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Cooperative Vs Competitive Goals In Educational Video Games

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COOPERATIVE VS COMPETITIVE GOALS IN EDUCATIONAL VIDEO GAMES

by

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ABSTRACT

The concept of serious games, or using games and gaming technologies for purposes other than purely entertainment, became popularized with the creation of the Serious Games Initiative in 2002 and has continued to grow. While this trend may appear new, the use of games for learning has a rich history and the idea of using a game as a learning platform is an established concept that had has withstood the test of time. Research in this area must move from if games can teach, to how do we improve games that do. Proponents of serious games suggest that they should improve motivation, time on task, motivation to learn, and a litany of other benefits based primarily on the thought that what works in an entertainment game will work in a learning game. Unfortunately, this might not always be the case. For example, a commonly held misconception in learning games is that competition will motivate learner to succeed, as it motivates players of an entertainment game to continue to play. This is, however, not well supported by the learning science literature. Cooperative goal structures commonly lead to increased motivation to learn as well as improved learning outcomes when compared to competition. This research seeks to provide a framework to view games for learning and more specifically explore the structure of challenge in the context of cooperative and competitive goal structures, as well as explore the use of the word game and how it could possibly modify the expectations of the learner.

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LIST OF ACRONYMS

ADL	Advanced Distributed Learning
CBT	Computer Based Training
COTS	Commercial Off The Shelf
DAU	Defense Acquisition University
DoD	Department of Defense
GDC	Game Developers Conference
ILS	Immersive Learning Simulation
IRB	Institutional Review Board
ISD	Instructional Systems Design/Designer
MCMSMO	Marine Corps Modeling and Simulation Management Office
PvP	Player versus Player
SG	Serious Game
SGI	Serious Games initiative
SGS	Serious Games Summit
STEM	Science Technology Engineering and Math
TCM	TRADOC Capabilities Manager
TDS	Tactical Decision-making Simulation
TRADOC	Training and Doctrine Command

CHAPTER ONE: INTRODUCTION

The use of video games in non-entertainment based applications such as education and training has been on the rise over the last few years. Researchers from around the world have started to gravitate to it as a solution to various educational dilemmas including the STEM crisis, adaptive military training, and cultural awareness, just to name a few. As this market has formed it has come to primarily identify itself under the label Serious Games. While the appropriateness of the term is often debated in academic circles, Serious Games has a long pedigree for its use in this space. The term was first used in 1970 by Clark C. Apt in his book titled simply, "Serious Games." This book defined Serious Games primarily around their use in education and is still considered relevant today (Apt, 1970). The term, however, was then largely unused until 2002 when the Serious Games Initiative adopted it to further its mission of spreading the use of games designed for any non-entertainment based applications. Through the decade that followed, the hype and popularity around Serious Games continued to grow, and hundreds of good Serious Games have been made. Many of these games have proven to be successful uses of games or gaming technologies and have spanned almost every major industry (B. Sawyer, Smith, P., 2008).

While many efforts have led to the development of good learning games that have shown promise there has unfortunately not been overwhelming evidence showing that the use of Serious Games leads to greater learning gains than any other means of training. While the smoking gun that the community could rally behind and easily repeat still has not emerged, by 2006 multiple reviews were completed on current efforts, none of which show games to be a clearly preferred

method for education in any situation. On the other hand, there was no clear evidence that they might be worse, and they did reveal some interesting side effects such as increased motivation, time on task, and engagement in the learning (Hays, 2005; Vogel, 2006). As a result effort is continuing to pursue games as a medium for learning with a greater focus being paid to how games should be implemented; how their design should inform learning; and how they should be aligned with existing learning pedagogies and instructional design models.

There is a growing need to explore the art of game design as it relates to Serious Games. In particular, there is a need to understand the effect of applying formal game design mechanics in educational games and determine if there is more to making educational games than current game design models provide. By determining what features of games are important to enhancing the learning outcomes of games a model can be produced mapping these features to conventional game designs and further determine why many games researchers believe inherently that all good games are well designed teaching tools (Gee, 2007a; Koster, 2005; Prensky, 2000)

All Good Games Teach

> *Fun from games arises out of mastery. It arises out of comprehension. It is the act of solving puzzles that makes games fun. In other words, with games, learning is the drug. (Koster, 2005)*

As Raph Koster (2005) speculated in his book, A Theory of Fun for Game Design, many researchers have suggested that good entertainment games are naturally good educational platforms. While at its core this assertion does not seem overly confrontational, this thought has commonly been associated with hyperbolic claims that games are inherently perfect learning tools and that pedagogy and the sound application of the science of learning should be discounted at the obvious superiority of good game design. It is this thought that led Marc

Prensky, one of the top proponents of games for training, to famously state, in a debate at the 2005 Serious Games Summit, that “under certain circumstances we can get rid of teachers.” Prensky’s implication is certainly on the extreme end of this argument, but he poignantly made the point clear (McDowell, 2005).

Less confrontational, but similar, views have come from other respected researchers, such as James Paul Gee. Best known for his book, “What video games have to teach us about learning and literacy,” Gee focuses on the idea that good video games exhibit thirty-six learning principles that are supported by current learning and cognition research. He does not, however, focus on what features of games would make them good learning tools in educational contexts. In fact, he argues against the idea that games have to have an explicit educational context at all in order to be educational (Gee, 2007a).

The thought that games can inherently be powerful tools in the educational space is hard to maintian while there has not been an overwelming example game that has lived up to the hype surrounding the concept. Kurt Squire’s work with Civilization has come the closest to providing an example of a successful commercial game with the inherent power to teach, but the game still required a high level of outside support to fulfill the educational goals (Squire, 2004). This is of course due to the fact that Sid Mier, the original designer of the Civilization series, had no educational goals in mind when designing the game (Meier, 2008). Ben Sawyer, the founder of the Serious Games Initiative, has argued that as it is hard to create a successful entertainment game, building a successful educational game should be just as hard if not harder (McDowell, 2005). Further given the fact that the best game designers are busy making these successful entertainment games they will not be working on the educational game design problem. The

people who are may not have the design ability or the development budget to match commercial quality games, even before adding the educational components. It is a seemingly impossible battle.

Regardless of the games educational intent Koster, Prensky, Gee, and many others have all suggested that good games have an inherent power to teach the player to master the games internal system. If this system is educational in nature they should be powerful tools that harness the same inherent features as good entertainment games. Despite a lack of many good examples in the educational space this thought may well be true. It is hard to argue against the evidence of players of one game easily mastering others with similar game play styles, or mechanics. Certainly players are learning something about the systems they are interacting with. Although, it still remains largely a mystery how to best leverage this power for practical education and training applications. Because of the nuance of game design as an art form, the power behind the learning is lost. Therefore, the fact that good games teach is moot if educational game designers cannot make them.

Problem Statement

This research seeks to go beyond the prevailing thought that good games have an inherent power to teach and begin the arduous task of understanding how. Chris Crawford said it best in the first sentence of his book The Art of Computer Game Design, "… Computer games constititute a new and poorly developed artform that holds great promise for both designers and players." (Crawford, 1984). Unfortunately it has taken many years for the artform to emerge with well thought out and accepted design methodologies that balanced the cultural desire to consider games an artform while maintaining strong ties to thoughtful systems engineering. Learning

games, however, need to meet the needs of wholy different communities that require these formal methodologies such as educational institutions, corporate learning, military training. As such, formal design models specifically targeted towards learning games should be developed, regardless of progress in the entertainment space.

If it is possible that all good games teach, expanding upon existing design models that lead to good games with guidelines that support existing pedagogies and instuctional design models should provide a strong basis for the development of learning games. While this may seem obvious, even trivial, determining what design models actually lead to good games, and further how to apply appropriate guidelines is more complicated than it appears. There are currently debates in the game industry that go further than what goes into good game design. There are debates that go to the core of what features make up a game at all. Avoiding these esoteric debates and looking at games on functional feature level of a formal system design will help tease out the appropriate guidelines and mechanics that can lead to effective learning games. The relationship between the features that define a game to the features of games that support learning is important, for good learning games to be created.

The primary question of this research is: If all good games teach are the features that make a good entertainment based video game the same as the features that make a good learning game? Also, if the features are the same should they be implemented in similar ways? That is to say, are the same attributes that make a game a good entertainment game fun the same attributes that make a good educational game teach?

The Purpose of This Study

With many arguing that good entertainment games are well designed educational tools it stands to reason that all of the commonly held features should be embodied in games in similar ways. Looking at the features of entertainment games as defined by Salen and Zimmerman (2004) in their book “Rules of Play” this work will look more closely at one common feature: conflict, or the challenge created in the game. Challenge in many of the most common games is built around an individualistic goal structure created between the player and the game in which a single player attempts to beat the game. It is also quite common for games to include various methods of competition including high score tables, PvP combat, split screen multiplayer combat, etc. In recent years networked multiplayer games have become more prevalent and have allowed for varied implementations of challenge within games. In recent years, with the growing popularity of online gaming networks, more multiplayer options have been added to games. This has led to many new ways to interact with other players including large numbers competing, team based modes, and cooperative play. Cooperative play in particular has become increasingly popular with the advent of hop in hop out multiplayer, where teammates can join the current player for a short play session without interrupting the flow of the rest of the game.

No matter how challenge is implemented it is a powerful tool in motivating players to participate in games. Competition, however, has recently been celebrated in learning game circles as one of the main features of games that make them useful for learning. Perhaps another goal structure would be a better way to evoke challenge in learning games.

> *Every gamer and game scholar knows that a great many gamers, including young ones, enjoy competition with other players in games, either one-on-one or team-based. It is striking that many young gamers see competition as pleasurable and motivating in video games, but not in school. Why this is so ought to be a leading question for research into games and learning. (Gee, 2007b)*

As called for as "a leading question for research" in games (Gee, 2007b) The purpose of this study is to further explore challenge as a feature of games, and more specifically challenge as it relates to competitive versus cooperative goals. While players value competition in entertainment games, this value does not seem to universally transfer over to education and by proxy to educational games. In fact, competition has been shown in some cases to have detrimental effect on learning outcomes. It is currently thought that using a cooperative goal structure will lead to superior learning outcomes when compared to an individualistic or competitive goal structures in sufficiently complex learning games. This study will explore the use of multiple goal structures implemented in an educational game to further the field of learning game design to better understand the appropriateness of each structure as it relates to challenge in games.

Research Questions

This research will first define a framework with which we can explore the features of learning games and what outcomes can be expected by implementing them. In particular it will explore a single game construct, challenge. The challenge of the game will be contextualized through narrative to investigate the use of both a cooperative and a competitive goal structure in an otherwise identical learning game. Through this context, this research will seek to find what changes occur in academic achievement, goal orientation, motivation, satisfaction, and self

efficacy. This research will further explore the use of the word game as it applies to learner expectations, as well as prior experience with games and preferences towards competition.

Definition of Terms

Competitive learning – Learners work independently to accomplish negatively interdependent goals.

Cooperative learning – Learners work in groups to accomplish positively interdependent goals.

Edutainment – A name given to games developed during a briefly successful attempt to popularize educational games in the 80s.

Game – A game is a system in which players engage in an artificial conflict, defined by rules, that results in a quantifiable outcome." (Salen & Zimmerman, 2004)

Individualistic learning – Learners work independently with no interdependence between their goals and the goals of other learners.

Learning Games – Games with the primary goal of education or training.

Serious Games – An umbrella term referring to any game developed for a non-entertainment based purpose.

CHAPTER TWO: LITERATURE REVIEW

> *The Earliest games were developed not for idle amusement but for serious purposes… By playing with teammates, they would also learn how to coordinate maneuvers and how to strategize. Over time, these athletic games evolved into formal competition. Undoubtedly, the best known of the ancient sporting events are the Greek Olympic Games. (Miller, 2004)*

While modern society often trivializes the importance of games, relegating them to the level of common children's toys, the idea of using games for educational purposes is as old as the idea of games themselves. As mentioned above by Carolyn Handler Miller, not only did games originate to teach youth how to participate in society they also taught strategy, how to compete, and also how to cooperate in teams. (Miller, 2004)

The earliest board game ever created, Senet, appeared in Egypt in 3000 BC. Archeologists have found at least 40 of these board games in various tombs throughout Egypt including those of Pharaohs and commoners alike. The game was thought to be both a form of entertainment and a window to mystical knowledge. Scholars suggested that players though certain results would forecast their fortunes, good players were favored by the gods, and only through mastery of the game could one ascend to death. By 1400BC a new game, Mancala, was formed from a commonly used accounting tool. While it evolved to be a gambling tool, do its roots imply that it also helped the player become a better trader? Unfortunately, the answer to that question has been lost to the ages. What is clear is that these games laid the ground work for future games like Go, Chaturanga, and chess that were commonly used to teach military strategy. These games would later evolve to lay the foundations of modern war gaming in the military. (R. Smith, 2009)

While most of the earliest games on record have some form of educational lineage, in more recent times games have come under fire as a scapegoat for many of society's problems including violence, obesity, and antisocial behavior, similarly to comic books, and television before them (Ferguson, 2007). Even president Obama named video games as a health concern for kids during a speech to the American Medical Association (GamePolitics.com, 2009). This misconception that video games are a negative influence on society could not be further from the truth. Video games are being used to bring attention to the plight of people in Darfur, teach people about other cultures, train soldiers, cure diseases, and educate America's youth. These games fall into a growing classification of games known as Serious Games.

