to complete milestones M1 and M2 and moved directly to milestone M3, "Approach the tower indicated by the arrow on the compass," while in *COD* the player was not able to advance through the objectives before completing milestone M1. The scaffolding of milestones M1 (Read each of these important signs) was a major obstacle for three *Novices* and one *Expert* player who did not complete all of the objectives. While *COD* and *MOH* had similar affordances, these affordances were used differently by *Novice* and *Expert* players.

3. *What differences between novice and expert players impact learning while playing the video games Medal of Honor and Call of Duty?*

The findings for this study are parallel to those from the *National Research Council* (2001), when they described several key principles of experts' knowledge on "how experts differ from novices" in the following manner,

1. Experts notice features and meaningful patterns of information that are not noticed by novices.
2. Experts have acquired a great deal of content knowledge that is organized in ways that reflect a deep understanding of their subject matter.
3. Experts' knowledge cannot be reduced to sets of isolated facts or propositions but, instead, reflects contexts of applicability: that is, the knowledge is "conditionalized" on a set of circumstance.
4. Experts are able to flexibility retrieve important aspects of their knowledge with little

attention effort.

5. Though experts know their disciplines thoroughly, this does not guarantee that they are able to teach others.

6. Experts have varying levels of Flexibility in their approach to new situations. (NRC, 2001, p. 31)

As Chart 5.1 illustrates, performance between *Expert* and *Novice* players in both *Medal of Honor* and *Call of Duty* were evenly distributed in terms of which type of player finished similar milestones in a shorter time period. In *Medal of Honor* (if Milestones M14 and M15 were removed from the calculations due to the lack of data from *Novices*), *Experts* showed a slightly faster overall completion rate (17.38% faster), while in *Call of Duty* the difference was even less for *Experts* who finished only 10.76% faster.

Expert and Novice Players Demonstrated Different Learning Approaches During Player Action

Novice players were more likely to listen to and follow the written and oral instructions on the screen, while Expert players were more apt to engage in trial and error in order to move through the training sessions. Expert players immersed themselves into the training session without considering the fact that there were specific goals for the session. In some ways, the knowledge about other games may have initially impeded Expert player trajectories because *MOH* and *COD* training sessions required players to respond to and follow instructions from the commander. As Rashid, an Expert player stated, "I don't need instructions, I just go find the gun and shoot targets."

Expert Players Quick to Utilize Affordances when Advancing through Training Session

For example, in *MOH*, if a player did not place explosives on the tank, a door would not open to the weapons training area and player progression would cease. Similarly, if players in *COD* did not read the five signs in (M1), a gate to the training course would not open. As evidenced by the Expert/Novice milestone completion rates, players exerted a deeper ability to process tools within each training session resulting in a higher milestone completion rate. Similarities in game conventions and prior knowledge may have expedited advancement during the learning process.

Table 5.1. Mean Time Comparisons on Similar Milestones (in seconds)

MOH			COD		
Milestones	Expert	Novice	Milestones	Expert	Novice
M1	0	26	M1	67	131
M2	25	95	M2	50	34
M4	93	69	M5	19	27
M5	116	54	M6	9	40
M6	30	25	M7	18	51
M8	40	41	M16	30	14
M9	36	92	M17	32	22
M10	23	58	M8	24	32
M12	42	18	M9/M10	41	14
M13	42	63	M11	11	16
M14	81	0	M14	67	45
M15	43	0	M15	22	11

Novice players may have benefited more from the commander's direct instruction, had the researcher asked players to follow the oral and written instructions prior to game-play. This response in not unlike player action found by Gee (2003) and Prensky (2001) who observed player action which "skipped" the "cut-scenes" in a rush to move into actual game play. Novice player's frustration came when they had no interactive support for learning to throw grenades in

the holes (See Table 5.1; *MOH* M14 and M15) because neither the game affordance nor the oral and written instructions support players along the trajectory of learning to throw grenades bounce against a wall into a bunker or concrete hole. There is little data to explain where the player would have acquired this type of player action in a real setting.

After finding themselves unsuccessful, Novice players attempted to move on to the next objective however, the game convention prevented players from advancing to the next objective. Again, if the game convention had required players to "learn" to employ the "use" key while climbing the ladder, players may have been able to successfully employ the "use" key later in the training session. As the player attempted to learn and adapt to game conventions, game-play time had elapsed and player could no longer continue with the rest of objectives. This is the main reason most Novice players did not complete all of the milestones. Novice players simply needed more time to learn the game conventions and affordances. If video game designers plan to promote video games and simulations for support of learning, interactivity of instruction and complexity of instructions should be important factors to consider. While mistakes and failure should be used as viable learning tools, some type of conducive interactive scaffolding learning activities is also in order.

For example Rashid, an Expert player, moved through the game affordances at a faster pace than Novice players, and his extended time with milestone (M14) employed the use of trial and error as he practiced throwing grenades into the bunkers. Rashid's prior experience with video games allowed him to move independently with minimal attention to written or oral instructions. For example, Rashid spent more time (81 seconds mean) on milestone (M14) than the Ideal time (30 seconds).

The following examples demonstrate Rashid's Expert player cognitive and metacognitive (see Appendix I) strategies,

1. Rashid was one of the most vocal players in this study, who verbalized his thinking through the entire play time. Rashid verbally interacted with the game.
2. Rashid seamlessly switched between weapons as each objective in the weapons training area emerged.
3. There was no indication, from the video data, that Rashid listened to any instructions inside the game.
4. Rashid's metacognitive skills were revealed routinely during the game. For instance, as Rashid missed throwing a grenade into a hole, he stated, “Oh- oh. I am going to kill myself!"
5. During times of frustration, Rashid used humor. When the grenades didn't hit the holes accurately, he jokingly stated, “Can I shoot someone when (I'm) done with this?” Having struggled with smaller aspects of weaponry, Rashid simply wanted to be able to practice during actual game play.
6. As an Expert player, Rashid was able to cognitively take advantage of multiple strategies he brought with him from prior game play experience. After several unsuccessful attempts to randomly throw grenades at bunkers, he showed signs of frustration exclaiming, “Stupid grenades!" As an Expert player, Rashid metacognitively questioned his own abilities when he stated, "Are you kidding me? Are you kidding me?” He did not loose his sense of humor even when he was having difficulties throwing the grenades into the holes.

7. After shooting the target during milestone M2 (shooting target with turret), Rashid seemed distracted by airplanes in the game. Frustrated by the noise of the airplanes flying over the weapons training area he exclaimed, “Stupid airplanes!” Frustrated, Rashid unleashed his weapon by shooting the walls, target, and airplanes.

Rashid's actions revealed his ability to combine multiple strategies to problem-solve his way through the training session with little need to attend to written or oral instructions from the commander. Novice players were more likely to depend on instructions within the game.

SUMMARY OF RESEARCH FINDINGS

Research question one (pp. 100-106). Some of the key attributes in Medal of Honor and Call of Duty that facilitated learning were audible and visual game attributes, the use of common game conventions, combined with game-play choices which facilitated learner control. For instance the game convention during milestone (M1 *COD*) forced players, both Expert and Novice, to read and listen to the commander's instructions before they were allowed to move on to the next objective (M2), resulting in higher completion rates than *MOH.*

Research question two (pp. 106-112). The key strategies players needed to learn to reach the goals within Medal of Honor and Call of Duty were rules of engagement, experiential learning, keyboard conventions, on demand list of objectives, and functional fidelity. Players who listened to the oral instructions during the training session were more likely to successfully complete milestones.

Research question three (pp. 112-116). In both Medal of Honor and Call of Duty, Expert players completed more milestones, than Novices. Expert players used what they knew from previous game play and "skipped" the "cut-scenes" in order to move into actual game play. Expert players were able to use alternative strategies to problem-solve through milestones which resulted in more efficient game-play. For example, Expert players either knew or were quick to use game control functions such as ctrl (crawl) + w (move forward). Both Novice and Expert players tended not to listen to instructions from the commander because they didn't "need instructions, I just go find the gun and shoot targets." When Novice players struggled with the use of trial and error, they were more likely to follow oral and written instructions from the commander. Some Expert players were able to manage frustration with humor or yelling at the

screen. So what are the lessons learned from the examination of Expert and Novice video game play?

Conclusions and Implications

The design of video games must be visually dynamic, include a compelling storyline, increasingly conducive learning environment (carefully scaffold level of difficulties), and high level of production design (high quality of animation, sound, special effects, and fast pace to keep the player at the "edge of ability"). The message design within these games should focus on clear statements of player objectives and provide access to resources for just-in-time review of these objectives.

For example, the notion of leveling up, through experiential learning, where mistakes and failure are an integral part of learning may serve to increase player engagement in learning. For instance, Gaming the Classroom (Sheldon, 2010) has reshaped praxis in university courses which included replacing the traditional grading system with Experience Points (XP). Sheldon's (2010) course focused "on massively-multiplayer online games and virtual worlds." As students learned the design elements and production requirements necessary to create and maintain online games, they "leveled up" to earn points based on class participation, projects, and collaborative activities.

As video-game strategies are incorporated into traditional instructional settings, this study demonstrated players who were willing to engage with difficult content if a clear pathway or solution to a problem became evident. Player action revealed Novice and Expert players were capable of multitasking within the training session. However, several players depended on a redundancy of instruction/information within the video game. This redundancy of instruction was important when a player's attention was distracted by numerous actions on the screen, and

this was the case especially if the objective was unclear to the player. The interactivity of the training sessions supported the need for game fidelity which included immediate feedback for learning to take place. The intimacy of learning within a video game provided players with the ability to make mistakes as a normal trajectory of learning. In several of the interviews, both female and male students mentioned in passing that they were more willing to make mistakes in a game than in the classroom. Additionally, several players explicitly expressed the fact that when you made a mistake in the game "no one is going to make fun of you." Important implications to be drawn from this study are that effective learning, within a virtual environment, is dependent on conditions wherein a player has the capacity to clearly identify objectives and immerse themselves into the game in an experiential situated learning context.

LIMITATIONS

One of the difficulties with using the milestone completion chart was that, while a player spent time on an objective, there was no manner in which to record the time on task or attempted completion rate. Data and data analysis was based only on those milestones which were completed. While analyzing data, it was triangulated between the Game Play Analysis Log Sheet, Post-Game Play Interview, and the Milestone Completion times to ensure accurate interpretations. Even then, my data analysis required that I return at least several times to ensure accurate interpretations. Further analyses using alternative lenses would have precipitated more in depth understanding of the current research study.

In order to provide consistency with the data collection, during the Pre-Play Analysis phase of EMF (Appelman, 2007), a condition of the protocol for this study was to provide players with a set amount of time. This time was estimated based on the average Ideal completion rate, which was five minutes for Call of Duty and four minutes for Medal of Honor.

A decision was made to cease play-time after approximately 10 minutes of engagement with each game, believing this 10 minute segment of time would be sufficient for successful completion of all milestones. However, this limited game-play time may have created conditions of increased anxiety. Because players were cognizant of the limited time, attempts to find a quick solution were evident. While player confusion may occur naturally, had players been allowed unlimited or extended time, some of the player completion rates may have provided different results.

The small sample size limited variability of players actions. With the limited number of participants, the game play pattern analysis revealed very limited understanding for Expert and Novice player action during game play.

While the age of the games (*COD*, 2003; *MOH* 2002) held a limitation for recommendations of improved game-design, the focus of this study was to observe individual player action in response to specific game attributes.

Because of the limited number of players, a decision was made not to include gender as a subcategory for analysis. While attention was paid to recruitment of an equal number of female and male participants, pattern analysis from the data in this study shows little valid difference between male and female player actions.

Post-Game Play Interviews were not extensive enough to collect data which would have revealed deeper metacognition. In this study, metacognitive actions were only analyzed if a student specifically verbalized how and why a specific player action was taken. The interview questions were either not specific enough or not open ended enough to prompt an extended explanation. For instance, when asked, "I noticed you had difficulty climbing over the crates." a player simply shrugged and stated, "Yeah, I know."

While this study was originally designed using convenient sampling, the data would have been much richer had the number of participants been greater. Including more than 30 participants would have provided broader variations in the mean play times, allowing for trends to emerge in a longitudinal study. Increasing the amount of participant playtime to thirty minutes or more would have allowed sufficient time to conduct Post-Game Play interviews. While the Post-Game Play interviews had specific questions, they did not necessarily provide students with opportunities to answer the questions in depth.