Serious Games

The term Serious Games, an umbrella term that has come to mean any games that have any goals other than pure entertainment, was popularized in 2002 when Ben Sawyer of Digitalmill, and David Rajeski of the Foresight and Governance Project at the Woodrow Wilson International Center for Scholars founded the Serious Games Initiative (SGI). The SGI was founded to pursue the goal of helping to organize and accelerate the adoption of computer games for non-entertainment purposes, this included exploring new techniques in development and building new partnerships between the games industry and other interested parties. (SeriousGames.org, 2011) Since 2002, the Serious Games community has grown to include hundreds if not thousands of developers and millions of dollars have gone into the development of these Serious Games (B. Sawyer, 2007). While the SGI has contributed to large scale growth in the Serious Games market they did not invent the concept. That of course happened many years before.

Background

Clark C Apt's book Serious Games was published in 1970 and represents the first recorded use of the term Serious Games (Apt, 1970). The term Serious Games was not, however, an instant success. In the 30 years that followed, serious games had a few false starts on the road to becoming a main stream part of the non-entertainment world, the most dramatic of these being in both the education and training arenas.

Before the more modern notion of Serious Games took hold the military made many attempts at using video games for training. The earliest being in 1980 when the Army commissioned Atari to build the Atari Bradley Trainer (P. Smith, In Press). This game was a modified version of the popular vector graphics based game Battlezone, also published in 1980. Only 2 Atari Bradley Trainers were ever built and shown at a trade show. It is unknown why the Army never deployed the game, but it was never actually used by soldiers.

Another military project was started by 1984, this time by the Navy, to use a video game to teach Morse Code (Driskell & Dwyer, 1984). This project also only made it through the prototyping phase. The military's view of games at the time was that they were not serious enough for military training, though the problem seemed to be one of vocabulary only. This is illustrated by the Marines common use of games under the name, Tactical Decision-making Simulations (TDS) since development of the game Marine Doom in 1996 (P. Smith, 2005). Marine Doom is a modification (mod) of the popular first person shooter game Doom created by the Marine Corps Modeling and Simulation Management Office (MCMSMO) developed for the training of Marine fireteams.

This prejudice against video games didn't carry over to the common practice of table top War Gaming, or the use of Flight Simulator Software on PC's, which were sold as games to the rest of the world. The military did not seem completely ready to embrace games for training until after DARPA created DARWARS Ambush, a mod to the game Operation Flashpoint, which was followed up by the Army creating TRADOC Capabilities Manager for Gaming (TCM Gaming) and deploying Virtual Battle Space 2 (VBS2) as one of many official Army Games in 2008. However this prejudice persisted after Serious Games as a concept were well established in other communities. (R. Smith, 2009)

Paralleling the emergence of games in the military is the development of the ill fated Edutainment market. In the early 1980s Edutainment games became an incredibly popular trend. These games, such as "Where in the World is Carmen Sandiego," "The Oregon Trail," "Reader Rabbit," "Math blaster," among many others flooded the market with games that contained some level of educational content. Mizuko Ito described it as a time where the developers where empowered with a "sense that they were creating possibilities for learning that freed it from the institutional constraints of schooling." (Ito, 2006).

Edutainment games succeeded in capturing an audience, and establishing itself as an accepted part of the games industry, however, they never quite got established as a credible form of education. Ito, suggests that the reason behind this is that, "edutainment embodies the challenges which reformers face in creating new genres of representation and practice…" (Ito, 2006). However the answer is much simpler. In general the games did not achieve the dual goals of being good educational platforms while also being good games. Some, like "Oregon Trail" are remembered for their fun sequences, while others like "Math Blaster" hammered home the

learning content. Few if any provided a sound model that future success could follow. Edutainment, along with many of the other past attempts to develop learning games have largely been deemed failures. A sentiment best stated by Michael Zyda, the Director of the Game Pipe Lab at USC.

> *The game industry has already witnessed the failure of edutainment, an awkward combination of educational software lightly sprinkled with game-like interfaces and cute dialog. This failure shows that story must come first and that research must focus on combining instruction with story creation and the game development process. (Zyda, 2005)*

When Serious Games began many people pointed at Edutainment as an important part of our past that should not be forgotten or repeated. Though, without new development models it is difficult to avoid the traps.

A New Call to Arms

The excitement that surrounded the establishment of the Serious Games Initiative sparked a new call to arms among researchers and game developers alike. Established game developers like Raph Koster the designer of Star Wars Galaxies began championing the serious games space. In Raph Koster's book, A Theory of Fun for Game Design (2005) he described the motivating factor of fun in all games, entertainment, education, or otherwise, as the act of learning. James Paul Gee a well respected games researcher best known for his book, "What video games have to teach us about learning and literacy," focuses on the idea that all good video games exhibit thirty-six learning principles supported by literature in learning and cognition research (Gee, 2007a). This new call to arms was not based solely on the idea that games can teach, but that the principles behind good game design actually support learning. That is, the idea that fun in games is not a passive act of absorbing learning material from a media platform, but

that it is a part of the fundamental act of experiencing games.

The change in perspective that moves new games researchers from can games teach to how do games teach is powerful, and yet difficult to answer. The caveate that it is not that all games teach but that all good games teach exposes a simple truth, it is hard to make a good game, no less a good game that is also educational. The real challenge is getting the people with the design abilities to make these games into the process of making good games for learning. Given that this is at the very least hard, the other alternative is to get the best developers to establish best practices and quantify what actually makes games as systems work. Efforts to move in that dirrection must begin with establishing terms and defining a framework for what goes into games for learning as formal systems.

Defining Serious Games

Clark C. Apt defined Serious Games as games that "have an explicit and carefully thought-out educational purpose and are not intended to be played primarily for amusement" (Apt, 1970). Apt wrote these words over thirty years before the founding of the SGI but his words are still relevant and extremely close to the current definition that most game scholars adhere to for serious games. His definition's one inconsistency is that serious games have evolved to include more applications than just education. Serious games are commonly defined as some derivation of: A game designed for a primary purpose other than pure entertainment. This definition and the others like it are all extremely open ended in order to encapsulate the diverse backgrounds of various serious game practitioners.

Many more definitions were proposed, most of which contained some reference to the definers area of interest. Further definitions that proposed a list of possible areas in which

Serious Games were applied inevitably left out some fringe group that also professed to create serious games. Mike Zyda, the Director of GamePipe at USC, for example defined serious games as: “a mental contest, played with a computer in accordance with specific rules that uses entertainment to further government or corporate training, education, health, public policy, and strategic communication objectives” (Zyda, 2005). His particular definition met his vision of what a serious game could be, but others whose application of serious games do not fit into the categories defined were still searching for a definition. Further still, many industries utilize gaming technology but do not create games and still feel part of the Serious Games Community. These applications should also be include in a definition of serious games.

Unfortunately, by 2008 no clear and agreed upon definition of serious games existed for the community to rally behind. Soon the unavoidable fragmentation had grown out of hand with fringe groups already breaking off and creating their own communities of practices under new names. The following section will delve into some of the more popular titles and provide some background as to why these communities came to be.

Tactical Decision-making Simulations (TDS)

As previously mentioned the U.S. Marine Corps rallied around the term Tactical Decision-making Simulations or TDSs. TDSs are for all intents and purposes Serious Games. They were for the most part developed for education or training applications. The moniker of TDS was used to avoid the idea that calling something a game would lead to it not being taken seriously. The Marines pioneered the use of games in the military, starting with the Doom Mod, Marine Doom. They also experimented with co-developing games with entertainment companies and utilizing Commercial off the Shelf or COTS games. Their current flagship TDS is VBS2,

and the community, including the Marines, accepts it as a game even if they still use the TDS label internally. (Woodman, 2006)

Persuasive Games

Created by researcher Ian Bogost from Georgia Tech, Persuasive Games is one of the newer classes of Serious Games. Bogost defined the term in his book, "Persuasive Games: the Expressive Power of Videogames" to include games built for advertising (commonly referred to as Advergaming), education, and politics. The term Persuasive games refers to the games ability to persuade the player over to the designers viewpoint on the content presented in the game (Bogost, 2007).

Immersive Learning Simulation (ILS)

The eLearningGuild released their 360 Report on Immersive Learning Simulations. In it they revealed that the result of a study of over 1,000 e-Learning professionals found the term Serious Games as an inappropriate term for the area of education and that they preferred the term Immersive Learning Simulation of ILS (Wexler et al., 2007). In recent years the eLearningGuild has begun to use the term Serious Game again, but usually in the context of an explanation of what an ILS is.

Games for Change

Games for Change are games developed to promote social change. Other similar terms used in the community are Games for Good and Social Impact Games have similar goals, but the Games for Change community has gained the most ground in the field. Games for Change sprung up out of a need for that community to separate from the then education focused Serious

Games community. The realization that they had a separate set of needs from educational game developers was one of the impetuses for trying to better understand the landscape of the Serious Games community (GamesForChange.org, 2012).

Learning Games

Learning games include groups that make educational games, training games, edutainment, digital game based learning, and other names that have come and gone over the years. The area of learning games is where most of the work in Serious Games has traditionally occurred, and where much of the funding dollars from the Department of Defense (DoD) and the Department of Education have traditionally gone. This group has no clear leadership, but certainly the largest membership. This is also the area that this research will concentrate on. (B. Sawyer, Smith, P., 2008)

Game Based "X"

Further fragmentation occurred through the use of the term "game based" followed whatever activity the game represented. This includes game based, work, school, advertising, learning, and any other term possible. The point is, the community fragmented and there was a need, and to that point there still is a need, to bring it back together. (B. Sawyer, Smith, P., 2008)

A Taxonomy for Serious Games

In an attempt to help stave off the continuing market fragmentation the Serious Games Initiative undertook a yearlong project to analyze the current market place and build a functional taxonomy for understanding the Serious Games community. The Taxonomy was presented at the Serious Games Summit (SGS) held at the 2008 Game Developers Conference (GDC). The focal

slide of the taxonomy is provided here. It defines the current categories of games that have been developed by the Serious Games industry including, Games for Health, Advergames, Games for Training, Games for Education, Games for Science and Research, Games for Production, and Games as Work. It further cross references them with the industries that currently use Serious Games. Further slides show the amount of development in each category, illustrating that most of the work in the Serious Games Space was being done for education and training in both schools and the military. (B. Sawyer, Smith, P., 2008)

Table 1 – The Serious Games Taxonomy

	Games for Health	Adver-games	Games for Training	Games for Education	Games for Science Research	Production	Games as Work
Government & NGO	Public Health Education & Mass Casualty Response	Political Games	Employee Training	Inform Public	Data Collection / Planning	Strategic & Policy Planning	Public Diplomacy, Opinion Research
Defense	Rehabilitation & Wellness	Recruitment & Propaganda	Soldier/Support Training	School House Education	Wargames / planning	War planning & weapons research	Command & Control
Healthcare	Cybertherapy / Exergaming	Public Health Policy & Social Awareness Campaigns	Training Games for Health Professionals	Games for Patient Education and Disease Management	Visualization & Epidemiology	Biotech manufacturing & design	Public Health Response Planning & Logistics
Marketing & Communication	Advertising Treatment	Advertising, marketing with games, product placement	Product Use	Product Information	Opinion Research	Machinima	Opinion Research
Education	Inform about diseases/risks	Social Issue Games	Train teachers / Train workforce skills	Learning	Computer Science & Recruitment	P2P Learning Constructivism Documentary?	Teaching Distance Learning
Corporate	Employee Health Information & Wellness	Customer Education & Awareness	Employee Training	Continuing Education & Certification	Advertising / visualization	Strategic Planning	Command & Control
Industry	Occupational Safety	Sales & Recruitment	Employee Training	Workforce Education	Process Optimization Simulation	Nano/Bio-tech Design	Command & Control

The success of the Taxonomy as a reference for where the market had evolved did not, unfortunately, meet the needs of everyone in the community. Debate on the appropriate categories continues. While criticisms can be made of final categorization, the model persisted and it is commonly understood that Serious Games cannot be defined as a single type of game. This has not, however, stopped market fragmentation. Instead, it has allowed fragmenting groups

to maintain a tie back to Serious Games. It also provided a solid definition for Serious Games: Serious Games are a type of game or use of gaming technology to further any non-entertainment goals.

Learning Games

While the previous sections explained what Serious Games are and tracked their lineage to show how they came to be, this work is concerned with a small subcategory of Serious Games, Learning Games. Learning Games are comprised of games developed primarily for education and training. This particular subcategory contains most of the games developed by the military in particular, excluding those games developed for recruiting purposes. They are also the games related closest to Edutainment.

The current generation of Learning Games has come a long way since the early 1980s. They have undergone much refinement through the lessons learned that led Michael Zyda to declare them a failure (Zyda, 2005). Despite the evolution they are still considered subpar by many due to the lack of development guidelines, and underprepared designers. Jacob Habgood of The University of Nottingham's Learning Science Research Institute labeled them to be "Chocolate-Covered Broccoli" due to their poor marriage of games and learning (J. Habgood, 2005). His suggestion to solve this is a tighter integration between game mechanics and the learning content or what he terms as Intrinsic Integration (M. Habgood, Ainsworth, & Benford, 2005). This is a sentiment shared by NavAir's Dr. Robert Hays in his game based research literature review as illustrated in Figure 1 (Hays, 2005).