The Impact of this Study on Future Directions

The intention of this study was to use a micro-analysis methodology to identify the specific learning patterns within games which allow players to remain engaged, to complete objectives, and all of this despite making mistakes. Unlike traditional learning or classroom environments, mistakes become an integral part of the learning experience. When a student fails a mission, the commander does not send a note home to parents, he simply asks the player to try again and to learn from those mistakes. Additionally, when instructions in the game seem unclear or goals vague students become confused. Movement through the game must include multiple modes of instruction through written, oral, and symbolic forms, and these forms must be redundant and accessible on-demand from players who need them. Four out of five students used the compass as immediate feedback to determine if they were headed in the correct path although the oral instructions did not instruct them to do so. Perhaps the players were simply familiar with the compass convention, or as noted earlier some players learned to use it through trial and error. Expert players easily transitioned between controller and keyboard/mouse functions which underscore the need for considerable practice with the game interface. Without this practice the concentration is less on the game and much more on the operation of the control interface. This

study also highlighted the importance of a training session to introduce players to subtle changes in how each interface works within each game, and which conventions are incorporated as well.

The conclusions to be gathered from the data is not what type of learning players are engaged in acquiring, but what can be learned from player experience during game play action. This study demonstrates that the EMF methodology is effective in identifying player experience coupled to the specific attributes of the game in effect at any point within the game. It is the hope of this researcher that future studies will not ignore this critical coupling between the game and the player. It is the dialog between the game and the player which forms the pattern of interaction that this study highlights. As such the information from this study will serve to assist instructional and game designers to increase players experience through multiple quests for meaningful engagement. Traditional teaching methodologies that include didactic or direct instruction do not meet the interactive propensities of students who are active gamers. As Gee (2008) explains, today's learners are more apt to attain information/knowledge/understanding through experience or affiliation with a group of experts as those found in the gaming community. Video games should then be seen as a way to marry the ability to use content knowledge to solve real world problems, not simply engage in problem solving activities.

This study demonstrates that players prefer a robust learner controlled environment, which means that not only do the players have choices, but the game designers also have choices to make these options available to players. Well designed games not only hold the design elements of creativity, dynamic interface design, and “rapidly paced” interaction, but are in a much deeper sense, rooted in social, cultural, and historical practice. As Sid Meier (2010) in his keynote address to the Game Developers Conference, "in the world of games, you pretty much always win." In video games, players are "constantly at a better place than before. . . smarter

than you were before. . . you are always more powerful." One cannot underplay the need for players to be rewarded and acknowledged, "you cannot reflect this process too much." Players value the ability to be able to gauge progress through a game. Leveling up is a very powerful method of instruction because the player has "one more turn. . .and cool stuff is coming."

In order to create engaging learning environments for students, players must immerse and become involved in the game quests and feel the experience which can intensify their curiosity. Educators and game designers must be able to rethink and allow new paradigms of knowledge construction to emerge from experiential learning within these future games and simulations. I believe this paradigm will come as methodology begins to push the boundaries of what constitutes learning within K-12 settings.

REFERENCES:

Activision (2003) *Call of Duty* [Computer Software]. Santa Monica, CA: Activision Publishing, Inc.

Aldrich, C. (2005). *Learning by doing: A comprehensive guide to simulations, computer games, and pedagogy in e-learning and other educational experiences.* San Francisco, CA: Pfeiffer.

Alexander, A., Brunyé, T., Sidman, J., & Weil, S. (2005). *From gaming to training: A review of studies on fidelity, immersion, presence, and buy-in and their effects on transfer in PC-based simulations and games.* DARWARS Training Impact Group. Retrieved from http://www.darwars.com/downloads/DARWARS%20Paper%2012205.pdf

Annetta, L., Murray, M., Laird, S., Bohr, S., & Park, J. (2009). Serious games: Incorporating video games in the classroom: Games designde using sound pedagogy actively engage the net generation in learning. *Educause Quaterly Magazine, 29(3).* Retrieved from **http://www.educause.edu/EDUCAUSE+Quarterly/EDUCAUSEQuarterlyMagazineVolum/SeriousGamesIncorporatingVideo/157412**

An, Y. & Bonk, C. (2009). Finding that special place: Designing digital game-based learning environments, *TechTrends, 53*(3), 43-48.

Appelman, R. L. (2003). VX Lab game play analysis. Study #03-8123 Retrieved May 15, 2005, from http://www.indiana.edu/~games/research/

Appelman, R. (2005). Designing experiential modes: A key focus for immersive learning environments. *TechTrends, 49*(3), 64-74.

Appelman, R. L. (2007a). Experiential modes of game play. Paper presented at the Digital Games Research Association (DiGRA) International Conference, Tokyo, Japan, September 24-28, 2007.

Appelman, R. L. (2007b). VX Lab game play analysis. Study #06-11618 Retrieved June 15, 2007, from http://www.indiana.edu/~games/research/

Auer, M. (2009). *Lara Croft meets Nicolai Grundtvig.* Unplublished master's thesis, Universitätslehrgang Educational Technology, Danube University Krems. retrieved July 15, 2009 from http://www.donau-uni.ac.at/imperia/md/content/department/imb/acgs/auer_master_thesis_endfassung.pdf

Barab, S., Dodge, T., Tuzun, H., Job-Sluder, K., Jackson, C., Arici, A., Job-Sluder, L., Carteaux, R., Jr., Gilbertson, J., & Heiselt, C. (2007). **The Quest Atlantis Project: A socially-responsive play space for learning.** In B. E. Shelton & D. Wiley (Eds.), *The Educational Design and Use of Simulation Computer Games*. Rotterdam, The Netherlands: Sense Publishers.

Barab, S. A., Sadler, T., Heiselt, C., Hickey, D., & Zuiker, S. (2007). Relating narrative, inquiry, and inscriptions: A framework for socio-scientific inquiry. *Journal of Science Education and Technology*.

Barab, S., Warren, S., & Ingram-Goble, A. (2006). *Academic play spaces: Designing games for education.* Paper presented at the Annual conference of the American Educational Research Association, San Francisco, CA, April 7-11, 2006.

Barry, I. (2005). Game design. In D. Pallai (Ed.), *Introduction to game theory (pp. 99-160).* Chales River Media,: Boston, Massachusetts

Becker, K. (2007). Pedagogy in commercial video games. In D. Gibson, C. Aldrich & M. Prensky (Eds.), *Games and simulations in online learning: Research and development frameworks* (pp. 21-47). Hershey, PA: Information Science.

Bielaczyc, K., & Collins, A. (1999). Learning communities in classrooms: A reconceptualization of educational practice. In C. Reigeluth (Ed.), *Instructional-design theories and models: A new paradigm of instructional theory* (Vol 2) (pp. 269-292). Mahwah, NJ: Lawrence Erlbaum.

Bonk, C. J. (2009). *The world is open: How web technology is revolutionizing education.* San Francisco, CA: Jossey-Bass.

Bonk, C. J., & Dennen, V. (2004). *Massive multiplayer online gaming: A research framework for military education, training and performance support* (No. A172134). Washington D.C.: Advanced Distributed Learning (ADL) Initiative, Under the Office of the Secretary of Defense.

Cambourne, B. (1988). *The whole story: Natural learning and the acquisition of literacy in the classroom.* Auckland, New Zealand: Ashton Scholastic.

Crawford, C. (2003). *Chris Crawford on Game Design*: Prentice Hall Ptr.

Dell Company (2010). Black Standard keyboard. Retrieved from http://accessories.us.dell.com/sna/productdetail.aspx?sku=A0690703&cs=04&c=us&l=en&dgc=SS&cid=27722&lid=628335

DeMaria, R. (2007). *Reset: Changing the way we look at video games.* San Francisco, CA: Berret-Koehler.

Denzin, N., & Lincoln, Y. (2000). *Handbook of qualitative research* (2nd Ed). Thousand Oaks, CA: Sage.

DeRusha, J. (June 12, 2006). *Teacher uses video games in English class*. WCCO-TV Website. Retrieved from **http://wcco.com/video/?id=17627@wcco.dayport.com**

Ericsson, K., & Simon H. (1993). *Protocol Analysis: Verbal Reports as Data* Cambridge, MA.: MIT Press.

EA Games (2002) *Medal of Honor: Allied Assault.* Redwood, CA: Electronic Arts Inc.

Gee, J. (2008). Learning and games. In K. Salen (Ed.), *The ecology of games: Connecting youth, games, and learning (pp. 21-40).* Cambridge, MA: The MIT Press.

Gee, J. (2007). *Good video games + good learning.* New York: Peter Lang.

Gee, J. (2003). *What video games have to teach us about leaning and literacy*? New York: Palgrave MacMillian.

Graves, I. (2009). *Positioning of students in small-group setting: Naming participation.* Dissertation, Indiana University, Bloomington, IN.

Greenfield, P., Camaioni, L., Ercolani, P., Weiss, L., Lauber, B., & Perucchini, P. (1994). Cognitive socialization by computer games in two cultures: Inductive discovery or mastery of an iconic code? *Journal of Applied Developmental Psychology, 15*(1), 59-85.

Helms, S. (2007). Punk rock fish: Applying a conceptual framework of simulations in a high school science classroom, *TechTrends*,*53*(3), 49-53.

Hickey, D., Moore, A., & Pellegrino, J. (2001). The motivational and academic consequences of elementary mathematics environments: Do constructivist innovations and reforms make a difference? *American Educational Research Journal, 38*(3), 611-652.

Hickey, D., Kindfield, A., Horwitz, P., & Christie, M. (Eds.). (2000). *Integrating instruction, assessment, and evaluation in a technology-based genetics environment: The GenScope follow-up study*. Mahwah, NJ: Erlbaum.

Horwitz, P., Schwartz, J., Kindfield, A., Yessis, L., Hickey, D., Heidenberg, A., et al. (1998). Implementation and evaluation of the GenScope learning environment: Issues, Solutions, and Results. In M. Guzdail, J. Kolodner & A. Bruckman (Eds.), *Proceedings of the Third International Conference of the Learning Sciences*. Charlottesville, VA: Association for the Advancement of Computers in Education.

Hutchins, E. (1999). Cognitive artifacts. In R. Wilson & F. Keil (Eds.). *The MIT Encyclopedia of the Cognitive Sciences*. (pp. 126-128), Cambridge: MIT Press.

Jenkins, H. (2007). *Confronting the challenges of participatory cultures: Media education for the 21st century*. MacArthur Foundation: Chicago, IL.

Jonassen, D. (1999). In C. Reigeluth (Ed.) *Instructional-design theories and models: A new paradigm of instructional theory* (Vol II). Mahwah, NJ: Lawrence Erlbaum.

Kebritchi, M., & Hirumi, A. (2008). Examining the pedagogical foundations of modern educational computer games. *Computers & Education, 51*, 1729-1743.

Kolb, D., & Fry (1975). Toward an applied theory of experiential learning. In C. Cooper (Ed.) *Theories of group process.* London: John Wiley & Sons.

Kress, G. (2003). *Literacy in the new media age*. London: Routledge.

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge, MA: Cambridge University Press.

Lebow, D. (1993). Constructivist values for systems design: Five principles toward a new mindset. *Educational Technology Research and Development*, 41, 4-16.

McDaniel, R., & Vick, E. (2010) Conceptualizing "Games for Good" as cognitive techniology. *International Journal* of *Cognitive Technology, 14* (2), 5-10.

McGonigal, J. (2010) TED 2010: Reality is broken. Game design must fix it. Retrieved from http://www.wired.com/epicenter/2010/02/jane-mcgonigal/

Meier, S. (2010). *The Psychology of Game Design (Everything you Know is Wrong).* Keynote address at the 2010 Game Developer Conference (GDC) San Francisco, CA. Mar 11, 2010.

Merrill, M. D. (2002). First principles of instruction. *Educational Technology Research and Development, 50*(3), 43-59.

Microsoft Xbox Controller game pad. Black Game Console. Retrieved June 13, 2010, http://www.google.com/products/catalog?q=microsoft+game+pad+controller&hl=en&cid=6255442940141015670&ei=81EVTI-pI4jONcjznYQE&sa=image&ved=0CAgQ8gIwADgA#p

Mumtaz, S. (2001). Children's enjoyment and perception of computer use in the home and the schools. *Computers and Education, 36*(4), 347-362.

National Research Council (2001). How people learn? *Brain, mind, experience, and school.* National Academy Press, Washington, D.C

Paddock, M. (2010, January 23). Medal of Honor: Allied Assault, *Game Vortex* [Web log post]. Retrieved from **http://www.gamevortex.com/gamevortex/soft_rev.php/640/medal-of-honor-allied-assault-mac.html**

Pew Research Center (2010). *The Millennials: Confident. Connected*. Open to Change. Retrieved from **http://pewresearch.org/pubs/1501/%20millennials-new-survey-generational-personality-upbeat-open-new-ideas-technology-bound**

Pew Research Center (2010) Millennials, a portrait of generation next. *Confident, connected, open to change* (PP. 1-140).

Prensky, M. (2001). *Digital game based learning*. New York, NY: McGraw-Hill.

Reigeluth, C. M. (1999). The elaboration theory: Guidance for scope and sequence decisions. *Instructional design theories and models, Volume II: A new paradigm of instructional theory.* Mahwah, NJ: Lawrence Erlbaum Associates.

Reigeluth, C., & Frick, T. (1999). Formative research: A methodology for improving design theories. In C. Reigeluth (Ed.), *Instructional -Design Theories and Models: A New Paradigm of Instructional Theories* (Vol. 2). Mahwah, NJ: Lawrence-Erlbaum.