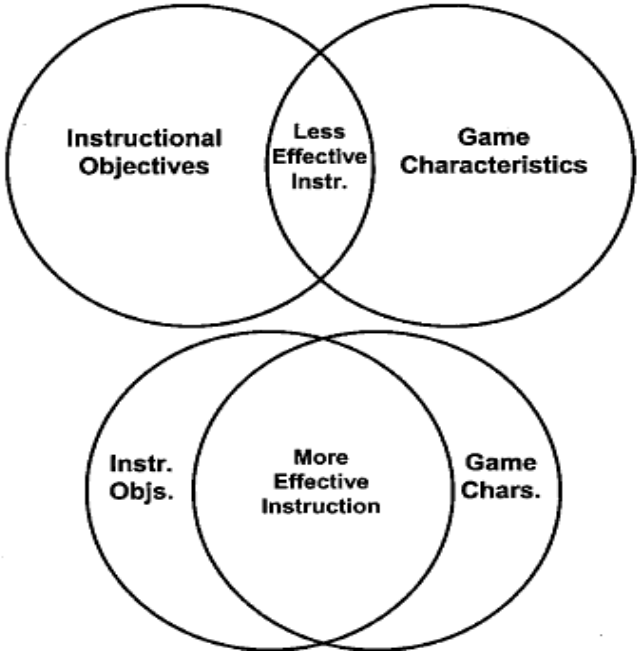


Figure 1 – The Overlap Among Instructional Objectives and Game Characteristics

Both Habgood and Hays understood that for good learning outcomes to occur gaming characteristic or features needed to support instructional objectives completely. This of course means that learning games need to go beyond the "lightly sprinkled… game-like interfaces and cute dialog" Zyda (2005) used as a charge against edutainment. They need game mechanics that support both gameplay and learning at the same time. Game mechanics are, "mechanisms through which players make meaningful choices and arrive at a meaningful play experience" (Salen & Zimmerman, 2004).

Determining Relevant Features of Games

In order to map mechanics to learning outcomes it is important to understand what features of games support what types of mechanics. Further in order to insure those games support learning it is important to have an understanding of what features of games support what

learning outcomes. By mapping these features against each other, an understanding of how game mechanics map to learning outcomes can be gained.

Features of Entertainment Games

Before being able to determine the features of games that lead to better learning, it is important to first identify the features that fundamentally define a game. Unfortunately, there isn't one agreed upon definition that everyone in the game industry uses. Further, the definitions that are used seem to vary widely.

Many definitions are far too simple to describe all games well. One of the most oft mentioned definitions is Sid Meier's declaration that, "A game is a series of interesting decisions." (Bateman, 2008). While this might be true of good strategy games, the type of games Meier is known for, this does not include simple twitch or rhythm games, where the player is tasked with maintaining good timing, but is limited on the decisions they can make. The definition cited by Jane McGonigal, a well known proponent of gamification, in her book, Reality is Broken, is the philosopher Bernard Suits. He stated, "Playing a game is the voluntary attempt to overcome unnecessary obsticles." (McGonigal, 2011; Suits, 1978) This definition, while open ended enough to justify gamification as a legitimate type of game does not provide enough details to even meet the features McGonigal suggests in her book, of goals, rules, feedback, and voluntary participation (McGonigal, 2011). Though this set of features are already flawed as many educational games are compulsory to courses.

The game designer who's games are most often cited when the question of what makes a game versus a simulation is Will Wright. His games include SimCity, The Sims, and Spore, but

he doesn't consider them games, he describes them as toys. "People call me a game designer, but I really like to think of these things more as toys." (Wright, 2007).

One of the earliest game scholar's, Johan Huizinga defined games in his book, Homo Ludins as:

> *… a free activity standing quite consciously outside "ordinary" life as being "not serious", but at the same time absorbing the player intensely and utterly. It is an activity connected with no material interest, and no profit can be gained by it. It proceeds within its own proper boundaries of time and space according to fixed rules and in an orderly manner. It promotes the formation of social groupings which tend to surround themselves with secrecy and to stress their difference from the common world by disguise or other means. (Huizinga, 1949)*

This definition might be too complex, and therefore also too restrictive. Jesper Juul provided a definition that attempted to encompass the various views one could take on games. In doing so, he categorized definition in the categories of: the game as a formal system, the player and the game, the game and the rest of the world, and other (Juul, 2003).

As this work is particularly concerned with learning games, a good definition would consider a game as a formal system that can be applied to learning. As such the definition of games used moving forward here will be Katie Salen and Eric Zimmerman's definition provided in their book Rules of Play. Salen and Zimmerman like many other game researchers developed their definition though a thorough analysis of various definitions. In particular, they used a total of eight leading definitions that were suitably feature rich. Three of these definitions have already been discussed; all of them are by leading games researchers or designers themselves. By carefully comparing these definitions and analyzing their meaning, they settled upon their definition and in so doing they have provided a workable framework for the features that make a game. (Salen & Zimmerman, 2004)

Using this framework as a guide, Salen and Zimmerman defined a game as: “A game is a system in which players engage in an artificial conflict, defined by rules, that results in a quantifiable outcome.” (Salen & Zimmerman, 2004). Using this definition, a game can be broken up into the follow set of core features: System, Players, Conflict, Rules/Goals, Outcomes, and the Artificial. This set of features will be used moving forward in this research.

Features of Learning Games

Learning games at their core can and should be considered games, and as games they should exhibit the same features of games that define games themselves. Therefore determining a list of features that defines learning games is a redundant process. The interesting task is in determining the features of games that support learning.

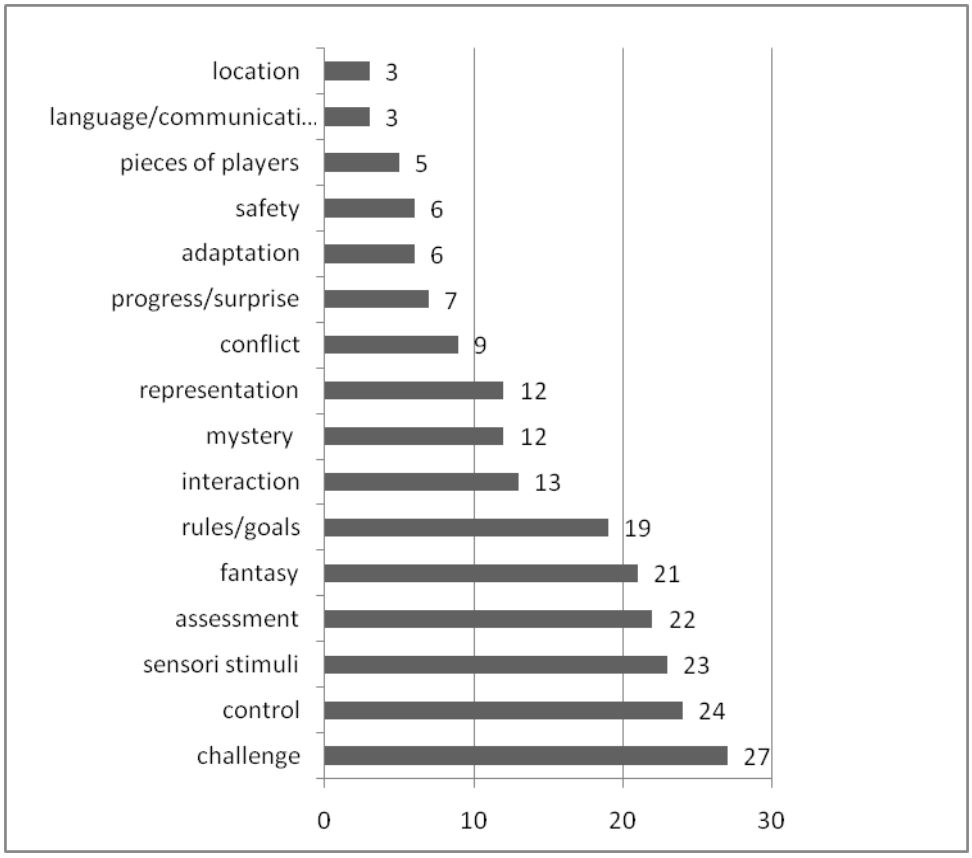


Figure 2 – A Comparison of Game Features Supporting Learning

In a comprehensive review of over 41 papers preformed in 2009, researchers identified over a dozen features of games that would support learning (Wilson et al., 2009). Upon closer inspection of the data provided, some features overlap with each other. Others are along considered features of games by a miniscule fraction of the 41 researchers. As seen in Figure 3, over 27 researchers found challenge to be an important feature for learning in games, while only 3 suggest location is important. For this research, only features agreed upon by 10 or more researchers will be considered agreed upon features. Further, overlapping features will be combined.

In particular, the feature of interaction, or the ability for the player to interact with the game, will be combined with control. Control is the ability for the player to maintain control of the flow of the game, an activity accomplished through interaction.

Another overarching feature of games is their aesthetic feel. This feature is represented by mystery, fantasy, representation, and sensori stimui. The Aesthetics determine if a game provides a mystery to unravel, if the game is fantasy based or based in realistic representation of reality, and they are responsible for the type and form of sensori stimui provided to the player. Once repeated features are consolidated and fringe features are removed we are left with the following list: Interaction, Challenge, Rules/Goals, Assessment, and Aesthetics.

Complementary Features

The list of features that game designers have determined to define games share a remarkable level of overlap with the list of features learning games researchers determined support learning.

Interaction / Players

Interaction is a key feature of games. Games are to be played by players, not observed or reported on. Interaction is sometimes defined by the players themselves, “Players interact with the system of a game in order to experience the play of the game” (Salen & Zimmerman, 2004). Other times it is defined through the type of hardware, such as a game controller, or mouse and keyboard combinations. Interaction can occur in many ways, and through many mechanisms, the important part of the equation is that the players input is accepted by the game through any means and has effect on the game.

Challenge / Conflict

"All games embody a contest of powers. The contest can take many forms, from cooperation to competition, from solo conflict with a game system to multiplayer social conflict. Conflict is central to games" (Salen & Zimmerman, 2004). While Salen & Zimmerman prefer to call it conflict, they have captured the essence of what this research will refer to as challenge. Challenge can be cooperative, competitive, or individualistic. It can also be a combination of any of the three. For example team v team challenge has competition with inter team competition.

Rules/Goals / Rules

Wilson coupled the terms rules and goals into a single feature, while Salen & Zimmerman refer to only rules. "Rules provide the structure out of which play emerges, by delimiting what the player can and can-not do" (Salen & Zimmerman, 2004). They instead associate goals with outcomes. Goals in particular are difficult to separate from other features, and are possibly their own feature.

Assessment / Outcomes

"Games have a quantifiable goal or outcome. At the conclusion of a game, a player has either won lost or received some kind of numerical score" (Salen & Zimmerman, 2004). Games must provide feedback to the player in the form of an assessment or outcome. While the assessment might not be explicit to the player in all games, the game must provide the appropriate outcome based on the performance of the player in the game.

Aesthetics / Artificial

"Games maintain a boundary from so-called "real life" in both time and space" (Salen & Zimmerman, 2004). Games provide aesthetics to the player. This might be fantasy or reality based. It might mean a deep storyline filled with interesting plot twists or it might mean a simple song and falling blocks. While the Aesthetic is important, it can vary widely between games.

Disparate Features

All five of the core features identified by learning games researchers have direct definitional overlap with features that game designers identified. The one feature game designers identified that learning games researches did not is the concept of a system.

Games are Systems and Systems are Simulations

Salen & Zimmerman use a definition of system that is taken from Stephen W. Littlejohn, and include 4 defining elements. They are objects, attributes, internal relationships, and environment (Littlejohn & Foss, 2007; Salen & Zimmerman, 2004). Using this definition, Salen & Zimmerman further define systems as simulations (2004).

The system is the core structure of a game. It determines how the environment works and what types of objects can operate within it. When other features are applied to it the game becomes fully formed. This is important when considering the game v simulation debate. It is easy to imagine that a game is a simulation with others gaming features added to it. This, however, is not the case.

In his 2010 keynote address to the GameTech Conference, Will Wright defined his particular types of games as toys. These toys, SimCity, The Sims, Spore, among others, are

commonly used to frame the argument between what is a game and what is a simulation. Will Wright further stated that his toys exist as a constrainment of freeform play, and if they were constrained more they could be considered games. He did not want to constrain them with preformed goals, outcomes, or challenges (Wright, 2010).

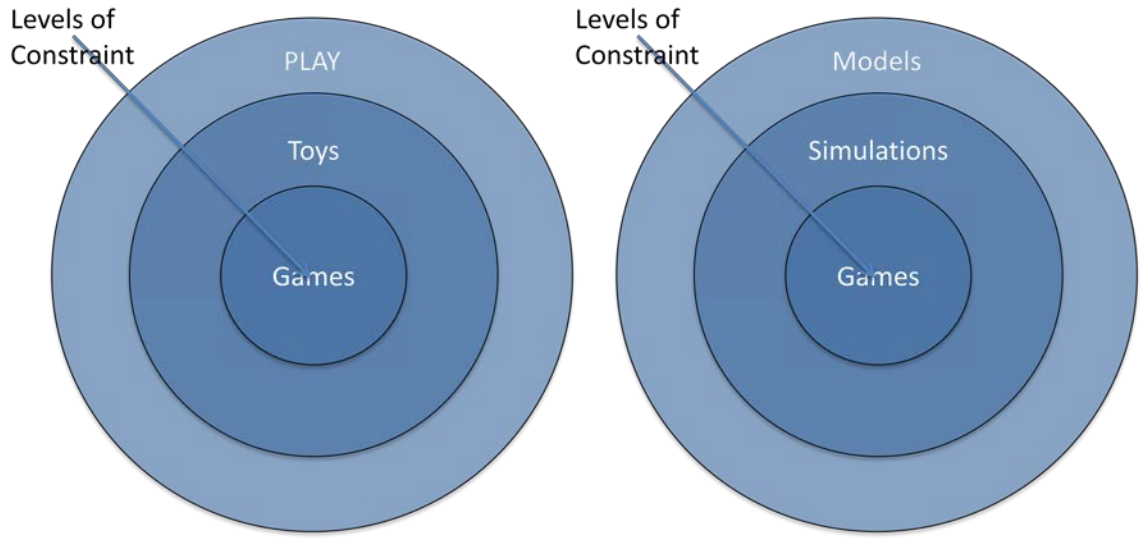


Figure 3 – Levels of Constraint in the Domains of Play and Modeling and Simulation

Taking a similar approach to the space of modeling and simulation one could consider a constructive simulation as a constrainment of the space, but a simulation still provides a level of freeform use that makes it similar to how Will Wright refers to toys in the space of play. Simulations need a facilitator to add goals, outcomes, and challenges to the exercise. Further constraining a simulation by introducing gaming features may result in a game.

A Working Definition of Learning Games

Looking at learning games through this lens of constrainment allows for the commonly used vein diagram to be applied. Thus, Learning Games can be considered the culmination of gaming features in the space of play, simulation, and learning.

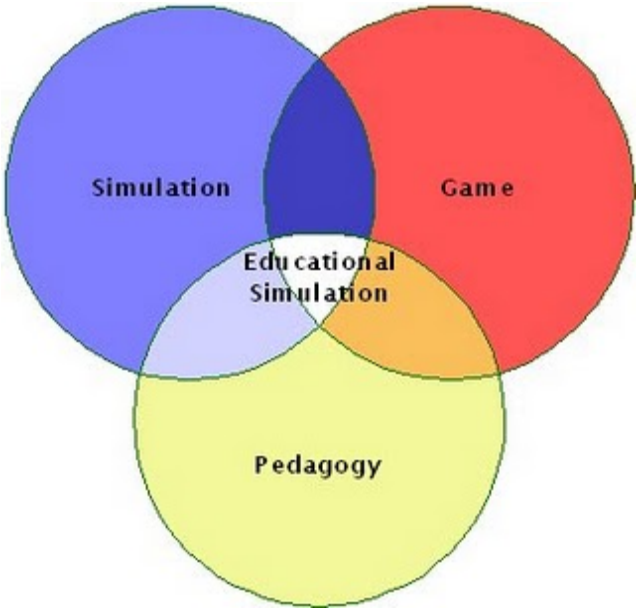


Figure 4 – Learning Games Vein Diagram

Thinking of learning games in this way allows for the full force of the constituent domains to be leveraged.

Focus on Challenge

The reason educational games are commonly considered boring is they have not yet embraced the features of games including challenge and still seem like simulations. "As soon as we start to have too much fun, educators become suspicious that there is not enough learning happening" (Becker, 2010). As such, the games that are experiencing acceptance, especially in the military, are simulation games. These PC simulations masquerading as learning games behave like simulations and have a facilitator providing gaming features to the players including challenge.

Challenge is the number one feature cited by games researchers as a feature of games that supports learning. As seen in figure 3, twenty seven of the forty one taxonomies identified

challenge as a central feature (Wilson et al., 2009). As such, challenge will be the focus for this research.

> *"Optimal experience: a sense that one's skills are adequate to cope with the challenges at hand, in a goal-directed, rule-bound action system that provides clear clues as to how well one is performing. Concentration is so intense that there is no attention left over to think about anything irrelevant, or to worry about problems. Self-consciousness disappears, and the sense of time becomes distorted."* (Csikszentmihalyi, 1991)

Many game designers have used the model of flow (Kremers, 2009; Swink, 2008). Flow experiences, first defined by Mihaly Csikszentmihalyi, is the thought that challenge should be balanced with skill to generate an optimum experience (Csikszentmihalyi, 1991). Obtaining maximum flow in a game is a major goal of entertainment game designers and is the result of very precisely balanced challenges. Similarly, game researchers have used the term "motivational tension" to describe the optimal amount of challenge in a game (Driskell & Dwyer, 1984). This tension is derived by the player not knowing if their current skill level will allow them to meet the current challenge. This unknowingness when perfectly balanced with the player's current skill levels leads to optimum experience in games. Getting to this level of optimum challenge in learning games is a constant struggle.

This will need to change for learning games to be successful. Learners play games and when they are given a game based solution they come with preconceived notions of what features should make that game. In a survey of university students who play games, researcher John M. Quick was able to find six features that students found important to enjoyment of games. Challenge was one of the major features students are looking for in games. Further, one aspect of challenge: competition, was also highly desirable. When Quick correlated these

features to current game design models, challenge was a top cited feature as well. (Quick & Atkinson, 2011)

Challenge Manifested Through Goal Structures

As Jane McGonigal (2011) states in her book Reality is Broken, "Games challenge us with voluntary obstacles and help us put our personal strengths to better use." It is clear that challenge plays a key role in the design of learning games. How challenge is implemented, however, is less clear. Certainly, many individual game mechanics can be employed to create challenging game experiences. There are so many individual mechanics that could be explored, the logistics of testing them all would be impossible. While there is a requirement for a challenge to exist, the context of the challenge mechanic is more important than the mechanic itself.

Salen & Zimmerman describe the concept of challenge as it is used in this research as conflict. By substituting challenge into their discussion, "…[Challenge] can take many forms, from cooperation to competition, from solo [challenge] with a game system to multiplayer social [challenge]. [Challenge] is central to games." (Salen & Zimmerman, 2004). The types of challenge they identify are identical to the three major goal structures for learning identified by Johnson and Johnson in an early review of the literature: cooperative, competitive, and individualistic (Johnson & Johnson, 1974).

Johnson and Johnson (1974) also suggested a forth structure, the use of no formal structure at all. In this structure the teacher provides the students with freedom to work any way they see fit without applying a formal structure to the student's interaction. Critics suggest that in this free form structure students will just gravitate towards the goal structure they are most familiar with (Kozol, 1972). In a later meta analysis conducted by Johnson et al. (1981) they

revise their four structures to include cooperation with intergroup competition in place of no formal structure. This structure uses a combination of both cooperation and competition.

Social Interdependence Theory

"The basic premise of social interdependence theory is that the way goals are structured determines how individuals will interact, and the interaction pattern determines the outcomes of a situation" (Stanne, Johnson, & Johnson, 1999). Lewin (1935) first suggested that goal structures for learning are a product of goal interdependence. Social interdependence theory was later developed to create a context to with which to discuss the goal structures created through this interdependence (Deutsch, 1949; Deutsch & Krauss, 1962; Johnson & Johnson, 1989).

Lewin (1935) described how goal interdependence could be used to promote cooperative, competitive, and individualistic goal structures depending upon the nature of interdependence. Positively interdependent goals result in a cooperative learning structure in which individuals will promote the success of others. Negatively interdependent goal structures promote competition as for one individual to be successful others must fail. In an individualistic goal structure there is no interdependence between the goals of individuals. In this goal structure individuals work alone, independent of others.

If a challenge is presented with positively interdependent goal, the player will employ a cooperative goal structure to obtain it. If, however, the same challenge is presented with a negatively interdependent goals a competitive goal structure will be used. The issue isn't what the challenge mechanics are, but what goal structure they are presented with.

Goal Structures for Learning

There are four prevailing goal structures for learning cooperative, competitive, individualistic, and cooperative with intergroup competition. Research in goal structures for learning has a rich history, with some of the earlier studies dating back to the 1920's (Maller, 1929). In this time there have been a large number of research reviews, and meta-analyses' that have compared them thoroughly. Before attempting to compare the various goal structures it is important to have a clear understanding of them all. The following sections will explore the various structures in depth.

Cooperative

Cooperation, the act of working together to accomplish shared goals, is a cornerstone of modern society. Majority of human interaction takes the form of cooperation. Even in the most competitive situations there are underlying cooperative agreements to the way in which the competition will be formed. The rules of engagement are a cooperative agreement between competitors. (Johnson & Johnson, 1974)

From social interdependence theory, a cooperative situation is one in which the participants have positively interdependent goals. In a cooperative situation, participants will actively seek outcomes that are not only beneficial to themselves but to the group as a whole. Robert Slavin (Slavin, 1980) developed a typology for evaluating cooperative learning techniques. That includes five dimensions: reward interdependence, task interdependence, individual accountability, teacher imposed structure, and the inclusion of group competition. While not all of these dimensions are required for a cooperative learning strategy, task interdependence, and individual accountability are considered the essential features (Slavin,

1996). Noncompetitive group learning structures lacking these two features are generally termed as collaborative. Collaborative learning is characterized by an unstructured process through which participants negotiate goals, define problems, develop procedures, and produce social constructed knowledge in small groups.

Deutsch (1949) proposed three psychological constructs through which cooperation can be structured. A forth structure, based on learning theory, was also proposed by Kelley and Thibaut (1969).

1. Substitutability: In this structure only one member of a cooperative group will need to accomplish a given task. (Deutsch, 1949)
2. Positive Cathexis: In this structure the evaluation of an individual member will be determined on their individual actions moving the group closer to their cooperative goals. (Deutsch, 1949)
3. Inducibility: In this structure as an individual performs tasks that move others closer to their goals they are likely to reciprocate by moving the individual closer to theirs. (Deutsch, 1949)
4. Group Work: In this structure individuals in the group are rewarded based on the quality of their group work. (Kelley & Thibaut, 1969)

The common thread for these structures is that an individual's efforts and accomplishments contribute positively to the accomplishments of the group. It should be noted that only Kelly and Thibauts' structure requires an extrinsic reward (Kelley & Thibaut, 1969). The fact that cooperative groups might not be presented with an extrinsic reward does not imply that cooperative groups cannot generally experience failure. Cooperative groups can fail just as

easily as they succeed. Failing cooperative teams could have similar lowered self worth due to failure as competitive teams (Ames, 1981). The only difference being the frequency in which cooperative group members experience failure. Further, failure in cooperative groups led to lower achievement than successful ones (Lou, Abrami, & d'Apollonia, 2001).

Cooperative learning may have greater positive effects than just supporting achievement. Hooper et al. (1993) found that cooperative learning also lowers the cognitive burden of learning navigational restrictions. Many researchers have also found a number of social benefits from cooperation that will be explored more fully in a later section.

Competitive

"In any study of incentives the element of competition holds a prominent place. It usually causes an act to be performed better or faster than it is performed by others or than the individual himself performed it before." (Maller, 1929) From social interdependence theory, a competitive situation is one in which the participants have negatively interdependent goals. In a competitive situation, participants will actively seek outcomes that are only beneficial to themselves and are commonly detrimental to others in the group.

Michaels (1977) concludes that individual competition has consistent superiority over other goal structures in strengthening the independent task performance of students. Individual competition, however, is not a competition with negative goal interdependence. It is a competition in which the participant is competing with their own person record. Stanne et al. (1999) rightfully categorized individual competition as an individualistic learning structure that is commonly categorized incorrectly as competition.

While usually celebrated for its motivating effects in entertainment and sports, competition's reputation is beginning to tarnish. In particular, a recent study found that competition in games has a greater effect on aggressive behavior than violence (Willoughby, Adachi, & Good, 2011). That is, competitive situations that do not promote violence make someone more aggressive than scenes or actions that include violent behaviors. In the case of this research Left 4 Dead 2, a game characterized as highly violent, was compared to Fuel, a competitive racing game. The players of the racing game exhibited increased levels of short term aggression, while the players of Left 4 Dead 2 did not.

Competition has a generally poor reputation for its use in education. Alfie Kohn's (1992) book, "No Contest: The case against competition," paints a bleak picture of the use of competition in learning and other situations. It has been found to increase anxiety, decrease intrinsic motivation, hurt self image, and cause participants to try to win at all costs, among other unappealing outcomes. While Alfie Kohn provides a very one sided view of competition, many other studies have correlated with his findings.

Ames and Ames (1981) found that competitive conditions persuade students to perceive ability as a more prominent cause of their successes and failures. Under such conditions, failing students were more self-punishing and perceived themselves as less capable (Ames, 1978, 1981; Ames, Ames, & Felker, 1977). Competition also contributed to unrealistic goal setting, and caused participants to employ tactics that increased the likelihood of failure, as participants disregard for information about their past performance (Ames, 1981). Competition also tended to magnify the pride of winning and the shame of failure (Ames & Felker, 1979).

One way of mitigating the negative factors of competition is the carefully planning the way the competition is structured. Stanne et al. (1999) identified two major forms of competition, zero-sum and appropriate competition. Zero-sum forms of competition are characterized by a winner take all mentality. If one participant wins the other participants lose, and cannot gain the same reward as the "winner." In a classroom environment this type of structure is often created through grading on a curve.

By carefully controlling how the competition is structured it is possible to minimize the detrimental effects of competition. Appropriate competition lessens the adverse effects of competition by meeting four criteria:

1. Winning is relatively unimportant: By making winning unimportant, appropriate competition lowers the anxiety, and the detrimental effects on self esteem from losing.
2. All participants have a reasonable chance to win: By insuring that all participants have a perceived opportunity to win, appropriate competition reduces the chance that a participant will avoid competition. It increases interest in the subject matter, and enjoyment in the experience.
3. There are clear and specific rules, and procedures for winning: By removing ambiguity, appropriate competition reduces worry about the fairness of tactics.
4. Participants are able to monitor each other's progress: By allowing for social comparison, appropriate competition can change the primary focus to the outcome of the competition and away from accomplishing the win state.

While Stanne et al. (1999) found no significant difference between cooperation and appropriate competition for motor performance based tasks, cooperation still faired a bit better in overall performance. Also, appropriate competition minimizes many of the features that differentiate competition from cooperation in the first place, making almost a false form of competition. Ames et al. (1977) suggest that even small variations like scarcity of rewards can throw off the balance in an appropriate competition based situation.