Reigeluth, C. M., Merrill, M. D., Wilson, B.G., & Spiller, R.T. (1980). The elaboration theory of instruction: A model for sequencing and synthesizing instruction. *Instructional Science, 9*(3), 195-219.

Rideout, V., Roberts, D., & Foehr, U. (2005). *Generation M: Media in the lives of 8-18 year-olds.* Executive Summary from a Kaiser Family Foundation Study. Retrieved March 17, 2008, from **http://www.kff.org/entmedia/upload/Executive-Summary-Generation-M-Media-in-the-Lives-of-8-18-Year-olds.pdf**.

Rieber, L., Smith, L., & Noah, D. (1998). The value of serious play. *Education Technology*,*38*(6), 29-36.

Rieber, L., & Noah, D. (1997). Effect of gaming and visual metaphors on reflective cognition within computer-based simulations, *1997 AERA*. Chicago, IL.

Rosas, R., Nussbaum, M., Cumsille, P., Marianov, V., Correa, M., Flores, P., Grau, V., Lagos, F., López, X., López, V., Rodriguez, P., & Salinas, M. (2003). Beyond Nintendo: Design and assessment of educational video games for first and second grade students. *Computers & Education, 40*, 71-94.

Salen, K., (2010) Quest to learn. A reason and A Purpose. Retrieved June 13, 2010, from http://instituteofplay.com/node/279

Schleiner, A. (2001). Does Lara Croft wear fake polygons? Gender and gender-role subversion in computer adventure games. *Leonardo, 34*(3), 221-226.

Shaffer, D., Squire, K, Halverson, R., & Gee, J. (2005). Video games and the future of learning. *The Phi Delta Kappan, 87*(2), 104-111.

Sheldon, L. (2010) *Gaming the classroom* Retrieved from http://gamingtheclassroom.wordpress.com/syllabus/

Simpson, E. (2005) Evolution in the classroom: What teachers need to know about the video game generation. *Tech Trends, 49*(5), 17-22.

Squire, K. (2004). *Replaying history: Learning world history through playing civilization III.* Dissertation Indiana University, Bloomington.

Squire, K. (2003). Video games in education. *International Journal of Intelligent Simulations and Games,2*(1), 49-62.

Squire, K., & Jenkins, H. (2003). Harnessing the power of games in education, *InSight, 3*(6), 5-33.

Stake, R. (1995). *The art of case study research.* Thousand Oaks, CA: SAGE publications, Inc.

Steinkuelher, C., & Chmiel, M. (2006). *Fostering scientific habits of mind in the context of online play*. Proceedings from the 7th Annual International Conference on Learning Sciences, Bloomington, Indiana. June, 2006. 723-729.

Swan, R. (2008). *Deriving operational principles for the design of engaging learning experiences* (Unpublished dissertation) Brigham Young University, Provo, UT.

Thiagarajan, S. (2003). *Design your own games and activities: Thiagi's templates for performance improvement.* San Francisco, CA: Wiley & Sons, Inc.

Turkle, S. (2005). *The second self: computers and the human spirit.* Cambridge, MA: MIT Press.

Van der Spek, E., Wouters, P., &Van Oostendorp, H. (2008). *Efficient learning in serious games: a cognition-based design guidelines approach.* . Conference proceedings for the Association for Educational Communications and Technology Conference, Orlando, Florida, November 7, 2008. *31* (2) 382-390.

VanDeventer, S., & White, J. (2002). Expert behavior in children's video game play. *Simulation and Gaming,33*(1), 28-48.

Vygotsky, L.S. (1978). *Mind in society*. Cambridge, MA: Harvard University Press.

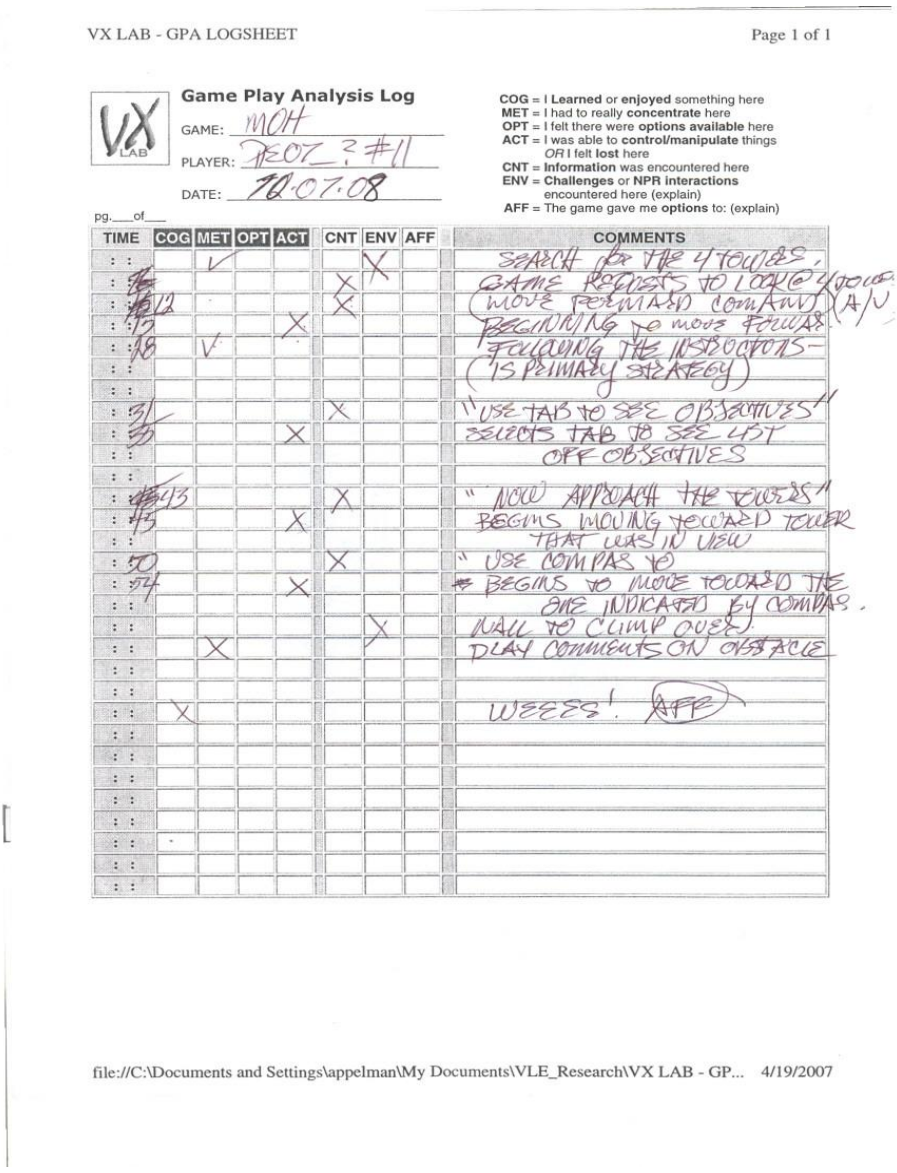
Yellin, D., Blake-Jones, M., & Devries, A. (2008). *Integrating the Language Arts.* (4th Ed.). Scottsdale, AZ: Holcomb Hathaway Publishers.

Yin, R. (1994). *Case study research: Design and methods* (2nd ed.). Beverly Hills, CA: Sage Publishing.

Ziaeehezarjeribi, Y., Worrell, P. & Graves, I. (2008). *Effective application of computer gaming technology in K-12 classrooms.* Presentation at the international meeting of the Association for Educational Communications and Technology, November 2-9, 2008, Orlando, FL.

Ziaeehezarjeribi, Y., Graves, I. & Gentry, J. (2010). From theory to practice, repurposing COTS games for P-12. In A. Hirumi (Ed.), *Digital Video Games for PrK-12 Education: Engaging Learners through Interactive Entertainment.* (pp.)Washington, D.C.: International Society for Technology in Education.

APPENDIX A:
SAMPLE GAME PLAY ANALYSIS LOG SHEET



VX LAB - GPA LOGSHEET

Page 1 of 1

Game Play Analysis Log

GAME: MOH

PLAYER: JEOZ_2 #11

DATE: 10.07.08

pg.___of___

COG = I **Learned** or **enjoyed** something here
MET = I had to really **concentrate** here
OPT = I felt there were **options available** here
ACT = I was able to **control/manipulate** things *OR* I felt **lost** here
CNT = **Information** was encountered here
ENV = **Challenges** or **NPR interactions** encountered here (explain)
AFF = The game gave me **options** to: (explain)

TIME	COG	MET	OPT	ACT	CNT	ENV	AFF	COMMENTS
: :		V				X		SEARCH FOR THE 4 TOWERS,
: :					X			GAME REQUESTS TO LOOK @ YOU
: :					X			MOVE PERMISSION COMMAND (A/V
: :				X				BEGINNING TO MOVE FORWARD
: :		V						FOLLOWING THE INSTRUCTIONS-
: :								(IS PRIMARY STRATEGY)
: :								
: :					X			"USE TAB TO SEE OBJECTIVES"
: :				X				SELECTS TAB TO SEE LIST
: :								OF OBJECTIVES
: :								
: :					X			" NOW APPROACH THE TOWERS"
: :				X				BEGINS MOVING TOWARD TOWER
: :								THAT WAS IN VIEW
: :					X			" USE COMPASS TO
: :				X				BEGINS TO MOVE TOWARD THE
: :								ONE INDICATED BY COMPASS.
: :						X		WALL TO CLIMP OVER
: :		X						PLAY COMMENTS ON OBSTACLE
: :								
: :								
: :	X							WEEES! AFF
: :								
: :								
: :								
: :								
: :								
: :								
: :								
: :								

file://C:\Documents and Settings\appelman\My Documents\VLE_Research\VX LAB - GP... 4/19/2007

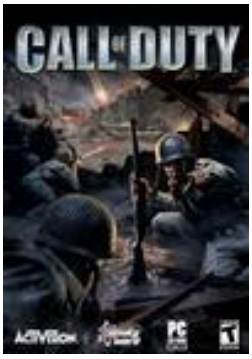
APPENDIX B:
VIDEO GAME RATING SYSTEM

The Entertainment Software Rating Board (ESRB, 2006) has created an easy rating system that is similar to the movie industry with *eC* rated for Early Childhood, *E* for everyone, *E10+* rated for children above the age of 10 years, *T Teen* for 13 and older, and *M* for mature audiences.

Table 4. Video Rating System (ESRB, 2006)

	Titles rated **EC (Early Childhood)** have content that may be suitable for ages 3 and older. Contains no material that parents would find inappropriate.
	Titles rated **E (Everyone)** have content that may be suitable for ages 6 and older. Titles in this category may contain minimal cartoon, fantasy or mild violence and/or infrequent use of mild language.
	Titles rated **E10+ (Everyone 10 and older)** have content that may be suitable for ages 10 and older. Titles in this category may contain more cartoon, fantasy or mild violence, mild language and/or minimal suggestive themes.
	Titles rated **T (Teen)** have content that may be suitable for ages 13 and older. Titles in this category may contain violence, suggestive themes, crude humor, minimal blood, simulated gambling, and/or infrequent use of strong language.

APPENDIX C:
VIDEO GAME SELECTION

Game	Game Description
	Publisher: **Electronic Arts** **This game is for age thirteen and older** This game has an introduction for training which deals with practicing with various artillery before entering the war. According to EA games, (2002) "Medal of Honor Allied Assault: Represents a unique addition to the Medal of Honor franchise. You'll assume the role of Sgt. Jack Barnes as he endures the final months of World War II, from Operation Overlord to the Battle of the Bulge and culminating with the fall of Berlin."
	Publisher: **Activision** **This game is for age thirteen and older** This game has an introduction for training which deals with practicing with various artillery and obstacles before entering the war. According to Activision (2003), "Call of Duty delivers the gritty realism and cinematic intensity of World War II's epic battlefield moments through the eyes of citizen soldiers and unsung heroes from an alliance of countries who, together, helped shape the course of modern history."

APPENDIX D:
DEMOGRAPHIC SURVEY

You are invited to participate in a research study that focuses on how users differ in their approach to playing games
This questionnaire helps us rank you as a particular type of game player,

and I will use this data in our research.

Demographic Data

Age: years

Gender: Male Female

Ethnicity: White Black Hispanic Asian Other

Country of Origin: (name of Country)

Highest education level completed:
1st - 5th grade
6th-9th
10th-12th
some undergraduate
undergraduate degree
some post-undergraduate

Handedness: Right-handed Left-handed Ambidextrous

Game Ownership

Which of the following do people play games on in your household? (check all that apply)

Nintendo Wii	Sega Dreamcast
Nintendo GameCube	Sony Playstation 2
Nintendo Gameboy	Sony Playstation 3
Nintendo Gameboy Advance	Microsoft XBox
Nintendo Gameboy Advance SP	Personal Computer

Which of the following did people play games on in your household in the past? (check all that apply)

Atari 2600	Commodore 64/128
Intellivision	Amiga Personal Computer
Coleco Vision	IBM PS2
Nintendo	Apple 2e
Sega Genesis	Ti-99
Super Nintendo	Macintosh

How many games have you purchased in the last 12 months?