Individualistic

In an individualistic learning structure participant's goals are completely independent. In a classroom environment this would imply that the students are all given their own materials and interact only with their teacher. There is no interaction among students regarding the learning material. The learning goal is perceived as important by each individual student and each student is expected to accomplish the goals without interference or assistance from other students.

Some researchers have found that young children tend towards an individualistic attitude, by only measuring progress against their personal records (Covington, 1984; Ruble, Parsons, & Ross, 1976). This type of interaction is expected to decrease as a student ages and a more competitive stance is taken as they attempt to achieve higher rewards and attention from the teacher (Johnson & Johnson, 1974).

Maller (1929) found, "that competition between groups will bring forth greater effort than individual work without competition." Other reviews also found group structures out performing individualistic ones. Springer et al. (1999) compared the effects of small group learning structures with individualistic learning and showed that various forms of small group learning are significantly more effective than individualistic learning in promoting achievement.

Hooper et al. (1993) found that individualistic structures were too expensive to develop, required more time to implement, and more effort to build specific modifications that met the needs of individualistic differences between participants.

It is important to mention that most Computer Based Training (CBT) uses an individualistic structure. Often times delivered online, students are presented with content as an individual and progress at their own pace. When assistance is available it is generally only provided to the individual. One major benefit to this is that adult learners are able to take training around their busy work schedules. Also, no classrooms, or synchronous presentation are required. Also, knowledgeable students are generally able to skip ahead of material that they already know.

Cooperation with Intergroup Competition

Johnson et al. (1981) introduced cooperation with intergroup competition to account for structures that mixed both competition and cooperation. In this structure participants have positively interdependent goals within a team and negatively interdependent goals between teams. There are many real world applications of this type of structure, including businesses competing in a market, sports teams competing in events, and students groups competing in an academic competition.

Researchers seem to have a difficult time efficiently categorizing cooperation with intergroup competition. Some consider it primarily as a form of competition because ultimately the teams compete, even if they are cooperating during the competition and during the time building up to the competition in preparation (Johnson et al., 1981; Kohn, 1992). Some categorize it as a form of cooperation as it has been found to reduce the negative effects of

competition as participants are constantly cooperating within their group (Roseth, Johnson, & Johnson, 2008). When compared to completely competitive structures cooperation with intergroup competition has been found to increase the enjoyment of the competition, diffuse responsibility for losing, lowers the negative impact of failure (Stanne et al., 1999).

Tauer and Harackiewicz (2004) conducted three empirical studies to examine the effects of different goal structures on intrinsic motivation and performance. They then conducted a meta-analysis on the three studies. In general, they obtained strong evidence that intergroup competition led to higher levels of task enjoyment and performance relative to pure cooperation and pure competition. Others, however, have found that cooperation generally fairs better than cooperation with intergroup competition (Johnson et al., 1981).

When to Use Various Goal Structures

Research in goal structures for learning has a rich history, with some of the earlier studies dating back to the 1920's (Maller, 1929). Johnson and Johnson (1974) completed the first thorough review of the literature and concluded that the research largely identified cooperation as a superior goal structure for achievement based tasks and that competition should be the least commonly utilized.

Johnson et al. (1981) followed this up with a meta-analysis of 122 studies that compare the relative effectiveness of the four goal structures: cooperation, competition, individualistic, and cooperation with intergroup competition in promoting achievement. Their results also show that cooperation is consistently the strongest goal structure for achievement based tasks. Cooperation with intergroup competition did not perform as well, but did outperform

competitive and individualistic structures. Finally, they found that there was no significant difference between individualistic and competitive structures.

Johnson et al. (1981) was met initially with disagreements. Both Cotton and Cook (1982) and McGlynn (1982) challenged the premise of Johnson et al. (1981). Both papers took issue with the quality of the results of a meta-analysis, and expressing a series of issues they disagree with from the original study. Johnson et al. (1982) rebuts both papers by going directly to the literature. They conclude by saying, “as we have repeatedly stated in our writings, we believe that there are conditions under which each of the goal structures is superior. Current evidence, however, is not as helpful as we would like in identifying those conditions.” Johnson et al. (1981) has continued to correlate well with more recent meta-analytic studies of the literature (Qin, Johnson, & Johnson, 1995; Roseth et al., 2008; Stanne et al., 1999).

While there is compelling evidence that the cooperative structure outperforms other structures for achievement based tasks, there are some situations in which evidence does suggest utilizing any of the prevailing goal structures might be reasonable. The best structure for a given situation depends on the type of information and the environment in which it is being presented (Johnson & Johnson, 1974).

Table 2 – When to Use Various Goal Structures

	Cognitive or Affective Outcomes	Learning Processes	Performance Based Outcomes	Limitations Exist
Cooperative	X	X		
Competitive	X (Appropriate)		X	
Individualistic				X
Cooperative with Intergroup Competition	X	X	X	

Table 2 is derived from research previously discussed in this review and identifies when it might be appropriate to use one of the various goal structures. One note on implementing any goal structure for learning is that it is important that participants understand what goal structure is being implemented in order to get the expected results (Johnson & Johnson, 1974).

In Table 2, it would appear that cooperation with intergroup competition would be the most versatile structure for learning. This is misleading as the ambiguity surrounding the cooperative and competitive nature of the structure has led to inconsistent results. When implementing this structure it will be important to carefully balance the competitive element for achievement based outcomes. The negative outcomes found by Johnson et al. (1981) are most likely due to a zero-sum competitive structure. While Tauer and Harackiewicz (2004) had positive results due to using appropriate competition thus minimizing the negative effects of competition, allowing the positive benefits of cooperation to improve the results of the otherwise competitive structure.

Springer et al. (1999) showed that group learning was significantly more effective than individualistic learning. Johnson et al. (1981) found that there was no significant difference between competitive and individualistic structures for achievement based tasks. . They concluded that while individualistic goal structure may be productive in learning, the lack of interaction among students would limit the use of this structure in classrooms. The reason to implement an individualistic structure is simply that they are easier to implement, can cost less, and have been shown to take less time which is why this structure is predominant in distributed learning and generally in CBT.

There is evidence that the participant's preferences towards one structure over another can play a role. Okebukola (1986) and Wheeler and Ryan (1973) found that preferences towards cooperative goal structures mattered. Students who held a preference toward cooperation learned more when presented with a cooperative structure over students who preferred a competitive one. Inglehart et al. (1994) insist that learning is influenced by subjective factors, specifically by the way we feel and think about subject matters and learning. Their studies show that the more the students value competition, the better will be their academic achievement in a competitive situation.

Cooperative v. Competitive Goal Structures in Achievement Based Games

As discussed in the previous section, there is clear evidence that cooperation is the preferred goal structure for learning in most achievement based situations. The value of cooperation goes beyond just achievement in scores, but provides a plethora of more social benefits as well. This, however, is not an overwhelmingly held belief in games research. In fact

there is a common misconception among games researchers that competition will be a primary motivating factor for implementing games.

While competition is considered a highly desirable trait in games, making it on Quick's (2011) list of features preferred by college students, it might not be desirable in learning games. Given the stark differences in the goal structures represented and that very different behavior can be expected as a result of implementing one goal structure over another, it is therefore possible that what makes a good learning game may not be the same thing that makes a good entertainment game.

Slavin (1980) defined two major categories of outcomes that are important in research on reward structures: performance and cohesiveness. Performance deals with achievement in the tasks at hand. Cohesiveness deals with more qualitative aspects such as, goal orientation, motivation, communication, satisfaction, and self worth.

Academic Achievement

Johnson et al. (1981) performed a meta-analysis of 122 studies and found that cooperation promotes higher achievement than competition by a staggering 65 to 8. 36 studies showed no significant differences, but that is still almost a 2 to 1 ratio. It is possible that these differences are the effect of zero-sum versus appropriate competition, but there is still a dramatic amount of evidence pointing to cooperation as the preferred goal structure for achievement based tasks. These results were found to hold for all subject areas, and age groups. The superiority of cooperation was found to increase as subjects were required to perform goal interdependent tasks. As group work increased so did achievement levels for tasks involving concept attainment and problem solving.

Goal Orientation

Participants in a achievement based learning game can exhibit mastery or performance based goal orientation. In mastery based goal orientations the participant focuses on the intrinsic value of learning. Efficacy is based on the belief that effort will lead to success. Covington (1984) found that mastery orientation was attributed to non-competitive events. With mastery goal orientation participants are oriented towards developing new skills, trying to understand the tasks, improving competence. This is often referred to as motivation to learn and the participant is focused on engaging the process of learning. (VandeWalle, Brown, Cron, & Slocum Jr, 1999)

Competition can also effect goal orientation (Ames, 1992). In a performance based goal orientation ability is gauged by doing better than others. Learning becomes just a method to accomplish the next goal. This type of goal orientation can damage a participant's view of their own ability. (VandeWalle et al., 1999)

Motivation

Johnson and Johnson (1974) showed that participants in cooperative groups would have greater intrinsic motivation while participants in a competitive group would have higher extrinsic motivation. Lower intrinsic motivation was found by Ames (1981) when cooperative groups failed to accomplish their goals, however, of the four methods of implementing cooperative goal structures defined in a previous section, only one provided an extrinsic reward which could be lost. Many cooperative structures do not allow for groups to lose. Extrinsic motivation is commonly associated with competitive structures. In a zero-sum competition there can be only one winner.

Communication

Cooperative teams have a greater propensity toward intellectual interactions. They will tend to share strategies, and discuss the content. Competitive teams will exhibit less intellectual interactions, possibly even taunting each other.

Johnson (1971) found that cooperation leads to the development of affective perspective-taking skills. That is, as participants are exposed to cooperative groups they will overtime develop empathy for their team mates and anticipate their needs.

Satisfaction

Ames (1981) found that losing in a competitive situation led to lowered feelings of satisfaction. While Johnson and Johnson (1974) found that cooperative goal structures lead to a higher level of satisfaction and better attitudes towards the learning.

Self Efficacy

Ames (1981) found that winning in a competitive situation led to self-aggrandizement, while losing lowered self perceptions of ability. In zero-sum competition this feeling becomes exaggerated as participants begin to feel as though they cannot win, and withdraw or avoid further competition (Johnson & Johnson, 1974). While failure in a cooperative group led to similar outcomes, the cooperative groups are afforded more opportunities to succeed without competition.

Expectations

The expectations of a participant can moderate a learners self efficacy, and motivation (Tannenbaum, Mathieu, Salas, & Cannon-Bowers, 1991). If a learner is expecting to get a game

for their training a number of attitudes towards the training might arise. In particular, the general misconception that games are competitive in nature may generate expectations of a competitive task. Expecting competition may have detrimental effects on a learner's goal orientation, motivation, and self efficacy as explained in previous sections.

Experiences

Existing experiences with games may impact a learner's expectations when given a game based learning task. In particular if a learner is not well versed in games they may have lower motivation and self efficacy when presented with a game based task even in a cooperative game.

Research Statement

In the proceeding literature review it was argued that, despite widely held misconceptions of competition in games, cooperation would be a superior goal structure for achievement based learning games.

The author summarized the relevant literature on the growing field of Serious Games. After describing the field at large the discussion showed the progression from Serious Games to Learning Games. In order to understand what makes a good learning game one must understand what make a good game. By developing a feature list for what makes a good game and a list of what features of games learning scientist have identified as important for learning, it was obvious that challenge was an important feature in both.

Concentrating on challenge as a feature of games, both for entertainment and learning, the author was able to show that challenges can be formed in any of four major goal structures.

The author provided a review of the four major goal structures: cooperation, competition, individualistic, and cooperative with intergroup competition. The discussion ended with a discussion of when to use each structure. The literature review concluded with a discussion of the specific aspects of cooperation and competition that could be leveraged to show the superiority of cooperation in learning game based scenarios.

CHAPTER THREE: METHODOLOGY

In order to determine the appropriateness of using various types of goal structures to implement challenge in a learning game a research project was conceived and executed as follows.

Hypotheses

This study explored 8 hypotheses organized in the categories of Learning Outcomes, Goal Orientation, Motivation, Communication, and Satisfaction. There are also 2 other research questions related to prior experience and preferences towards competition. They are as follows:

- Learning Outcomes
    - H1: Players of a cooperative game will have equal or greater learning outcomes when compared to players of a competitive game.
- Goal Orientation
    - H2: Players of a cooperative game will report higher mastery based goal orientation after play.
    - H3: Players of a competitive game will report higher performance based goal orientation after play.
- Motivation
    - H4: Players of a cooperative game will report higher levels of intrinsic motivation than players of a competitive game after play.
    - H5: Players of a competitive game will report higher levels of extrinsic motivation than players of a cooperative game.

- Satisfaction
    - H6: Players of a cooperative game will report a higher level of satisfaction with their experience than players of a competitive game after play.
- Self Efficacy
    - H7: Winners of a competitive game will have a higher self efficacy than losers and all players of a cooperative game.
- Expectations
    - H8: Players who are told they are receiving a game will have higher performance based goal orientation and higher extrinsic motivation than players who are told they are receiving a learning experience.
- Experiences and Preferences
    - R1: Game Experience will impact the goal orientation and motivation of players.
    - R2: Competition/Cooperation preferences will impact the goal orientation and motivation of players.

Participants

Participants were recruited from the students, faculty, and staff at the University of Central Florida. A total of approximately 160 participants were recruited for the experiment. The recruitment material did not mention that this research includes games. The participants were randomly divided into four groups for testing against the two major categories of cooperation and competition, and the two expectation modalities of games, and learning interventions. All participants were treated in accordance with the “Ethical Principles of Psychologist and Code of

Conduct" set forth by the American Psychological Association (1992). The experiment was also performed with approval of the UCF Institutional Review Board (IRB).