How many days per week (on average) do you play games?
Less than 1 1 2 3 4 5 6 7

How many hours per day (on average) do you play games?
Less than 1 1-3 4-6 7-9 10-12 12+

Game Preferences

Please rate the following systems for playing games

	Hate it	Don't like it	Never played games on it	Like it	Love it
Nintendo Wii					
Sony Playstation					
Microsoft Xbox					
Personal Computer					

Do you play games online? YES NO

If YES, how do you play them?

Via Game Console
Via Internet
Other *(please describe)*

What is your favorite video game you've played in the past 12 months?

Name of the game:

System played on:

What is your least favorite video game you've played in the past 12 months?

Name of the
game:

System played
on:

What is your favorite video game of all time?

Name of the
game:

System played
on:

What percentage of your gametime is:
Played by yourself? % *(0 - 100)*
Played with others cooperating? % *(0 - 100)*
Played against others ? % *(0 - 100)*

Which of the following types of games do you prefer to play most? *(choose ONE only)*
Sports *(examples are Madden football and NBA basketball)*

Strategy *(examples are Warcraft, Civilization and Tetris)*

Simulation *(examples are The Sims, SimCity and Zoo Tycoon)*

1st person shooters *(examples are Halo, UnReal and Quake)*

RolePlaying Games *(examples are Baldurs Gate, Final Fantasy and Morrowind)*

Adventure Games *(examples are Super Mario World, Zelda)*

Other *(Write in a preference category not listed)*

APPENDIX E:
POST GAME INTERVIEW

Post Game Play Debriefing:

Following either the completion of the play task, or the end of the allotted game play time (whichever comes first), you will go to the gaming cubicle and say:

- Your play session is over. Thank you for letting us videotape your playing for this game.
- Now I would like to ask you a few questions about why you chose to do some things during the game play. I will also record your responses on video tape.

Choose from the following if appropriate:

- I noticed that you _____
    - Could you tell me why you did that?

- You had a choice to _____
  or to _____
    - Could you tell me why you chose what you did?

- Can you tell me WHY you chose the character in the game that you did?

- What do you like about the setting, or story,
  of the game?

    - Did you find any part of the game confusing?

- Did you find any part of the game difficult?

- How hard was it?

- How easy was it?

    - How easy was it to control the action of your character?
    - How easy was it to use the tools (or weapons)?
    - How easy was it to know what to do next?

- Is there anything else you would like to tell us about the game or your playing of the game?

- We thank you very much for participating in this study. You are free to leave now.

APPENDIX F: MEDAL OF HONOR KEYBOARD FUNCTIONS

GENERAL GAMEPLAY	
Left Mouse Button	fire, cook grenade
Click Middle Mouse Wheel	alt fire (available on upgraded weapons)
W or S Key	move
A or D Key	strafe
E Key	use, action
Spacebar Key	jump, flare chute
Control Key	crouch, stand
Shift Key	sprint, ironsights move
G Key	cycle grenade
F Key	melee attack
Esc Key	pause game
IN THE AIR	
w, S, A or D Key	steer
Spacebar Key	flare your chute
F Key	melee attack (while in your chute)
SPRINTING	
Shift Key (Hold) + W Key	sprint
Control Key + Shift Key (Hold) + W Key	sprint while crouching
F Key	strong melee attack (while sprinting)
USING COVER TO YOUR ADVANTAGE	

Ctrl Key + W Key	creep forward while crouching
Right Mouse Button + W or S Key	peek above above or below cover (while crouched)
Right Mouse Button + A or D Key	peek around corner (while crouched)
IRONSIGHTS	
Right Mouse Button	enable scope or gun sight
W or S Key	peek safely around or over cover (when in ironsights)
D Key	duck
A Key	peek above cover (when crouched)
Shift Key	walk (when in ironsights)

APPENDIX G:
CALL OF DUTY WORLD AT WAR KEYBOARD FUNCTIONS

CONTROLS	
W Key	forward
S Key	back
A Key	left
D Key	right
Q Key	lean left
E Key	lean right
Shift Key	sprint
Left Mouse Button	attack
Right Mouse Button	aim down sight
V Key	melee
N Key	nightvision
5 Key	grenade launcher
6 Key	c4, uav, airstrike, helicopter
7 Key	claymore
1 Key	next weapon
2 Key	previous weapon
Middle Mouse Button or G Key	throw frag grenade
4 Key	throw smoke grenade, throw flashbang grenade
F Key	activate

R Key	reload weapon
Tab Key	view score
Space Bar Key	up stance, jump
Ctrl Key	go prone
C Key	command
Pause Key	pause
Esc Key	menu
- Key	bring up console
T Key	multiplayer text chat
B Key	multiplayer quick message
Y Key	multiplayer team chat
Z Key	multiplayer voice chat
F1 Key	multiplayer vote yes
F2 Key	multiplayer vote no
F4 Key	multiplayer scores
F12 Key	Take a screenshot

APPENDIX H:
CALL OF DUTY AND MEDAL OF HONOR GAME FIDELITY CHART

Medal of Honor (MOH)		Call of Duty (COD)	
Oral narration	Written Information	Written Information	Oral narration
It's time to commence field training. Pay attention and you might even stand a chance on the battlefield		Alright, Listen up. Private Martin, you're on the obstacle course and doing weapons training today.	Alright. Listen up. Private Martin. You are on the obstacle course and doing weapon training today.
First I want you to use your mouse to look at each of the 4 towers.	Use your mouse to look at each of the 4guard towers! An objective has been added	Before starting the obstacle course read each of these important signs. Do what they tell you.	Before starting the obstacle course read each of these important signs. Do what they tell you.
Good, now press your forward key to move in the direction you are facing.	Press [w] to move forward!	Objective updated (in green after each sign is read)	
Press your backwards key to move back	Press [s] key to move backward.	Press your Move Left key [A] to move left Press your Move Right key [D] to move right Press you Move Forwards [W] to move forwards Press your Move Back key [S] to move backwards	Move five Paces to left Now five to the right Five paces forwards Five paces backwards
Press strafe left to move left and strafe right to move right.	Press [a] to move left and d to move right.		
Using these 4 keys to cover with the mouse is critical to your success against the enemy.	An objective has been added		
Press your objectives key. See your current objectives. When you've completed your objective, it is checked off on this list.	Press tab to see your list of objectives! <u>Mission Objectives</u> ☐ Look at all four towers {0 remaining}	Good, now check your objectives. (bottom center of screen) Press [tab] to see your objectives (center of screen) Position triangle shows soldier standing up.	Good, now check your objectives.

	☐ Approach the tower indicated by the arrow on the compass.		
Your current objective is highlighted in yellow.	☐ Press tab to see your list of objectives. An objective has been completed Press tab to see your list of objectives ☐ Approach the tower indicated by the arrow on the compass ☐ Get over the wall on the north.	You'll notice that your current objective is highlighted. <u>Objectives</u> √Read each sign [0 remaining] Approach the sign indicated by the compass star. ☐Open the gate to the obstacle course. ☐Pick up both at the target a total of 12 times. ☐ Pick up Springfield, hit the target a total of 4 times. ☐Pick up Thompson and hit the target 10 times ☐Switch weapon s and hit the target 3 more times. ☐Pick up some Grenades & throw a Grenade into each window and door. ☐Plant the explosives. ☐Go through the last gate to exit training	You'll notice that your current objective is highlighted.
Now, notice that the arrow on your compass is pointing at one of the towers.			
The arrow points to your current objective. As you near your current objective, the ball bearings on the compass will move closer together.		In addition, the location of your current objective is marked by the star on your compass.	In addition, the location of your current objective is marked by the star on your compass.
Approach the tower indicated by the arrow.	☐ Approach the tower indicated by the arrow on the compass	As you approach your current objective, the star will move towards the center of your compass.	As you approach your current objective, the star will move towards the center of your compass.

Good. Now press your objectives keys again. You have a new objective. Now complete it.		Objective completed This weapon has no alternative mode to switch to. That's it. Close enough. You will notice that objective is checked off and you now have a new one.	That's it. Close enough. You will notice that objective is checked off and you now have a new one.
Press the jump and forward keys to jump up on this pile of crates.	 Get over the wall on the north. Press tab to see your list of objectives Press space to jump. Press left Ctrl to duck. Press left Ctrl to stand up.	Alright Martin, Open the gate and run the obstacle course. GO! GO! GO! Press tab to check your current objective. This weapon has no alternative mode to switch to.	Alright Martin, Open the gate and run the obstacle course. GO! GO! GO!
Press the duck key and then move forward pass under the barbed wire.	Press left Ctrl to duck.	<u>Mission Objectives</u> √ Open the gate to the obstacle course. Pvt. Mantarro Riffleman Martin. Good to see you. They got your sorry butt here too. Huh? Hey, good luck.	Martin. Good to see you. They got your sorry butt here too. Huh? Hey, good luck.
		Move it ladies! This is not your Aunt Fanny's dance. Get the lead out. Press [c] to crouch. Soldier's position in triangle changes to crouch.	Move it ladies! This is not your Aunt Fanny's dance.
		Jump over 'em! Come on Elder, get the lead out. Soldier's position in triangle flashes yellow. Press [space] to jump.	Jump over 'em! Come on Elder, get the lead out.
Press the duck key again to stand up.	Press left Ctrl to stand up.	Press [ctrl] to go prone. Soldier's position in triangle flashes yellow. Not bad. Now hit the dirt and crawl forward under the barbed wire. Soldier's position in triangle has shifted to crawl.	Not bad. Now hit the dirt and crawl forward under the barbed wire.
		Sergeant. Fire up those machine guns.	Sergeant. Fire up those machine guns.
Look up and press the forward key to climb the ladder.	Press w and look up to climb up the ladder.	Those are live rounds boys. Stay low!	Those are live rounds boys. Stay low!

		Stay down!	Stay down!
Press the use key to grab a ladder from above or below.	Press e key to grab a ladder Look down and press w to descend the ladder	Climb these ladders, private. Let's go! Let's go! Let's go! Soldier's position in triangle flashes yellow. Press [space] to jump. Press [c] to crouch. Triangle shift's position to standing up.	Climb these ladders, private. Let's go. Let's go. Let's go.
Approach the explosives and press the use key to pick them up. Notice that an image of the explosives has appeared in the upper right corner of your view. This shows you the items in your inventory.	Press e to get the explosives You have acquired explosives An objective has been completed Game saved	Objective completed. Private Martin. Proceed through that door. Sergeant Moody's gonna take you through weapons training. The rest of you ladies, stay right here.	Private Martin. Proceed through that door. Sergeant Moody's gonna take you through weapons training. The rest of you ladies, stay right here.
The other image represents the radio through which we are communicating.		Eyes up, private. I am up here in the observation tower.	Eyes up, private. I am up here in the observation tower.
A red transparent image of the explosives has appeared on the tank.		Grab one of those M1A1 Carbines from the table. To pick up weapons. Look at it and press Use [F]. Pick up the second M1A1 Carbine.	Grab one of those M1A1 Carbines from the table.
Press the use key while near the image to plant the explosives on that tank.	Press e to plant the bomb on the tank!	To pickup ammo from another weapon, walk close to it or look at it and hold Use [F]. To get more ammo, grab it from any loose weapon of same type you were carrying.	To get more ammo, grab it from any loose weapon of same type you were carrying.
Items you need to use or destroy to complete your mission will also pulse red.	<u>Mission Objectives</u> ☐ Look at all four towers {0 remaining. ☐ Approach the tower indicated by the arrow on the compass. ☐ Get over the wall to the north. ☐ Find the explosives. ☐ Plant the explosives on the tank.	Use your mouse fire your weapon Hit the target 6 times.	Approach the fence and fire 6 more rounds at your target. Your accuracy will be defined by the tightness of your crosshairs.

		Hit the target 6 times. Fire 6 more rounds at your target, in different stances and while moving.	Fire 6 more rounds at your target, in different stances and while moving.
		You will be more accurate while not moving and in the crouching positions. These skills could mean your life.	You will be more accurate while not moving and in the crouching positions. These skills could mean your life.
Move away from the tank to avoid being injured.	An objective has been completed Complete the rest of training. Game saved	Alright private. Move on to the next area. Grab up a Springfield rifle from the table switching it for your carbine. Press to reload any time.	Alright private. Move on to the next area. Grab up a Springfield rifle from the table switching it for your carbine.
Press the use key to open doors. Some doors might be locked. The sound will clue you in.	An objective has been completed Press e to open doors!	Turn to the left. Move to the fence and fire two rounds at your target!	Turn to the left. Move to the fence and fire two rounds at your target!
		Hit the far target twice. Now fire two rounds while aiming down your sight. Hold down the [mouse 2] to aim down the sight.	Now fire two rounds while aiming down your sight.
You will automatically pick up first aid supplies when your health level is below 100%. Same for ammunition and weapons but remember that each weapon has a maximum amount of ammo you can carry.	Recovered 100 health	Alright. I hope it is clear to you that you will be more accurate while aiming down the sight. Alright private move on to the next area. Exchange your Springfield for one of the Thompsons submachine guns.	Alright. I hope it is clear to you that you will be more accurate while aiming down the sight. Alright private move on to the next area. Exchange your Springfield for one of the Thompsons submachine guns.
Some items are too far away to be automatically picked up.		Unless you have three hands you can only carry two weapons at a time besides your sidearm and grenades.	Unless you have three hands you can only carry two weapons at a time besides your sidearm and grenades.
		Hit the target 10 times. Fire ten rounds at your target, first from the hip, then aiming down the gun sight. Compare your accuracy. Get used to firing both ways. Thompson/Full-Auto	Fire ten rounds at your target, first from the hip, then aiming down the gun sight. Compare your accuracy. Get used to firing both ways.
Press the use key to grab these items.	Pick up the pistol {press e}	Take a few steps while aiming down your sight. You'r gonna	Take a few steps while aiming down your sight. You'r gonna move slower this way.

		move slower this way.	
Select the Colt 45 pistol by pressing the pistol key.	Got 24 Pistol Rounds Pick up Colt 45 Press 1 to switch to a Pistol Press Mouse2 to Pistol whip Press Mouse1 to fire Shoot the target three times	In close quarters combat, you can hit your enemy with the butt end of your weapon. This is called a melee attack. Try it with your Thompson. Don't screw around kid. This is for real. Press [shift] to do a melee attack	In close quarters combat, you can hit your enemy with the butt end of your weapon. This is called a melee attack. Try it with your Thompson. Don't screw around kid. This is for real.
To neutralize an enemy without drawing his attention, press the secondary attack key to activate the pistol whip.	Press Mouse 2 to Pistol whip Go to the next room and pick up the Thompson {press e}	Now switch weapons private. Unless you are dumb as you are ugly, it may dawn on you that each weapon is good for different situations. Make the wrong choice and you could by the farm. Hold [2] to sway Thompson for Springfield Picked up ammo for Thompson	Now switch weapons private. Unless you are dumb as you are ugly, it may dawn on you that each weapon is good for different situations. Make the wrong choice and you could by the farm.
Press the primary attack key to fire any of your weapons.		Hit the target 3 times.	Fire three more rounds at your target.
Remain stationary and fire short bursts to increase your accuracy.		Objective completed. Outstanding private. Proceed to the next area.	Outstanding private. Proceed to the next area.
Fire a couple of shots on that target with your Colt 45.			
Switch to the Thompson submachine gun by pressing the "SMG" key. You may reload any of your weapons at anytime by pressing your reload key.	Pick up Thompson Press 3 to switch to submachine gun.		
Always reload your weapons before going into combat.	Press r to reload		
Shoot that target 20 times with the Thompson.	Shoot the target twenty times Go to next room and pick up the sniper rifle {press e} Pick up Springfield 03 Sniper		

	Got 24 Rifle Rounds Got 24 Rifle Rounds		
Switch to the Springfield 03 sniper rifle by pressing the rifle key.	Press 2 to switch to a Rifle Press Mouse 2 to use the scope Got 96 SMG Rounds Got 96 SMG Rounds Got 96 SMG Rounds		
Press the secondary attack key to toggle the sniper scope ON and OFF.			
Aim through the scope at the farthest target.	Hit the farthest bulls eye three times		
Hit the red dot 3 times.	Hit the red dot 3 times.	Press [F] to pick up the M2 Frag Grenade. Picked up M2 Frag Grenade ammo. Pick up the frag grenades from the table. Pick 'em up!	Pick up the frag-grenades from the table. Pick 'em up!
Select the fragmentation hand grenades by pressing the grenade key.	Go to the next room and pick up some grenades {press e}	Press to [1] for next weapon. Press [2] to select previous weapon. Press [4] to switch to your grenade. Throw a grenade into one of each of these opening before you. Rock and fire!	Throw a grenade into one of each of these opening before you. Rock and fire. All right private. Move on to the next area. Our last station will be explosives.
A grenade's primary attack is a long throw. Use the secondary attach for shorter tosses.	Got 1 Grenade	Pick 'em up partner. That's a lot of fire power there. Treat it with respect.	Pick 'em up partner. That's a lot of fire power there. Treat it with respect.
The longer you hold down the secondary attack key, the farther you throw.	Got 1 Grenade Got 1 Grenade Got 1 Grenade Got 1 Grenade Press 5 to select a grenade Press 1 for a long throw Press 2 for a short throw Throw a grenade into each of the concrete box	Press the [q] key to lean to the left. Press the [e] to lean to the right. Move behind the concrete post and lean out to the left, then the right. M2 Frag Grenade	Move behind the concrete post and lean out to the left, then the right.
		Leaning can help protect you from the enemy.	Leaning can help protect you from the enemy.
Use bank shots with the grenades to clear rooms where the enemy might be hiding.		Objective completed All right Private, move on to the next area.	All right Private, move on to the next area.

Throw grenade to each of the holes.	Throw a grenade into each of the concrete box	Pressing [e] will cycle through your inventory. Remember private, if you get hurt grab one of those health kits and use it. Don't be a hero; they will save your life.	Remember private, if you get hurt gram one of those health kits and use it. Don't be a hero; they will save your life.
Approach the MG42 stationary machinegun and press the use take command of the weapon. Destroy the target with that machinegun.	Go to the next room and use the machine gun {press e} Destroy the target	Our last station will be explosives.	Our last station will be explosives.
		Pick 'em up partner.	Pick 'em up partner.
When you are ready, press the use key on the red door at the end of the range to exit.	Press e on the red door to exit the firing range	That's a lot of firepower there, treat it with respect. That stuff doesn't care what it blows up.	That's a lot of firepower there, treat it with respect. That stuff doesn't care what it blows up.
This training should help you keep your head under fire.		Explosive planted. Note that a stop watch has appeared. This will tell you how much time you have to get your butt out of there unless you want it blown off.	Note that a stop watch has appeared. This will tell you how much time you have to get your butt out of there unless you want it blown off.
Shoot at the explosive in the field!		Objective completed Fire in the hole!	Fire in the hole!
You are dismissed Lieutenant Powel. Good Luck.	Exit training!	Go through the last gate to exit training. Or backtrack through the weapons course if you want more practice. Good job, private. Well done. Keep your weapons with you and clean at all times. You are dis:smissed.	Good job, private. Well done. Keep your weapons with you and clean at all times. You are dis:smissed.

APPENDIX I:
MEDAL OF HONOR GAME PLAY ANALYSIS *EXPERT PLAYER* LOG SHEET

Game Play Analysis Log

GAME: _Medal of Honor_PIE 07___

PLAYER: __Male #11_ Rashid_ M14 *Expert* M15 & M16___

DATE: _____

pg.___of___

COG = I Learned or enjoyed something here
MET = I had to use a strategy here
OPT = I felt there were options available here
ACT = I was able to do things, *OR* I felt lost here

CNT = Information was encountered here
ENV = Environmental interactions encountered here
AFF = The game gave me options to manipulate or make choices

TIME	COG	MET	OPT	ACT		CNT	ENV	AFF		COMMENTS
: 00:00						X	X			View of the grenade room Milestone, M14 *Expert* M15 & M16 • Player is holding the Springfield 03 sniper rifle by walking to the next room where the grenades are on the table, on the right hand corner of the bunker room • Two tables are located on the right hand corner of the training room • Radio on the upper right hand corner of the screen • There are two doors, one in front entrance door and an exit door to the other side of the next training room • Open windows where the concrete holes are. • This is an open bunker where the trees are on the right hand side visible from the inside obstacle training course • The compass is located on the upper left hand corner. • The Health bar on the lower left hand corner of the

									screen • The written text on the lower right hand corner of the screen “Springfield 03 sniper rifle”
: 00:06	X	X		X			X		As soon as Rashid walked in the grenade room, he said, “I love Grenades. His cognitive and metacognitive ability was very apparent in this action while he held the rifle on his hand
				X					Rashid took action by picking up the grenades and said, “I love grenades and he used by throwing it into the bunkers.”
		X							Rashid was one of the most vocal players in this study, who constantly used the talk-out-loud protocol by saying “I love grenades, thanks” by stating the actions while multitasking.
: 00:09	X			X	X				At this juncture Rashid seemed not paying attention to any of the instruction (he was an expert player) when he entered in the grenade room, he still held his rifle and moved toward the grenades which were located on the table. He checked both tables where the grenades were and then moved to the concrete window where he had to throw the grenades.
		X		X					Rashid approached close enough to the grenades where he picked up 4 more grenades and his rifle was still on his hand and moved toward the concrete holes by aiming at the farthest target with his rifle. He was very vocal and said “I love grenades”
: 00:11		X	X	X		X			While Rashid held the rifle which implied that he may have understood the visual or oral cues from the commander, he instinctively pressed the switch key from rifle to grenades. Based on his action on the video there was no implications that he used any of the instructions at this juncture.

				X		X	X		[Audio] A grenade's primary attack is a long throw. Use the secondary attach for shorter tosses. [Visual] Press 5 to select a grenade Press 1 for a long throw Press 2 for a short throw Throw a grenade into each of the concrete box'
: 00:20				X					While Rashid was holding the grenade in his hand, he then used the keys on the keyboard by moving rapidly to the right and to left which shook the screen.
						X	X		[Visual] Stack of 5 grenades on the screen and written text, "frag-grenades" shown on the screen.
		X							Rashid said I may kill myself" his metacognitive indicated that he was describing the danger of holding a grenade in his hand.
:00:25				X					Rashid was targeting the farthest bunker to throw the grenade into.
		X							Rashid used his metacognitive skill by talking out loud "Have it in it" He missed the target and said "oh oh" I am going to kill myself, while he is shaking the grenades.
:00:35				X					Rashid tried one more time. He threw total of 3 grenades and missed all three and said " I threw over the top"
						X	X		[Audio] Use bank shots with the grenades to clear rooms where the enemy might be hiding. Implication, no response to the commander's instructions. [Audio] Throw grenade to each of the holes. [visual] Throw a grenade into each of the concrete box When he misses the closest hole, he then says "come on dude"

	X	X		X					Rashid's cognitive and metacognitive abilities seemed to help him to vocalize the process of picking up grenades and talks aloud After 4 attempts, he said yes, "I got that one"
: 00:39	X	X		X					After several attempts, Rashid's action and trajectory changed and he aimed this time with more focused by calibrating the target, like a plus signs by moving the target locater up and down to see if that helps him to throw the grenades into the hole. It seemed the instructions did not resonate with him in this action. Rashid's trial and error approach seemed to help him to make more accurate throws and said, "That's how you how you do it"
	X	X		X					Rashid's cognitive ability seemed evident in this action and tried to make sure his trajectory selection would work. Given the fact that the commander provided him the instruction by pressing; Press 1 for a long throw Press 2 for a short throw
:00:43	X	X							Rashid showed some sign of frustrations when the grenades did not hit the holes accurately. He then vocalized jokingly, "Can I shoot someone when done with this". The indication was that he possibly wanted to get into the actual game so he could shoot in the battle field.
: 00:48	X			X					Rashid went back when ran out grenades to pick up some more grenades and said "this is some kinda hard. I am one man pants" Not sure what he meant by that.
: 00:54				X					Rashid made 4 attempts to the closest hole and finally made it. He also said "This, dude sucks" he may was referring to the bunker hole.
: 01:04				X					Rashid went to the next hole and threw one which was supposed to bounce against the wall; his trajectory was off as the video showed in the data, which went over

									the bunker hole. Then he hit the hole, he says again "That's how you how to do it"
: 01:11						X	X		[Visual] Got 1 Grenade, Got 1 grenade and also the compass on the upper left hand corner showing he is not close to the target
: 01:19	X	X		X					Rashid spent a lot of time on the closest hole, but he missed again and said, "are you kidding me, stupid grenades" Rashid metacognitive ability to talk over which gave the impression that he was cool with that and described the process in which he was not doing well, however, he did not give up trying.
: 01:24	X		X	X					Visual actions were the same, Got 1 grenade, Got 1 Grenade After 3 attempts, he finally threw the grenades on the left hand side of the bunker hole. He also said "we have to add some pizzaz to this computer"
:01:31	X	X		X					Rashid strategy seemed paying off when he finally figured out he could not rush throwing grenades into the holes. He gave the impression of some sign of frustrations and said "stupid grenades", "are you kidding me, are you kidding me" He seemed to have his sense of humor even when he was having difficulties throwing the grenades into the holes. Milestone 2 completed
: 01:37			X			X	X		The door to the next training rooms opened and he moved to the next bunker. [Visual] Go to next room and grab turret and destroy target. Using the "E" button grab the turret and shoot the target as many times as it takes to destroy it. [Audio] Approach the MG42 stationary machinegun and press the use take command of the weapon. Destroy the target with that machinegun.