Procedure

The study had all participants fill out a number of pre exposure surveys before being placed in a group of two and told they were participating in a study of a game or a study of a learning intervention. They then completed the paperwork and individually completed the tutorial level of the game "Acquisition Proposition!" The population was then split between competitive and cooperative versions of the game. More information on the specific modifications of the game can be found in the section "Modifications Made" below.

Pre-training surveys

All participants were required to sign an informed consent form before participating in the study. They then were administered a number of pre-exposure surveys. These included a demographics form to collect general information about the participant. The participants then took a survey to determine their attitudes towards cooperative, competitive, and individualistic learning environments. They were then given a content pre-test for the acquisition content covered in the game. They were told explicitly that they were participating in a game or learning intervention, however, both groups were given the same intervention, "Acquisition Proposition!" The Pre-Exposure surveys concluded with a goal orientation measure, and a motivation measure.

Game Tutorial Session

After the measures were administered and collected, all participants played through the tutorial level of "Acquisition Proposition!" and waited for their counterpart to complete it as

well. This level walked the participant though the basic usage of the game and introduced them to the setting and major characters.

Participant Clarification

After both participants finished the tutorial they were given an opportunity to ask any questions that they had during the process of playing through the tutorial. This opportunity focused only on control issues. No information regarding the acquisition process or other learning objectives was shared at that time.

Main Game Play Exposure

At this point in the study groups were randomly assigned together to one of two groups. Both groups played a version of "Acquisition Proposition!" with identical game play and functionality. All groups played at computers positioned next to each other, so that both players could see each other's screens and monitor each other's progress.

The difference between the games was manifested through the narrative as expressed by the boss character in the game. This character provided half of the groups with a scenario in which players were either cooperating as new employees at an office, or rival employees who were competing for a job. Players played through two levels and were allowed to play at their own pace.

Care was taken to ensure that there was a correlation between the cooperative and competitive groups. That is, especially in experiment 1 defined below, both versions of the game were self contained single player experiences that allowed the player to use the narrative to determine if they were competing or cooperating, but game play was otherwise identical. The

reasons for this are twofold. First, it was important that the games were functionally identical to ensure that there was not some part of the experiment that would bias the results towards one group or the other. This is something that could have occurred if there were special considerations made to accommodate a more closely coupled cooperation that could not be matched in the competitive group, like for example externally combining or subtracting scores. Secondly, the methodology used would better map to likely use of the game in a classroom. If a teacher was expected to administer the game to a large group of students they would not have time or resources to implement activities outside the game. In later experiments (experiment 2 and 3) external reward structures were added, but this was to further the specific effects of competition, and experiment 1 still remained as a base line.

Post-training surveys

At the end of the game play session the participants were administered a number of post-exposure surveys. These surveys included a post-test to determine the learning effectiveness of the game play session. This was followed by a self efficacy measure to determine how the participant thinks they preformed. They were then be administered a goal orientation survey to determine if the players were mastery or performance oriented; a motivation scale to see if they were intrinsically or extrinsically motivated; a learner satisfaction survey to see how satisfied they were with the learning experience; and finally an expectations survey to determine if the experience they had matched their expectations.

Participant Debrief

Once the surveys are all completed, the participants were debriefed on their part of the study. They were told where comments and concerns could be reported, and their immediate feedback was recorded. The participants were then be released.

Equipment and Materials

In order to successfully explore the use of cooperative and competitive structures in learning games a multitude of equipment and materials were needed. The following sections explain what these were and how they were used.

Surveys and Measures

Several surveys were administered during the process of completing this study. General demographics information was collected as well as special considerations for measures for specific outcomes related to the hypotheses outlined previously.

Demographics Survey

General demographics including age, gender, race, and educational level were collected. Although they did not directly relate to a particular hypothesis, it was important to gain an understanding of what the population was comprised of to ensure that there were no obvious inconsistencies that could create another population within the study. The demographics form also captured previous military experience because the game covered DoD acquisition content. Knowledge of this content could have created a ceiling effect between the pre and post test.

Pre/Post Test

A Pre/Post Test covering the desired learning outcomes of the game was administered to determine the user's knowledge of the subject being explored in the game and knowledge acquisition during game play. In this case the topic being covered was the general acquisition process. This test was developed with the assistance of staff at the Defense Acquisition University (DAU) and consisted of multiple-choice, and option ordering questions. These tests were used to satisfy Hypothesis H1.

Goal Orientation Measure

The Learning Goal and Performance Goal Orientation measure developed by Button, Mathieu, and Zajac (1996) was developed through an in depth review of over 20 empirical studies in goal orientation between 1975 and 1992. The resulting measure is designed to identify a learner's goal orientation and was used to satisfy Hypotheses H2, H3, and H8 as well as R1 and R2.

Intrinsic Extrinsic Motivation Scale

The intrinsic and extrinsic motivation scale created by Lepper, Corpus, and Iyengar was used for this study (Lepper, Corpus, & Iyengar, 2005). It was used to satisfy Hypotheses H4, H5, H8, R1, and R2.

Learner Satisfaction Survey

Learners were asked to rate their satisfaction with the learning intervention. This was comprised of a number of questions on a Likert scale. This measure was used to satisfy hypothesis H8.

Self Efficacy Survey

Students were asked to rate how they thought they performed in the game and the subsequent post test. This was comprised of a number of questions on a Likert scale and was used to satisfy hypothesis H7.

Game Experience Survey

Students were asked to rate their individual experience with games. They were asked what type of games they play, how often, and were tested on common gaming knowledge. The survey used is a modified version of the survey proposed by Singer and Knerr from the U.S. Army (Singer & Knerr, 2010). This was used to satisfy hypothesis R1.

The Cooperative/Competitive Strategy Scale

The Cooperative/Competitive Strategy Scale developed by Simmons et al. was used to develop a base line to determine if the population is predisposed to one orientation or the other (Simmons, Wehner, Tucker, & King, 1988). This was used to satisfy R2.

Game: "Acquisition Proposition!"

"Acquisition Proposition!" was originally developed by the ADL Co-Lab for DAU as part of their Casual Games Initiative. It is available free to play online at https://clc.dau.mil/games/game/131 along with a number of other games available on the portal. This game served as an experimental test bed for the study.

Description of Game Play

"Acquisition Proposition!" is a time management simulation casual game in the style of the popular "Diner Dash" line of games. In this game the player takes on the role of either a male

or female employee beginning to work in an acquisition command. After completing the initial tutorial explaining how to play the game, the player is set free to run projects through the entire acquisition process, encountering harder and harder challenges as the levels progress.

During game play the player is constantly communicating with their boss through on screen interjected text boxes. The boss explains the scenario, starts new contracts, and otherwise sets the stage for the action in the game. The player must start a contract received from the boss and subsequently move the contract around the office to various workstations representing the phases of the acquisition cycle. At each phase the player must bring the appropriate documents for that phase to the other employees in the office as they request them.

By bringing the contract through the lifecycle the player learns, what the steps are in getting a document through the acquisition process; the names of important verification authorities; the names of the phases within the process; and are introduced to what documents are required at each phase of the process. Understanding the process is important to being good at the game at the core level.

Modifications Made

For this study two modified versions of "Acquisition Proposition!" were needed. Each retained the original game play mechanics, but the interjections from the boss were changed to provide a context of either cooperation or competition within a group of two players. Changes were only be made to the text interjected into the game, and no actual interaction occurred between the games being played.

In the cooperative version of the game the boss presented the players a scenario in which they were new employees in the organization and they were tasked with working together to help

the office run smoothly and get the contracts completed. Players were encouraged to consider each other as teammates.

In the competitive version of the game the boss presented the players a scenario in which they were both new employees in the organization, but only one job position was available. The players had to compete for the position by showing that they could help the office run more smoothly and get the contracts completed. Players were oriented to consider each other competitors.

Experiments

At pilot study was conducted to look at the validity of a cooperative goal structure without the inclusion of explicit cooperative tasks between players. Due to the inherent single player nature of the games cooperation and competition was to be construed through the games narrative. That is, the player's boss in the game either told players they were competing with the person next to them or cooperating, there was no mechanism for help or hinder players within the games. At the conclusion of the pilot test the data appeared to be trending well for the hypotheses regarding cooperation. This was not the case, however, for hypothesizes about competitition ones. At the conclusion of the pilot study it was decided that in an attempt to increase the effects of competition the study would be carried out as a series of 3 experiments described below.

Experiment 1

After the initial pilot, of 44 participants, the collection in this group continued in both the cooperative and competitive conditions until 80 participants were run. This included 40

cooperative and 40 competitive. The cooperative group for experiment one was reused for all other experiments. Experiment 1 followed the procedure described above. Beginning with pre-intervention surveys; followed by grouping in game or learning intervention group; a few more pre-intervention surveys; the intervention; and then post-intervention surveys. The defining characteristic of this experiment was that the participants were not explicitly told if they were competing or cooperating by the experimenters. This was accomplished through the use of in game narrative only.

Experiment 2

Experiment 2 consisted of 40 participants all in grouped into competitive groups. The cooperative group for this experiment was carried over from experiment 1. This experiment mostly followed the procedure described above. Beginning with pre-intervention surveys; followed by grouping in game or learning intervention group; a few more pre-intervention surveys; the intervention; and then post-intervention surveys. The defining characteristic of this experiment was that the participants were told explicitly that they were competing by the experimenters. This was to motivate the players to attempt to compete in order to declare them self the winner of the competition.

Experiment 3

Experiment 3 consisted of 40 participants all in grouped into competitive groups. The cooperative group for this experiment was carried over from experiment 1. Like experiment 1, this experiment mostly followed the procedure described above. Beginning with pre-intervention surveys; followed by grouping in game or learning intervention group; a few more pre-

intervention surveys; the intervention; and then post-intervention surveys. The defining characteristic of this experiment was that the participants were told explicitly that they were competing by the experimenters and offered a reward for competing. The reward in this case was a $10.00 gift card to the Apple iTunes store. This was to motivate the players to attempt to compete in order to win the reward being offered. At the end of the experiment all participants were given the gift card if they won or not, but they did not know this would happen until after the final surveys were filled out.

CHAPTER FOUR: RESULTS

IRB approval for this project was received in the spring semester of 2012. Data collection started in the spring and continued through the summer term and was completed early in the fall semester. Each experimental session was approximately 1 hour long and 162 students participated. Participants were not financially compensated for their part in the research; however, the project did go through the University of Central Florida (UCF) Psychology Departments SONA system. Students were provided with 1 SONA point at the completion of the research.

Demographics

Through not specifically related to any hypothesis this study included the collection of general demographics as a means to better understand the participant pool and to insure that no obvious anomalies existed. All 162 participants were provided the demographics forms, however, answering every question was not required, so some results have varying totals.

Table 3 – Participant Gender

	Frequency	Percent	Valid Percent	Cumulative
Male	61	37.7	37.9	37.9
Female	100	61.7	62.1	100.0
Total	161	99.4	100.0	

Table 3 shows the participant gender split. The participants in this study were more than a third being male (37.7%) and the rest female (61.7%).

Table 4 – Participant Age

	Frequency	Percent	Valid Percent	Cumulative
18	80	49.4	51.0	51.0
19	32	19.8	20.4	71.3
20	19	11.7	12.1	83.4
21	11	6.8	7.0	90.4
22	9	5.6	5.7	96.2
23	2	1.2	1.3	97.5
24	2	1.2	1.3	98.7
25	1	.6	.6	99.4
27	1	.6	.6	100.0
Total	157	96.9	100.0	

Majority of the participants were 18 years old. Generally, participants at this age would not be expected to have knowledge of the Defense Acquisition University (DAU) content that is provided on the assessment. All of the participants were between the ages of 18 and 27. However over 90% were 21 years of age or younger.

Table 5 – Participant Race

	Frequency	Percent	Valid Percent	Cumulative
Asian	11	6.8	6.8	6.8
Caucasian	92	56.8	56.8	63.6
Black	21	13.0	13.0	76.5
Hispanic	27	16.7	16.7	93.2
Other	11	6.8	6.8	100.0
Total	162	100.0	100.0	

Race is not expected to play a role in this study, however, majority of the participants (56.8%) were Caucasian.

Table 6 – Participant Level of Education

	Frequency	Percent	Valid Percent	Cumulative
HS	126	77.8	81.3	81.3
Assoc.	26	16.0	16.8	98.1
College	3	1.9	1.9	100.0
Total	155	95.7	100.0	

Majority of the participants have finished high school, but not college. Only 3 participants had a bachelor's degree.

Table 7 – Participant Year in School

	Frequency	Percent	Valid Percent	Cumulative
Freshman	95	58.6	59.0	59.0
Sophomore	35	21.6	21.7	80.7
Junior	18	11.1	11.2	91.9
Senior	12	7.4	7.5	99.4
Grad Student	1	.6	.6	100.0
Total	161	99.4	100.0	

Over 80% of the participants were freshmen or sophomores in college. Only 1 (0.6%) was a grad student.

Table 8 – Previous DoD Experience

	Frequency	Percent	Valid Percent	Cumulative Percent
No	146	90.1	90.7	90.7
Yes	15	9.3	9.3	100.0
Total	161	99.4	100.0	

Majority of the participants had no DoD Experience (90.1%). Given the ages of the population and the DoD experience the likely hood that a participant might have preexisting content knowledge on the pre-test is low.