:01:43	X	X							Implication was that the visual image of the machineguns were perceived as reinforcing his constant metacognitive ability acquiring gun which he constantly talked about it throughout the play time action, “I need a gun, I need a gun” He was beginning to form a concept of the goal to be achieved.
: 01:49				X					Rashid did not even for a second wait and started shooting with the turret and shot the target as many times as it took to destroy it.
: 01:54	X	X		X					Implications, Rashid seemed to understand what the objective was, when he used the turret, and destroyed the target. Rashid then said “Oh wow” and also Rashid said, “I think it is done” when he totally turn the target into pieces. He gave the impression he finally got what he wanted when he started asking from the beginning of the game “give me a gun” Milestone 3 Completed
: 02:10		X		X					After Rashid finished shooting the entire target, he said, “stupid airplanes” and kept on shooing with turret everywhere in the air and the walls. From the video it indicated that Rashid was very frustrated and seemed satisfied after using the turret.

APPENDIX J:
MEDAL OF HONOR GAME PLAY ANALYSIS *NOVICE PLAYER* LOG SHEET

Game Play Analysis Log

GAME: _Medal of Honor_ PIE 07_

PLAYER: __Female_#6__Courtney_
Novice, M8, M9and M10

DATE: _____

pg.___of___

COG = I **Learned** or **enjoyed** something here
MET = I had to use a **strategy** here
OPT = I felt there were **options available** here
ACT = I was able to **do** things, *OR* I felt **lost** here

CNT = **Information** was encountered here
ENV = **Environmental interactions** encountered here
AFF = The game gave me **options** to manipulate or make choices

TIME	COG	MET	OPT	ACT		CNT	ENV	AFF		COMMENTS
:04:14						X	X			• The player action starting time at 4:14 for **Milestones, 8, 9, and 10** • View of the walk way in the alley with trees and shrubs on both sides • Health Bar in green color on the bottom of the left hand corner • Walk way in the alley is fenced • The Compass is highlighted in red at the 2:30PM and 5:30PM clock position • There is a visual text on the upper left had corner under the compass indicating [Look down and press "w" to downward the ladder." • The image of the Radio for communication is displayed on the upper right hand corner of the screen
:00:05				X						Courtney descended the ladder by jumping down on the ground and suddenly took a turn back to the ladder nowhere to go.

	X	X						The video showed the possibility of her becoming disoriented and shifts her direction toward the Crates when she realized that she could not go through the fence.
:00:07				X				Courtney made 120 degrees turn facing the ladder, then changed her direction and turned right forward toward the crates where the explosive was.
:00:12					X	X		[Audio] from commander: either the audio from the commander or the crates themselves may have given her the visual cue to move toward the crates. [visual] cue to "Press e to get the explosives"
		X						This action may have shifted her sudden move
:00:17	X	X						This implied that Courtney may have understood based on her cognitive ability to change her strategy that appeared to be targeted at the explosive on the crate.
								Courtney did not give any indication that she was noticing the sudden change in her direction toward the crate
:00:19					X	X		[Visual] cues showing the red explosive on the crate seemed to have changed her sudden move toward the explosive "Press [e] to get the explosives" "You have acquired explosives
:00: 23	X	X						Based on the video observation, player action seemed indicate that she listened to the commander's instructions
					X	X		[Audio] Press [**e]** to get the explosives. You have acquired explosives. An objective has been completed Game saved
	X			X				Both the Audio and visual cues were perceived as reinforcing her strategy by pressing on the [e] key to

									pick up the explosive
:00: 27	X		X	X					Video clip indicated Courtney paused for 3 seconds while the commander was giving the instruction; it seemed her cognitive and metacognitve ability instinctively drew her attention what action to take by approaching the crates and picking up the explosive
					X	X			[Audio] Notice that an image of the explosives has appeared in the upper right corner of your view. This shows you the items in your inventory.
:00:32	X			X					Again here Courtney paused for 6 seconds when the commander orally provided the instructions. Her cognitive ability to listen to the commander's instructions seemed to indicate that she followed the instruction.
	X			X					It was not clear whether Courtney made the connection, but her action gave the viewer the impression that she followed the instructions
:00:36					X	X			[Audio] The other image represents the radio through which we are communicating.
	X		X	X					Courtney paused again for 4 seconds in the middle of the walk way in the alley, implication, she may was listening to the commander's instruction while making her next move. Courtney then changed her direction moving through the repair shop on both sides passing the tank and trucks, no indication why she simply missed the tank on her right
					X	X			[Visual] An objective has been completed
	X				X	X			Courtney seemed listen to the audio, but turned around and went back to the crates and then she gave the impression that she noticed that she missed the tank and made a U turn

:00:40					X	X		[Audio] A red transparent image of the explosives has appeared on the tank Press the use key while near the image to plant the explosives on that tank. [Visual] Press e to plant the bomb on the tank!
: 00:52	X			X				Courtney turned around and scanned the area make a 180 degrees panning the view of environment in the video, all the trucks and tank were visible in front of her, she suddenly moved toward the oil barrels, while the tank was in front of her running.
:01 :01	X		X	X	X			From the video, it appeared that Courtney was taking cover in case of explosion which she seemed avoiding the tank, and then she moved toward the tank. She pressed the Tab key to view the objectives which appeared on the screen. No data on what her motivation or action at this juncture was.
:01: 04				X	X	X		Courtney noticed the tank and moved toward it, and tried to jump over it by pressing the spacebar and forward key "W". She slowly moved around the tank and noticed the flashing red pulse on the tank
:01:06					X			The explosive appeared on the top right hand corner of the screen where the radio was
			X	X	X			[visual] the two ball bearing on the compass closed in, but the video action does not indicate whether she noticed the visual cue on the compass
:01:09	X	X		X	X			Courtney's attempt to place the explosive seemed a long journey, but her cognitive and mecognitive ability seemed paying off by using trial and error strategy to get closer to tank
:01:12			X		X	X		[Visual] cue of a red ghost icon on the tank and the sound of running engine seemed to draw her attention which may have helped her to place the explosive on the tank. Another visual cue was that may have given Courtney the warning signal which was the image of a ticking clock, looks like a stop watch which "Pulsed Red" [Audio] A red transparent image of the explosives has

									appeared on the tank. Also written content on the upper left hand corner appeared, indicating “An objective has been completed”.
					X	X			At this juncture Courtney finally approached the tank close enough to the spot where the explosive automatically was placed and started ticking, she appeared to listen to the audio indicating;
:01:14	X			X	X	X			[Audio] Move away from the tank to avoid being injured. While she waited next to the door, slowly and slowly she turns around to see if the explosion has taken place which she sees a ball of fire and smoke in the air as well as the sound of the blast. [Milestone 9 completed]
	X	X							It appeared that Courtney by listening to the ticking sound of a time bomb may have cued her cognitive and metacognitive ability to instinctively dash toward the doors taking cover,
:01:17					X	X			[Audio] Press the use key to open doors. Some doors might be locked. The sound will clue you in. [Visual] An objective has been completed Press e to open doors!
				X					Implication, after the tank was exploded, she turned around toward the doors.
:01:21				X	X				[Audio] Press the use key to open doors. Some doors might be locked. The sound will clue you in.
	X	X							Courtney’s cognitive and metacognitive ability implied in this action that she seemed to follow the commander’s instructions and turned around toward the doors. She made a 180 degrees panning in front of both doors and using trial and error to see if the other door would open.

:01:24				X		X			The commander's audio seems to resonate with her initial cue to open the doors and she is standing in front of the doors and positions herself to take action. The clicking sounds of the door clue her that the first door on the left is not the one and she moves to the right. [Visual] Press e to open the doors. The compass ball bearings on the upper left hand corner moves further apart, no indication is she noticed that.
: 01:32	X	X							It appeared the audio and visual cues to resonate with Courtney at this point of the game. Her cognitive and metacognitive ability gave her the implication on how to navigate and take action.
:01:39				X		X	X		[Audio] You will automatically pick up first aid supplies when your health level is below 100%. Same for ammunition and weapons but remember that each weapon has a maximum amount of ammo you can carry. The video observation indicates that she was moving forward,
	X			X					As soon as Courtney heard the commander's instruction she quickly changed her direction and moved toward the health kit and grabbed one.
:01:46		X				X	X		[Visual] Game saved on the upper left hand corner under the compass and she is standing next to the first aid table. [Audio] You will automatically pick up first aid supplies when your health level is below 100%. Same for ammunition and weapons but remember that each weapon has a maximum amount of ammo you can carry.
	X	X		X					As soon as Courtney heard the instruction form the commander, she immediately moved closer to the health kit and pressed the e key and the health bar goes from 99 to 100%.

	X		X						At this juncture, the video date revealed that she Courtney was following the instruction when the commander cued her in; her response was immediate which she walked quickly toward the First-Aid.
: 01:49				X		X	X		[Audio] Some items are too far away to be automatically picked up. [Audio] Press the use key to grab these items. She quickly moves to the right and then to the left close to the tables on the right where the guns are. [Visual] Pick up the pistol {press e}
: :		X	X			X			Got 24 Pistol Rounds Courtney moved toward the table and from her previous action seemed indicate that she was following instructions from the commander. **Milestone 10 completed.**

APPENDIX K:
CALL OF DUTY GAME PLAY ANALYSIS *EXPERT PLAYER* LOG SHEET

Game Play Analysis Log

GAME: _Call of Duty- PIE 07__

PLAYER : Male # 2 Eric_*Expert, Milestones, M1, M2*

DATE: _____

pg.___of___

COG = I **Learned** or **enjoyed** something here
MET = I had to use a **strategy** here
OPT = I felt there were **options available** here
ACT = I was able to **do** things, *OR* I felt **lost** here

CNT = **Information** was encountered here
ENV = **Environmental interactions** encountered here
AFF = The game gave me **options** to manipulate or make choices

TIME	COG	MET	OPT	ACT	CNT	ENV	AFF	COMMENTS
: 00:06					X	X		• View of a fenced in area where the signs are posted • On the other side of the fence in the center of view is a military person lieutenant Foley • Two large signs are inside our fenced in area and on either side of the view of the military person • There is a large green bar on the bottom right of the screen • There is a figure of a Compass on the bottom left of the screen • There is a white triangle with a figure of a military person inside • There is text on the screen in the upper third: "Use your mouse to look at large signs"

				X		X	X		Eric was observed looking at the sign in front of him, while Lieutenant Foley was standing on the other side of the fence.
: 00:09	X	X		X					It seemed that Eric was trying to make sense of this scene and was closing in to approach the signs. He was not certain what action he was supposed to take. It was not evident on the tape if he has heard the instructions from the military person.
		X		X					Eric moved toward the first sign (written on it, use grenades) and the sound of the beep possibly gave him the indication that it might be what he was supposed to do.
: 00:15				X		X	X		Eric began to position himself in front a sign and also began looking around the scene and moved to the right where there were more signs, the beep of the 2nd sound seemed as reinforcement to moved him again to the left.
:00: 17		X		X		X	X		Eric may have understood either the audio (the BEEP) sound or visual cue to look at the signs appeared to be his strategy to be targeted at the signs.
:00:26				X		X	X		Compass dial and star began changing and turning the position as Eric moved quickly to the right
:00:28	X	X		X					Eric did not give any indication that he was listening to the commander's instructions and made a 360 degree moved to the left and back to the right to the other signs.
:00:30						X	X		[Audio] BEEP [Visual] Press [tab] to see your objectives, small green text appears on the lower left hand side above the compass "Objective Updated"
: 00:37	X	X		X					Eric began to position himself directly in front of the other signs and pressed on the tab key and all objectives displayed on the screen. He seemed to take a notice of reviewing the objectives and pressed the tab key again.

: 00:41		X	X	X				Implication was that the beeps were perceived as reinforcing his strategy for looking at signs. The video shows that the player seems to take notice when he heard the commander's response.
		X		X	X			[Audio] "Good that's enough He makes a dash toward the fence which gives the indication that concept of the goal to be achieved.
:00:48					X	X		[Audio] BEEP, he heard the commander's voice "Good that's enough [Visual] small green text "Objective Updated" **[Milestone M #1 completed]**
: 00:59				X				Eric then moved straight in the walk way toward the fence, he paused in the middle of the walk way, the video showed, the player pressed on the [Tab] key to see the Mission Objectives again.
:01:02		X		X				Eric took a quick action and moved back toward the signs, and turned quickly back toward the gate which was not the correct gate to open, since there were two gates, he chose the gate in front of the alley rather than the one on the right-hand side.
:01:09		X	X	X				Eric tried another strategy since the last one did not work. Eric pushed against the gate and tried to jump over the gate, but it would not open. He then pressed on the [Tab] key and the Mission Objectives were displayed on the screen
:01:13				X		X		He tried pushing against the gate which wouldn't open.
:01:15		X	X	X				Eric strategy changed and he seemed notice another gate next to the first gate and dashed toward the gate. This time the gate will open and he received a greeting from the training commander.