Gamer v. Non-Gamer

All participants were asked to indicate if they considered themselves gamers. Majority responded that they were not gamers (77.8%)

Table 9 – Self Selected as Gamer

	Frequency	Percent	Valid Percent	Cumulative
No	126	77.8	77.8	77.8
Yes	36	22.2	22.2	100.0
Total	162	100.0	100.0	

While this does not mean that the self declared non-gamer participants do not play games at all, but that they do not consider themselves what culture dictates a gamer is. Given the stigma around the term the number of self declared gamers (22.2%) is impressive.

Hypothesis 1: Learning Outcomes

This hypothesis predicted that players of a cooperative game would have equal or greater learning outcomes when compared to players of a competitive game. The data generated for this analysis was from a pre-test and post-test of the games learning content. The results of this hypothesis were calculated for each experimental group in Table 10 below.

Table 10 – Learning Outcomes Effects

	F	*df*	*Sig*
Experiment 1			
Learning Outcomes	53.026	72.00	.000
Learning Outcomes x Coop v Comp Group	.650	72.00	.423
Experiment 2			
Learning Outcomes	59.940	74.00	.000
Learning Outcomes x Coop v Comp Group	1.103	74.00	.297
Experiment 3			
Learning Outcomes	66.780	70.00	.000
Learning Outcomes x Coop v Comp Group	1.026	70.00	.315

For Experiment 1, results of a General Linear Model for repeated measures did demonstrate a significant main effect F (1,72) = 53.026, p = .000; but did not indicate a significant interaction effect between those participants who were in a cooperative condition and those who were in a competitive condition in which no verbal reinforcements or rewards were offered F(1,72) = .650, p = .423. Therefore for experiment 1 hypothesis 1 is upheld; there is no significant difference between the groups related to learning outcomes.

For Experiment 2, results of a General Linear Model for repeated measures did demonstrate a significant main effect F (1,74) = 59.940, p = .000; but did not indicate a significant interaction effect between those participants who were in a cooperative condition and those who were in a competitive condition in which verbal reinforcement to compete was offered F(1,74) = 1.103, p = .297. Therefore, for experiment 2 hypothesis 1 is upheld; there is no significant difference between the groups related to learning outcomes.

For Experiment 3, results of a General Linear Model for repeated measures did demonstrate a significant main effect F (1,70) = 66.780, p = .000; but did not indicate a significant interaction effect between those participants who were in a cooperative condition and those who were in a competitive condition in which a rewards was offered to win the competition F(1,70) = 1.026, p = .315. Therefore, for experiment 3, hypothesis 1 is upheld; there is no significant difference between the groups related to learning outcomes.

Table 11 – Learning Outcomes Means

	Condition					
	Cooperative			Competitive		
	N	M	SE	N	M	SE
Experiment 1						
Pre	37	54.212	1.653	37	56.261	1.653
Post	37	68.446	1.907	37	67.658	1.907
Experiment 2						
Pre	37	54.212	1.677	39	54.252	1.633
Post	37	68.446	1.726	39	65.085	1.681
Experiment 3						
Pre	37	54.212	1.658	35	57.167	1.705
Post	37	68.262	1.705	35	68.262	1.614

The pre and post test were graded on a scale of 100 points. Table 11 shows the means for the cooperative and competitive groups for all 3 experiments. There was an increase in scores in all 3 experiments.

Hypotheses 2: Mastery Goal Orientation

Hypothesis 2 predicted that players of a cooperative game would report higher mastery based goal orientation after play. The data generated for this analysis was a goal orientation

measure administered pre and post intervention. The results of this hypothesis were calculated for each experimental group in Table 12 below.

Table 12 – Mastery Goal Orientation Effects

	F	*df*	*Sig*
Experiment 1			
Mastery Goal Orientation	9.374	76.00	.003
Mastery Goal Orientation x Coop v Comp	.979	76.00	.326
Experiment 2			
Mastery Goal Orientation	10.751	79.00	.002
Mastery Goal Orientation x Coop v Comp	1.776	79.00	.187
Experiment 3			
Mastery Goal Orientation	9.694	76.00	.003
Mastery Goal Orientation x Coop v Comp	1.668	76.00	.201

For Experiment 1, results of a General Linear Model for repeated measures did demonstrate a significant main effect $F(1,76) = 9.374$, $p = .003$; but did not indicate a significant interaction effect between those participants who were in a cooperative condition and those who were in a competitive condition in which no verbal reinforcements or rewards were offered $F(1,76) = .979$, $p = .326$. Therefore, for experiment 1, hypothesis 2 is rejected. There is no significant difference between the groups related to mastery goal orientation.

For Experiment 2, results of a General Linear Model for repeated measures did demonstrate a significant main effect $F(1,79) = 10.751$, $p = .002$; but did not indicate a significant interaction effect between those participants who were in a cooperative condition and those who were in a competitive condition in which verbal reinforcement to compete was offered

F(1,79) = 1.776, p = .187. Therefore, for experiment 2, hypothesis 2 is rejected. There is no significant difference between the groups related to mastery goal orientation.

For Experiment 3, results of a General Linear Model for repeated measures did demonstrate a significant main effect F (1,76) = 9.694, p = .003; but did not indicate a significant interaction effect between those participants who were in a cooperative condition and those who were in a competitive condition in which a rewards was offered to win the competition F(1,76) = 1.668, p = .201. Therefore, for experiment 3, hypothesis 2 is rejected. There is no significant difference between the groups related to mastery goal orientation.

Table 13 – Mastery Goal Orientation Means

	Condition					
	Cooperative			Competitive		
	N	M	SE	N	M	SE
Experiment 1						
Pre	40	5.778	.122	38	5.694	.126
Post	40	5.669	.133	38	5.480	.137
Experiment 2						
Pre	40	5.778	.117	41	5.808	.115
Post	40	5.669	.134	41	5.549	.132
Experiment 3						
Pre	40	5.778	.101	39	5.737	.108
Post	40	5.669	.118	39	5.503	.117

The pre and post mastery goal orientation measures were graded on a scale of a possible 7 points. Table 13 shows the means for the cooperative and competitive groups for all 3 experiments. There was a decrease in scores in all 3 experiments.

Hypotheses 3: Performance Goal Orientation

Hypothesis 3 predicted that players of a competitive game would report higher performance based goal orientation after play. The data generated for this analysis was a goal orientation measure administered pre and post intervention. The results of this hypothesis were calculated for each experimental group in Table 14 below.

Table 14 – Performance Goal Orientation Effects

	F	*df*	*Sig*
Experiment 1			
Performance Goal Orientation	13.925	78.00	.000
Performance Goal Orientation x Coop v Comp	.434	78.00	.512
Experiment 2			
Performance Goal Orientation	18.421	80.00	.000
Performance Goal Orientation x Coop v Comp	.473	80.00	.494
Experiment 3			
Performance Goal Orientation	12.773	78.00	.001
Performance Goal Orientation x Coop v Comp	.499	78.00	.481

For Experiment 1, results of a General Linear Model for repeated measures did demonstrate a significant main effect $F(1,78) = 13.925$, $p = .000$; but did not indicate a significant interaction effect between those participants who were in a cooperative condition and those who were in a competitive condition in which no verbal reinforcements or rewards were offered $F(1,78) = .434$, $p = .512$. Therefore, for experiment 1, hypothesis 3 is rejected. There is no significant difference between the groups related to performance goal orientation.

For Experiment 2, results of a General Linear Model for repeated measures did demonstrate a significant main effect F (1,80) = 18.421, p = .000; but did not indicate a significant interaction effect between those participants who were in a cooperative condition and those who were in a competitive condition in which verbal reinforcement to compete was offered F(1,80) = .473, p = .494. Therefore, for experiment 2, hypothesis 3 is rejected. There is no significant difference between the groups related to performance goal orientation.

For Experiment 3, results of a General Linear Model for repeated measures did demonstrate a significant main effect F (1,78) = 12.773, p = .000; but did not indicate a significant interaction effect between those participants who were in a cooperative condition and those who were in a competitive condition in which a rewards was offered to win the competition F(1,78) = .499, p = .481. Therefore, for experiment 3, hypothesis 3 is rejected. There is no significant difference between the groups related to performance goal orientation.

Table 15 – Performance Goal Orientation Means

	Condition					
	Cooperative			Competitive		
	N	M	SE	N	M	SE
Experiment 1						
Pre	40	5.616	.137	40	5.491	.137
Post	40	5.303	.168	40	5.272	.168
Experiment 2						
Pre	40	5.616	.149	42	5.804	.145
Post	40	5.303	.170	42	5.577	.166
Experiment 3						
Pre	40	5.616	.128	40	5.534	.128
Post	40	5.303	.155	40	5.325	.155

The pre and post performance goal orientation measures were graded out of a possible 7 points. Table 15 shows the means for the cooperative and competitive groups for all 3 experiments. There was a decrease in scores in all 3 experiments.

Hypotheses 4: Intrinsic Motivation

Hypothesis 4 predicted that players of a cooperative game will report higher levels of intrinsic motivation than players of a competitive game after play. The data generated for this analysis was a motivation measure administered pre and post intervention. The results of this hypothesis were calculated for each experimental group in Table 16 below.

Table 16 – Intrinsic Motivation Effects

	F	*df*	*Sig*
Experiment 1			
Intrinsic Motivation	3.787	74.00	.055
Intrinsic Motivation x Coop v Comp Group	8.128	74.00	.006
Experiment 2			
Intrinsic Motivation	14.637	77.00	.000
Intrinsic Motivation x Coop v Comp Group	.318	77.00	.575
Experiment 3			
Intrinsic Motivation	9.694	75.00	.003
Intrinsic Motivation x Coop v Comp Group	1.668	75.00	.201

For Experiment 1, results of a General Linear Model for repeated measures did not demonstrate a significant main effect $F(1,74) = 3.787$, $p = .055$; but did indicate a significant interaction effect between those participants who were in a cooperative condition and those who were in a competitive condition in which no verbal reinforcements or rewards were offered

$F(1,74) = 8.128$, $p = .006$. Therefore, for experiment 1, hypothesis 4 is upheld. There is a significant increase in intrinsic motivation in the cooperative group.

For Experiment 2, results of a General Linear Model for repeated measures did demonstrate a significant main effect $F(1,77) = 14.637$, $p = .000$; but did not indicate a significant interaction effect between those participants who were in a cooperative condition and those who were in a competitive condition in which verbal reinforcement to compete was offered $F(1,77) = .318$, $p = .575$. Therefore, for experiment 2, hypothesis 4 is rejected. There is no significant difference between the groups related to intrinsic motivation.

For Experiment 3, results of a General Linear Model for repeated measures did demonstrate a significant main effect $F(1,75) = 9.694$, $p = .003$; but did not indicate a significant interaction effect between those participants who were in a cooperative condition and those who were in a competitive condition in which a rewards was offered to win the competition $F(1,75) = 1.668$, $p = .201$. Therefore, for experiment 3, hypothesis 4 is rejected. There is no significant difference between the groups related to intrinsic motivation.

Table 17 – Intrinsic Motivation Means

	Condition					
	Cooperative			Competitive		
	N	M	SE	N	M	SE
Experiment 1						
Pre	38	5.172	.123	38	5.193	.123
Post	38	5.336	.132	38	5.163	.132
Experiment 2						
Pre	38	5.172	.139	41	5.133	.134
Post	38	5.336	.145	41	5.255	.140
Experiment 3						
Pre	38	5.172	.110	39	5.116	.108
Post	38	5.336	.119	39	5.184	.117

The pre and post motivation measures were graded out of a possible 7 points. Table 17 shows the means for the cooperative and competitive groups for all 3 experiments. There was a increase in scores in all 3 experiments except for the competitive group in experiment 1 which had a slight decrease in intrinsic motivation.

Hypothesis 5: Extrinsic Motivation

Hypothesis 5 predicted that players of a competitive game would report higher levels of extrinsic motivation than players of a cooperative game. The data generated for this analysis was a motivation measure administered pre and post intervention. The results of this hypothesis were calculated for each experimental group as displayed in Table 18 below.

Table 18 – Extrinsic Motivation Effects

	F	*df*	*Sig*
Experiment 1			
Extrinsic Motivation	1.469	75.00	.229
Extrinsic Motivation x Coop v Comp Group	.053	75.00	.818
Experiment 2			
Extrinsic Motivation Outcomes	.140	74.00	.710
Extrinsic Motivation x Coop v Comp Group	1.522	74.00	.221
Experiment 3			
Extrinsic Motivation	.050	75.00	.824
Extrinsic Motivation x Coop v Comp Group	1.365	75.00	.246

For Experiment 1, results of a General Linear Model for repeated measures did not demonstrate a significant main effect F (1,75) = 1.469, p = .229; and did not indicate a significant interaction effect between those participants who were in a cooperative condition and those who were in a competitive condition in which no verbal reinforcements or rewards were offered F(1,75) = .053, p = .818. Therefore, for experiment 1, hypothesis 5 is rejected. There is no significant difference between the groups related to extrinsic motivation.

For Experiment 2, results of a General Linear Model for repeated measures did not demonstrate a significant main effect F (1,74) = .140, p = .710; and did not indicate a significant interaction effect between those participants who were in a cooperative condition and those who were in a competitive condition in which verbal reinforcement to compete was offered F(1,74) = 1.522, p = .221. Therefore, for experiment 2, hypothesis 5 is rejected. There is no significant difference between the groups related to extrinsic motivation.

For Experiment 3, results of a General Linear Model for repeated measures did not demonstrate a significant main effect F (1,75) = .050, p = .824; and did not indicate a significant interaction effect between those participants who were in a cooperative condition and those who were in a competitive condition in which a rewards was offered to win the competition F(1,75) = 1.365, p = .246. Therefore, for experiment 3, hypothesis 5 is rejected. There is no significant difference between the groups related to extrinsic motivation.