					X	X		The video observation indicated Eric noticed several other trainees waiting next to the commander and heard the greeting from the commander Foley
:01:19					X	X		[Audio] "Martin good to see you" They got your sorry butt here too. Huh? Hey, good luck. [Visual] Press [C] to crouch appears in the middle of the screen [Audio] "Move it ladies" [Visual] Soldier is standing position in the triangle and concrete tubes on the right in front of the trainees.
		X	X	X				It took Eric 4 seconds and he noticed the sing in the middle of the screen "Press [C] to crouch appeared in the middle of the screen" **[MILESTONE #2 COMPLETED]**

APPENDIX L:
CALL OF DUTY GAME PLAY ANALYSIS *NOVICE PLAYER* LOG SHEET

Game Play Analysis Log

GAME: ___Call of Duty__PIE 07____

PLAYER: _Female #4 Jamie *Novice* Player_*Milestones,M1 and M2*

DATE: _____

pg.___of___

COG = I **Learned** or **enjoyed** something here
MET = I had to use a **strategy** here
OPT = I felt there were **options available** here
ACT = I was able to **do** things, *OR* I felt **lost** here

CNT = **Information** was encountered here
ENV = **Environmental interactions** encountered here
AFF = The game gave me **options** to manipulate or make choices

TIME	COG	MET	OPT	ACT	CNT	ENV	AFF	COMMENTS
: 00:07					X	X		• View of a fenced in area where the signs are posted • On the other side of the fence in the center of view is a military person lieutenant Folly • Two large signs are inside our fenced in area and on either side of the view of the military person • There is a large green bar on the bottom right of the screen • There is a figure of a Compass on the bottom left of the screen • There is a white triangle with a figure of a military person inside • There is text on the screen in the upper third: "Use your mouse to look at large signs"
	X	X						Since the Jamie was observed looking at the screen with headphones, it was probable that she was trying to make sense of this scene and her cognitive ability provided her with some idea of what the task was that Jamie was supposed to do. It was not evident on the

									tape if she heard the command from the military person that repeated what was written on the screen?
:00:15				X					Jamie began to position herself in front some signs and also began looking around the scene
		X							This implied that Jamie may have understood either the audio or visual cue to look at the signs and her strategy appeared to be targeted at the signs. She did not give any indication that she was noticing the changing compass yet.
					X	X			Compass dial and star began changing position as player moved
:00:31					X	X			[Audio] BEEP [Visual] small green text "Objective Updated"
:00:34				X					Jamie began to position directly in front of other signs
		X							Implication was that the beeps were perceived as reinforcing her strategy of looking at signs. She was beginning to form a concept of the goal to be achieved.
:00:36					X	X			[Audio] BEEP VX LAB - GPA LOGSHEET [Visual] small green text "Objective Updated"
:00:37				X					Jamie moved sideways to be in front of another sign and pauses there
		X							It was as if she was waiting for a beep to test her strategy with the signs, but she was apparently unaware that she had already received a beep for that sign.
:00:55				X					Player looks at other signs from where she stands
		X							Jamie now tries another strategy since the last one did not work

:00:56						X	X		[Audio] BEEP [Visual] small green text "Objective Updated"
:00:58				X					Jamie moved forward, hesitates, then looked at other signs to the right
		X							Jamie possibly thought that proximity to the sign was a key requirement, but when she did not receive the beep, she looked to the other signs to the left testing a different strategy
:01:05						X	X		[Audio] BEEP [Visual] small green text "Objective Updated" [MILESTONE #1 COMPLETED]
:01:06						X	X		[Audio] "Good, now check your objective" [Visual] Press [TAB] to see your objectives [Audio] "Note that your current objective is highlighted" [Visual] Note that your current objective is highlighted
:01:07		X							[NOTE] Jamie did not press tab key at this point which would have brought up a window to show all the objectives and the current one highlighted. Therefore the audio cue was perceived as meaningless, as was the strategy of using the objectives list.
:01:08						X	X		[Audio] "In addition note that the location of your current objective is marked by the star on your compass" [Visual] In addition note that the location of your current objective is marked by the star on your compass [Visual] Star on compass is expanding and glowing [Audio] "As you approach your objective the star will move to the center" [Visual] As you approach your objective the star will

								move to the center
:01:19					X	X		[Audio] "Approach your current objective" [Visual] Approach your current objective [Visual] Star on compass is now in-line and close to center
				X				Player moves forward, then moves back
:01:24		X						Because Jamie did not open the objectives list, she was uncertain of what the objective was, so she was using a trial and error strategy
:01:27					X	X		[Audio] "Move 5 paces to your left" [Visual] Press your move left key [A] to move left
:01:28				X				Player moved left by depressing the [A] key 5 times
					X	X		[Audio] sound of feet taking steps
	X	X						Jamie either learned to use the [A] key to move left or used her previous knowledge of control conventions.
:01:29					X	X		[Audio] "Move 5 paces to your right" [Visual] Press your move right key [D] to move right
:01:32				X				Jamie moved right by depressing the [D] key 5 times
								[Audio] sound of feet taking steps
	X	X						Jamie either learned to use the [D] key to move right or used her previous knowledge of control conventions.
:01:36					X	X		[Audio] "Move 5 paces forward" [Visual] Press your forward key [W] to move forward
:01:37				X				Player moved forward by depressing the [W] key 5 times
					X	X		[Audio] sound of feet taking steps

	X	X						Jamie either learned to use the [W] key to move forward or used her previous knowledge of control conventions.
:01:43					X	X		[Audio] "Move 5 paces backward" [Visual] Press your backward key [S] to move backward
				X				Player moves backward by depressing the [S] key 5 times
					X	X		[Audio] sound of feet taking steps
	X	X						Jamie either learned to use the [S] key to move backward or used previous knowledge of control conventions.
:01:48					X	X		[Audio] "Approach your current objective" [Visual] Approach your current objective [Visual] Star on compass moves to 10:00 position and middle distance from center
:01:49				X				Jamie hesitated and began to look around to her right. She then started to walk away from the signs and towards the gate at the end of the fenced in area
					X	X		[Visual] Star on the compass begins to move far from center and toward bottom
		X						Jamie could have understood what the objective was had she learned to use the [TAB] key for the list of objectives, but instead she was using her previous strategy, which worked before, of trial and error exploration. Before she approached to the far gate, she stopped and paused. It was probable that she noticed the star was getting farther from the center and in the opposite direction from where she had learned it should be.
:02:11				X				Player backs up and then turns around to face the sign

					X	X			[Visual] Star on compass moves back to bottom center and then swings to top center
	X	X							It was becoming more apparent that the Jamie was attempting to learn how to control her moves to correlate with the star motion and position.
:02:17				X					Jamie moved forward inside the alley between two fences.
					X	X			[Visual] Star on compass moves to center
		X							Player was getting confirmation between moves and star action
				X					Jamie began to turn right, then back, then moved toward the fence facing the military person and pressed the [jump key] to attempt to jump over the fence
:02:43		X							Jamie appeared confused about why the compass was not working according to the model she has formed in her mind and was also unaware of what the current "objective" was, since she was attempting to guess that the military person was the objective. The use of the [jump key] indicated previous knowledge of game control conventions. Since she has not encountered that instruction yet as part of the game.
				X					Jamie backed up, turned around, and then moved toward a sign. She pauses and then began turning around again to face other areas of the fenced in space.
:02:50					X	X			[Visual] Star on compass moves to center then end up and to the left of center. The star ends up below and off to the left of center.
	X	X							If Jamie had understood the model incorporated by the designers of the game, she would at this point understand that the "objective" was slightly to her left and she would have needed to move forward a bit to achieve the objective. Jamie has not yet learned this model, and was becoming more lost.

:03:21			X	X		X	X			[EXTERNAL INPUT] Researcher interrupted play to show Jamie learned how to use the [TAB] key and reveal the "Objectives" list, and also points out the highlighted objective. The highlighted objective [Visual] Approach the Sign in the Corner
:03:36				X						Jamie rotated toward the sign in the corner and moves toward it
						X	X			[Visual] Star on compass aligns with forward direction and moves to center
		X								By looking at the list of objectives on the screen Jamie's strategy was more specific and targeted directly at the specific sign that was listed. The compass then became more of a check and reinforcer for her current strategy
:03:46						X	X			[Visual] small green text "Objective Updated" [Audio] "Close enough, now check your current objective" [Visual] Check your current objective [MILESTONE #2 COMPLETED]

Dr. Yadi Ziaee

723 Harvard Street Apt 34 Cell: 812.219.6720
Spearfish, SD57783
yadi@bhsu.edu
yadi@indiana.edu
yadiz5674@gmail.com

EDUCATION

2010 Ph.D. in Instructional Systems Technology (IST), Department of IST, Indiana University School of Education, Major: IST. Minor: Library Information Science, Department of Library Information Science, Bloomington, Indiana. Dissertation: *A Cased-Based Study on the Contributing Factors and Strategies applied in video games, virtual 3D environments, and blended learning for engagement and meaningful learning.*

2002 Master of Science: Instructional Systems Technology (IST Department), Indiana University, School of Education: Minor in Telecommunications, Department of Telecommunications, Indiana University, Bloomington, Indiana.

1987 Bachelor of Arts and Science: Major: Chemistry B.S. in College of Arts and Science, minor in German, Indiana University, Bloomington, Indiana; 1987

PROFESSIONAL APPOINTMENTS

2010-Present **Instructional Designer and Faculty Development,** Educational Outreach, Online Distance Education Department, at Black Hills State University, Spearfish South Dakota.

Responsibilities include: Designed, developed, and authored interactive and engaging instructional multimedia materials with assessment and simulation using a variety of tools and applications. Collaborated with faculty on the creation of new courses, and adaptation of existing courses for blended learning environment, through one-on-one consultations, workshops, and online training.

Lead role in designing instructional multimedia (instructional videos, training, and workshop activities), facilitate *Second Life* virtual 3D environment, and be a liaison between the faculty and technology enriched environment.

Certified for Quality Matters and Peer Reviewer program for the development, and improvement of online and face-to-face courses.

Provided trainings and mentorship to faculty regarding the course management system

(Desire2Learn) on an ongoing basis.

Effectively utilized technology and best practices in teaching and learning to develop and deliver initial and ongoing faculty training in the use of multimedia tools, course design, and online instruction.

Provided assistance to faculty in revising courses and materials to include multimedia components for enhancing student learning.

Created and edited audio and Instructional video aids (such as video snippets and podcasts) to supplement courses using best practices in video production and a variety of software such as Adobe Premiere, Photoshop, Flash, Audacity, Dreamweaver, Windows Movie Maker, Camtasia, and Adobe captivate.
Worked collaboratively with faculty to improve their technical skills and provided support to faculty and other staff members to develop pedagogically strong simulations in Second Life.

2007-2009 **Technology Support Specialist/Faculty,** Department of Curriculum & Instruction, Tarleton State University, Stephenville, Texas.

***Responsibilities include*:** Support students, preservice teachers and faculty in the use of technology applications, to include multimedia applications, graphic design, web design, instructional tools, videography, digital imaging, in support of instructional design products and tools make recommendations for syllabus revisions and technology applications according to Texas Technology Standards and national technology standard. Implement departmental standards and supported faculty for Chalk and Wire, Blackboard, and Professional Development course requirements. Additionally, provide students and faculty with instructional theory from design to development, including assessment tools for contextual factors and projects.

2007-2009 **Faculty,** Department of Curriculum &Instruction**,** Tarleton State University, Stephenville, Texas 76402.

COURSES TAUGHT

Summer 2009 (Tarleton, Texas A&M System Campus)

EDU 511 Effective Methods of Teaching in K-12, Technology Lab

***Responsibilities include*:** Introducing technology skills and their applications in support of the Tarleton Model for Accelerated Teacher Education (TMATE) course to include the use of multimedia design and development for diverse settings, technology, related terms, and concepts. Software for this session included, **Web 2.0 applications, BlackBoard, Desire to Learn (D2L), WebCT, PhotoStory3, Windows based video editing application and Webpage design.**

Spring 2007-2009 (Weatherford and Tarleton, A&M System Campuses)

EDU 320 Professional Development I: Understanding Learners approach to teaching and technology.

***Responsibilities include*:** Introducing technology skills from theory to practice in support of the Teacher Education Program Professional Development course to include the use of multimedia design and development for diverse settings, technology, related terms, and concepts. Software for this session included, **Web 2.0 applications, BlackBoard, PhotoStory3, Windows based video editing application** and **Webpage design, WebCT, which resulted a 20% increase in preservice teachers final exit exam score.**

Spring 2008 (Killeen, A&M System Campus)

EDTC 549 Educational Media and Technology, Tarleton State University.

Responsibilities include: The focus of this course is to introduce students and educators effectively in diverse educational settings with competencies that are instrumental to planning, designing, developing, implementing, assessing, and re-evaluating existing or proposed practices. In this course a variety of technology rich learning environments will be explored creating a vision of the ideal learning environment as well as describing the appropriate role of technology in that environment. Including critical and inquiry writing at graduate level.

2007-Present **Co-Investigator,** Virtual Xperience lab (VXLab), Indiana University, Bloomington, IN, 47405, 2007**.** Principal Investigators: Dr. Robert Appelman and Dr. Sonny Kirkley**.**

The research agenda of the VX Lab in the Instructional Systems Technology Department of the College of Education at Indiana University is to establish base-line data for game play. It is also used to establish methodologies which measure any of the Player Experiences in conjunction with Virtual Learning Environments, specifically games and their structures.

***Responsibilities include*:** collecting video data of 7^{th} and 9^{th} grade students while playing various games in the VXLab, Observation and assessing student's practices using video data using data analysis to determine if effective learning takes place. Worked with K-12 students and teacher on various projects, supporting in-service teachers to improve their teaching activities in classroom by using multimedia and blended learning strategies to engage students in a meaningful learning environment.

2006 **Assistant Instructor Distance Education,** Department of Instructional Systems Technology, Indiana University, Bloomington, Indiana.

R521: Instructional Design and Development for Online Courses
Introduced the instructional systems development process, from analysis through evaluation and implementation. In this course, students move through all the development phases incorporating various instructional design (ID) models, with emphasis on design issues such as classification of learning tasks, selection of instructional strategies, and development of prototypes. After completing this course, students are able to design effective and appealing instruction based on principles from instructional theory to practice and application of Adobe and Microsoft programs.

R541: Instructional Development & Production Process I
Introduced students to the multimedia production process from instructional theory to practice. During this course, students developed instructional products using a number of graphic, audio and video, presentation, and web development software. The emphasis of this course was on basic skills in writing, graphic design, message and communication design, interface design, scripting, prototyping, editing, formative and summative evaluation, and quality assurance. Supervised group of students assisting projects from design to development. Presented lecture, engaged in group discussion and final project evaluation. Graded their projects. Provided technical and application support.

1998-2007 **Adjunct Faculty**, Department of Computer Information Systems and Business Industrial Training, Ivy Tech State College Bloomington, Indiana.

CINS 101: Introduction to Microcomputers
Introduced the physical components and operation of microcomputers. Focused on computer literacy and provides hands-on training in four areas of microcomputer application software; word processing, electronic spreadsheets, database management and presentation software. Used professional business integrated applications package was emphasized.

CINS 102: Information Systems Fundamentals
Introduced information processing and programming with emphasis
on hands-on computer experience. Examined the role of information processing in an organization including: information processing applications, computer hardware and software, internal data representation, stored program concepts, systems and programming design, flowcharting, and data communications. Reviewed the history of computers, related computer careers, the social impact of computers, and computer security.

CINT 106: Microcomputer Operating Systems
Introduced the organization, structure, and functions of an operating system for a microcomputer. Presented the student with operating system concepts such as commands, error messages, interrupts, function calls, device drivers, structure, files and organization. Incorporated concepts into practical applications.

CINT 213 Hardware Support and Troubleshooting
Student will learn through lectures, discussions, demonstrations, textbook exercises, and classroom labs the skills and knowledge necessary to support end users who use microcomputers

in a corporate, small business, or home environment. The course will focus on key concepts of computer management including installing and updating operating systems, support local users and groups, manage hardware, and configure file and folder access. The student will learn techniques in resolving issues with hardware and operating systems, printers, and network connectivity.

CINT 121: Network Fundamentals
A study of local area networks, their topologies and their functions and provides a general understanding of the basic LAN protocols. Topics covered include; fundamental concepts and terminology, the IEEE/ISO Logical Link Control standard, construction of a LAN, and LAN data links for Internet works.

CINT 220: Network Server Technologies
A study of network servers, particularly the hardware and software necessary to efficiently maintain a modern network. This course focuses on installation, configuration, administration, and troubleshooting of network servers. In addition it deals with site preparation, performance monitoring, and disaster recovery. The course provides support and guidance for preparation of the student to take the Server+ certification exam, a COMPTIA vendor neutral test which can apply to Microsoft's MCSA, or stand on its own merit. This course contains elements above basic hardware fundamentals of a standard PC and so the certification is considered more advanced than the A+. In addition this course deals with Industry Standard Server Architecture (ISSA) issues, such as RAID, SCSI, multiple CPUs, SANs and other networking server issues.

CINT 225 Windows Network Operating Systems
Provides instruction to demonstrate the ability to implement, administer, and troubleshoot information systems that incorporate Microsoft Windows Server. This course is designed to follow a preparation path towards the appropriate Microsoft certification series.

Provided Corporate and Industrial Training for RCA and General Electric
Technology Workshops

***Responsibilities include*:** Design and instruct classes on the fundamental concepts in Windows based operating systems. Instruction in *Windows* operating systems and microcomputer applications. Emphasis on developing critical software, improve analytical skills, customizing *Windows* environments including *Microsoft Office*, and integrating applications. To include *Windows Systems A+* (certification) components of personal computer hardware, operating system software, and productivity tools as word processors, spreadsheets, and presentation graphics. Additionally taught Windows local area network (LAN) and wide area networks (WAN) administration, as well as *Windows NT* based courses, and network configuration setting.

1996 -2006 **Manager of Computer (*Computer Connection*) Department**, Indiana University

***Responsibilities include*:** Administer the purchase of software, hardware and volume licensing, provide expertise and technical support as well as consultation services at Indiana University. Interact with clients, departments, faculty, staff, and students. Provide leadership; establish store priorities to meet department sales goals. Identified and remained current with technology trends and advise departments of future educational needs. Implemented departmental policies, utilized departmental resources effectively and efficiently, designed, developed, and maintained software tools and customer database for tracking productivity. Supervised between 20-25 employees for the *Computer Connection*. Duties included staff scheduling, budgeting, overhead reduction, cost analysis, and sales workshops for employees which maximized productivity for the computer department. Within a four year period, increased the sales productivity from five hundred thousand dollars in the red to three million dollars in the black. Designed and developed customized purchase orders, entry, and retrieval systems. Negotiated purchase prices with variety of national vendors.

1996 **Distance Education Coordinator,** Radio-TV Services and School of Telecommunications at Indiana University, Bloomington, Indiana.

***Responsibilities include*:** Troubleshooting, computer graphics, digitize sound, setting up computers, assisting teachers with training and technology. Managed distance education *Studio 7* for the purpose of interactivity in the classroom, familiarity with different electronic equipment both analogue and digital.

1994 **National Association for Perinatal Addiction Research and Education,** Chicago, Illinois.

***Responsibilities include*:** Directed and produced a series of training videos, responsible for setting up production equipment, lighting, photography, graphics, and editing, familiar with both digital and analog editing technology.

1993 – 1996 **Graduate Assistant,** Instructional Systems Technology, Indiana University,

***Responsibilities include*:** Consulted with faculty, staff, and students at all levels in providing technical support, troubleshooting and installation on a variety of computing problems, platforms, software, and hardware. Worked with international students, maintained computing lab and production studio and provided leadership in developing and implementing the application of new technologies; designed workshops to teach the use of video and multimedia production. Directed and produced a series of educational and promotional videos for adult learners. Including training material for multimedia application for Educational Psychology and Education Language departments, took lead role in project management and message design and communication.

1985 – 1989 **Director of Disaster Services**, American Red Cross, Bloomington, Indiana.

***Responsibilities include*:** Supervised team of 10-20 employees, staff scheduling, budgeting, training and planning. Provided leadership in organizational development, implemented departmental policies, participated in organizational fundraising, established priorities, and problem solving for disaster relief scenarios. Identified the needs of fire and disaster victims as well as provided shelter and accommodations for low-income families.

SCHOLARSHIP

Publications

Ziaeehezarjeribi, Y., Graves, I. & Gentry, J. (in Press August 2010). From theory to practice, repurposing COTS games for P-12. In A. Hirumi (Ed.), *Digital Video Games for PrK-12 Education: Engaging Learners through Interactive Entertainment.*

Graves, I., Ziaeehezarjeribi, Y., (2009) *Meeting the challenges of traditional learners in a 3D Virtual environment: Preservice teachers learn to use the prism of avatars for instruction.* Conference proceedings for the Association for Educational Communications and Technology Conference, Louisville, Kentucky, Oct 30, 2009

Ziaeehezarjeribi, Y., Worrell, P. and Graves, I. (2008). *Effective application of computer game technology in K-12,* Session presented at the Association for Educational Communications and Technology Conference, Orlando, Florida, November 7, 2008.

Frick, T., An, J. S., Koons, A. and Ziaeehezarjeribi, Y. Wayfinding on the Web. At AECT, Long Beach, CA, February. 18, 2000.

Presentations

Graves, I., Ziaeehezarjeribi, Y., (2009) *Meeting the Challenges of Traditional Learners in a 3D Virtual Environment: Preservice Teachers Learn to use the Prism of Avatars for Instruction.* Session presented at the Association for Educational Communications and Technology Conference, Louisville, Kentucky, Oct 30, 2009

Ziaeehezarjeribi, Y., Worrell, P. & Graves, I. (2008). *Effective application of computer gaming technology in K-12 classrooms.* Presentation at the international meeting of the Association for Educational Communications and Technology, November 2-9, 2008, Orlando, FL.

Professional Affiliations

- Game Developer Conference (GDC) http://www.gdconf.com/
- International Game Developer Conference (IGDA) http://www.igda.org/
- Serious Game (SG) http://www.gdconf.com/conference/sgs.html

- Association for Educational Communications and Technology (AECT) http://www.aect.org/
- Virtual Xperience Lab (VXLab) Indiana University, Bloomington, Indiana

RECENT PROFESSIONAL SERVICES

2010

Presentation on best practices in Distance Education. Example of Blended learning, Web 2.0 tools, simulations and video games, and designed-based practices. Black Hills State University, Spearfish, South Dakota, (January, 2010)

2009

Member of Second Life Virtual Environment Design and Development Team, Tarleton State University, Stephenville Texas (2009-present)

Effective methods of teaching and learning with microcomputer application and preservice teacher work-sample data analysis. Tarleton State University, Stephenville, Texas (Fall 2009)

Presentation on the role of pre-service and in-service teachers working with diverse cultural setting. Tarleton State University, Stephenville, Texas (Fall 2009)

Chalk and Wire Workshop for Faculty Development- use of assessment tools for preservice teachers. (Spring 2009)

Presentation on multicultural and social issues, Department of Curriculum and Instruction, Tarleton State University, Stephenville, Texas (Summer 2009)

Workshop on *Faculty Development and Web 2.0 tools and Google Docs***,** provided instructions on how to setup a Gmail account, create, revise, and track revisions, and share, store, and export documents. Tarleton State University, Stephenville, Texas (Spring 2009)

Presentation on diversity – and the role of teachers working in diverse cultural settings. Tarleton State University, Stephenville, Texas (Spring 2009)

2008

Preservice Teacher's Technology Workshop- current software applications for use in elementary settings. (Fall 2008, Spring 2009, Summer 2009)

Editorial Service

2009- Present *Editorial Review Board* and Editor/Mentorship, *Journal of Effective School Project,* Tarleton State University, Stephenville, Texas

2008-Present Manuscript *Reviewer,* Instructional Systems Technology (IST) Conference 2008, Local chapter, Indiana University, Bloomington, Indiana

2007-Present *Member and Editorial Review Board,* International Journal of Gaming and Computer-Mediated Simulations (IJGCMS)

2007 *Manuscript Reviewer,* Handbook of Research on Effective Electronic Gaming in Education.

2000 *Group Usability Tester,* Indiana University Website, Bloomington, Indiana.

OTHER SPECIAL SKILLS

Excellent public relations and organizational skills, writing, general office management, negotiation; detail and deadline orientated, project management, budgeting, analysis and design, development, education, planning, marketing, client relations, project review, and managing day-to-day activities, enjoy working with diverse environment and international communities.

Experience writing grant proposal as part of a group to conduct needs analysis for the Indianapolis Public School (IPS) System to identify the use and improvement of technology in the IPS system that included one-on-one interviews and group workshops. IPS received a grant of $1.5 million towards technology development based on this proposal.

Twenty years of experience in both Apple (Macintosh) and Windows (PC) computers

---

REFERENCES

Dr. Robert Appelman: Professor, Indiana University School of Education, 812.856.8456, appelman@indiana.edu

Dr. Curt Bonk: Professor, Department of Instructional Systems Technology Indiana University School of Education, 812.322.2878, cjbonk@indiana.edu.

Dr. Ingrid Graves: Assistant professor, Department of Curriculum & Instruction**,** Tarleton State University, Stephenville, Texas 76402, 817.721.9729, ingrid.graves@bhsu.edu