Table 19 – Extrinsic Motivation Means

	Condition					
	Cooperative			Competitive		
	N	M	SE	N	M	SE
Experiment 1						
Pre	38	3.845	.146	39	3.912	.145
Post	38	3.775	.158	39	3.864	.156
Experiment 2						
Pre	38	3.845	.154	38	4.120	.154
Post	38	3.775	.169	38	4.158	.169
Experiment 3						
Pre	38	3.845	.151	39	3.968	.149
Post	38	3.775	.168	39	4.016	.166

The pre and post motivation measures were graded out of a possible 7 points. Table 19 shows the means for the cooperative and competitive groups for all 3 experiments. The mean changes were not consistent between experiments.

Hypothesis 6: Satisfaction

This hypothesis predicted that players of a cooperative game would report a higher level of satisfaction with their experience than players of a competitive game after play. The data

generated for this analysis was a satisfaction scale administered post intervention. The result of this hypothesis was calculated for each experimental group below.

Table 20 – Satisfaction Effects

		t	*df*	*Sig (2-tailed)*
Experiment 1				
	Satisfaction	-.337	78.00	.737
Experiment 2				
	Satisfaction	.111	80.00	.912
Experiment 3				
	Satisfaction	-1.905	77.00	.061

For Experiment 1, results of an Independent Samples T-Test did not demonstrate a significant effect t (78) = -.337, p = .737; between those participants who were in a cooperative condition and those who were in a competitive condition in which no verbal reinforcements or rewards were offered. Therefore, for experiment 1, hypothesis 6 is rejected. There is no significant difference between the groups related to satisfaction.

For Experiment 2, results of an Independent Samples T-Test did not demonstrate a significant effect t (80) = .111, p = .912; between those participants who were in a cooperative condition and those who were in a competitive condition in which verbal reinforcement to compete was offered. Therefore, for experiment 2, hypothesis 6 is rejected. There is no significant difference between the groups related to satisfaction.

For Experiment 3, results of an Independent Samples T-Test did not demonstrate a significant effect t (77) = -1.905, p = .061; between those participants who were in a cooperative condition and those who were in a competitive condition in which a rewards was offered to win the competition. Therefore, for experiment 3, hypothesis 6 is rejected. There is no significant difference between the groups related to satisfaction.

Table 21 – Satisfaction Means

	Condition					
	Cooperative			Competitive		
	N	M	SD	N	M	SD
Experiment 1						
Satisfaction	40	3.9250	1.1694	40	4.0150	1.2215
Experiment 2						
Satisfaction	40	3.9250	1.1694	42	3.8952	1.2589
Experiment 3						
Satisfaction	38	3.9250	1.1694	39	4.4205	1.1423

The pre and post motivation measures were graded out of a possible 7 points. Table 21 shows the means for the cooperative and competitive groups for all 3 experiments. Satisfaction was higher in experiment 1 and 3 and lower in experiment 2.

Hypothesis 7a: Self Efficacy Winners and Losers

This hypothesis predicted that winners of a competitive game will have a higher self efficacy than losers. For the results this hypothesis was broken into two parts. The data generated for this analysis was a self efficacy measure administered post intervention. The results of this hypothesis were calculated for each experimental group as displayed in Table 22 below.

Table 22 – Self Efficacy Winner v Losers Effects

		t	*df*	*Sig*
Experiment 1				
	Self Efficacy	-3.135	38.00	.003
Experiment 2				
	Self Efficacy	-4.294	40.00	.000
Experiment 3				
	Self Efficacy	-3.504	38.00	.001

For Experiment 1, results of an Independent Samples T-Test did demonstrate a significant effect t (38) = -3.135, p = .003; between those participants who won a competitive game and those who lost a competitive game in which no verbal reinforcements or rewards were offered. Therefore, for experiment 1 hypothesis 7a is accepted. There is a significant difference between the groups, winners had higher self efficacy than losers of a competitive game.

For Experiment 2, results of an Independent Samples T-Test did demonstrate a significant effect t (40) = -4.294, p = .000; between those participants who won a competitive game and those who lost a competitive game in which verbal reinforcement to compete was offered. Therefore for experiment 2 hypothesis 7a is accepted. There is a significant difference between the groups, winners had higher self efficacy than losers of a competitive game.

For Experiment 3, results of an Independent Samples T-Test did demonstrate a significant effect t (38) = -3.504, p = .001; between those participants who won a competitive game and those who lost a competitive game in which a rewards was offered to win the competition. Therefore, for experiment 3, hypothesis 7a is upheld, there is no significant

difference between the groups, winners had higher self efficacy than losers of a competitive game.

Table 23 – Self Efficacy Winners v Losers Means

	Condition					
	Win			Lose		
	N	M	SD	N	M	SD
Experiment 1						
Self Efficacy	18	5.3796	1.0869	22	4.1288	1.3771
Experiment 2						
Self Efficacy	20	5.1364	1.1814	22	3.5083	1.2755
Experiment 3						
Self Efficacy	21	5.6228	1.09972	19	4.1111	1.5619

The pre and post self efficacy measures were graded out of a possible 7 points. Table 23 shows the means for the winning and losing groups for all 3 experiments. Self efficacy was higher for winners than losers in all 3 experiments.

Hypothesis 7b: Self Efficacy Winners and Cooperators

This hypothesis predicted that winners of a competitive game would have a higher self efficacy than all players of a cooperative game. The data generated for this analysis was a self efficacy measure administered post intervention. The results of this hypothesis were calculated for each experimental group as displayed in Table 24 below.

Table 24 – Self Efficacy Winner and Cooperators Effects

		t	*df*	*Sig (2-tailed)*
Experiment 1				
	Self Efficacy	-1.248	56.00	.217
Experiment 2				
	Self Efficacy	-.699	60.00	.487
Experiment 3				
	Self Efficacy	-1.876	57.00	.066

For Experiment 1, results of an Independent Samples T-Test did not demonstrate a significant effect t (56) = -1.248, p = .217; between those participants that cooperated and those who won a competitive game in which no verbal reinforcements or rewards were offered. Therefore for experiment 1 hypothesis 7b is not upheld. There is not a significant difference between the groups related to self efficacy.

For Experiment 2, results of an Independent Samples T-Test did not demonstrate a significant effect t (60) = -.699, p = .487; between those participants cooperated and those who won a competitive game in which verbal reinforcement to compete was offered. Therefore, for experiment 2. hypothesis 7b is not upheld. There is not a significant difference between the groups related to self efficacy.

For Experiment 3, results of an Independent Samples T-Test did not demonstrate a significant effect t (57) = -1.876, p = .066 for 2-tailed results; between those participants who cooperated and those won a competitive game in which a rewards was offered to win the competition, however, this was a directional hypothesis and the 1-tailed results are p = .033.

Therefore, for experiment 3, hypothesis 7b is upheld, there is a significant difference between the groups, winners had a significantly higher self efficacy cooperators.

Table 25 – Self Efficacy Winner and Cooperators Means

	Condition					
	Cooperative			Winner		
	N	M	SD	N	M	SD
Experiment 1						
Self Efficacy	40	4.8667	1.5807	18	5.3796	1.0858
Experiment 2						
Self Efficacy	38	4.8667	1.5807	22	5.1364	1.1814
Experiment 3						
Self Efficacy	40	4.8667	1.5807	19	5.6228	1.0997

The pre and post self efficacy measures were graded out of a possible 7 points. Table 25 shows the means for winners and cooperators for all 3 experiments. Self efficacy was higher for winners than cooperators in all 3 experiments.

Hypothesis 8: Expectations

Hypothesis 8 predicted that players who were told that they were receiving a game will have higher performance based goal orientation and higher extrinsic motivation than players who are told they are receiving a learning experience. The data generated for this analysis was a pre and post goal orientation measure and a pre and post motivation measure. The results of this hypothesis were calculated for each experimental group as displayed in Table 26 below.

Table 26 – Expectations Effects

	F	*df*	*Sig*
Experiment 1			
Performance Goal Orientation	1.530	77.00	.220
Extrinsic Motivation	3.011	77.00	.087
Experiment 2			
Performance Goal Orientation	.014	76.00	.910
Extrinsic Motivation	.149	76.00	.700
Experiment 3			
Performance Goal Orientation	1.359	77.00	.264
Extrinsic Motivation	.327	77.00	.560

For Experiment 1, results of a MANOVA did not demonstrate a significant effect $F(1,77) = 1.530$, $p = .220$ on performance goal orientation; and did not indicate a significant effect $F(1,77) = 3.011$, $p = .087$ on extrinsic motivation between those participants who were in a condition in which they were told they were receiving a game or told they were receiving a learning intervention. Therefore, for experiment 1, hypothesis 8 is rejected. There is not a significant difference between the groups related to expectations.

For Experiment 2, results of a MANOVA did not demonstrate a significant effect $F(1,76) = .014$, $p = .910$ on performance goal orientation; and did not indicate a significant effect $F(1,76) = .149$, $p = .700$ on extrinsic motivation between those participants who were in a condition in which they were told they were receiving a game or told they were receiving a learning intervention. Therefore, for experiment 2, hypothesis 8 is rejected. There is not a significant difference between the groups related to expectations.

Fore Experiment 3, results of a MANOVA did not demonstrate a significant effect $F(1,77) = 1.359$, $p = .264$ on performance goal orientation; and did not indicate a significant effect $F(1,77) = .327$, $p = .560$ on extrinsic motivation between those participants who were in a condition in which they were told they were receiving a game or told they were receiving a learning intervention. Therefore, for experiment 3, hypothesis 8 is rejected. there is not a significant difference between the groups related to expectations.

Table 27 – Expectations Means

	Condition					
	Game			Learning Intervention		
	N	M	SE	N	M	SE
Experiment 1						
Performance Goal Orientation	40	3.714	.154	39	5.072	.156
Extrinsic Motivation	40	3.986	.156	39	5.478	.166
Experiment 2						
Performance Goal Orientation	37	3.976	.175	41	5.459	.176
Extrinsic Motivation	37	4.005	.166	41	5.366	.167
Experiment 3						
Performance Goal Orientation	40	3.794	.151	39	5.266	.149
Extrinsic Motivation	40	4.056	.168	39	5.349	.166

The pre and post performance goal orientation measures as well as the pre and post extrinsic motivation measures were graded out of a possible 7 points. Table 27 shows the means for both groups. The performance goal orientation and extrinsic motivation were higher in the learning intervention group in all cases.

Research Question 1: Game Experience

This hypothesis predicted that game experience will impact the goal orientation and motivation of players. The data generated for this analysis was a pre and post goal orientation measure and a pre and post motivation measure, as well as a game experience survey. The results of this hypothesis were calculated for each experimental group as displayed in Table 28 below.

Table 28 – Game Experience Effects

	F	*df*	*Sig*
Experiment 1			
Mastery Goal Orientation x Coop v Comp	.410	69.00	.524
Performance Goal Orientation x Coop v Comp	.470	71.00	.495
Intrinsic Motivation x Coop v Comp Group	6.342	68.00	.014
Extrinsic Motivation x Coop v Comp Group	.002	68.00	.061
Experiment 2			
Mastery Goal Orientation x Coop v Comp	1.206	73	.276
Performance Goal Orientation x Coop v Comp	.411	74	.523
Intrinsic Motivation x Coop v Comp Group	.411	72	.523
Extrinsic Motivation x Coop v Comp Group	1.350	68	.249
Experiment 3			
Mastery Goal Orientation x Coop v Comp	.861	69	.357
Performance Goal Orientation x Coop v Comp	.204	70	.653
Intrinsic Motivation x Coop v Comp Group	1.824	68	.181
Extrinsic Motivation x Coop v Comp Group	1.983	67	.164

For Experiment 1, results of a General Linear Model for repeated measures with game experience as a covariate did not demonstrate a significant effect F (1,69) = .410 p = .514 for mastery goal orientation; and did not demonstrate a significant effect F (1,71) = .470, p = .495 for performance goal orientation; and did demonstrate a significant effect F (1,68) = 6.342, p = .014 for intrinsic motivation; and did not demonstrate a significant effect F (1,68) = .002, p =

.061 for extrinsic motivation between those participants who were in a cooperative condition and those who were in a competitive condition in which no verbal reinforcements or rewards were offered. These results match those without game experience as a covariate, therefore for experiment 1 Research Question 1 is rejected, gaming experience did not have impact on the results.

For Experiment 2, results of a General Linear Model for repeated measures with game experience as a covariate did not demonstrate a significant effect $F(1,73) = 1.206$, $p = .276$ for mastery goal orientation; and did not demonstrate a significant effect $F(1,74) = .411$, $p = .523$ for performance goal orientation; and did not demonstrate a significant effect $F(1,72) = .411$, $p = .523$ for intrinsic motivation; and did not demonstrate a significant effect $F(1,68) = 1.350$, $p = .249$ for extrinsic motivation between those participants who were in a cooperative condition and those who were in a competitive condition in which verbal reinforcements were offered. These results match those without game experience as a covariate, therefore for experiment 2 Research Question 1 is rejected, gaming experience did not have impact on the results.

For Experiment 3, results of a General Linear Model for repeated measures with game experience as a covariate did not demonstrate a significant effect $F(1,69) = .861$, $p = .357$ for mastery goal orientation; and did not demonstrate a significant effect $F(1,70) = .204$, $p = .357$ for performance goal orientation; and did not demonstrate a significant effect $F(1,68) = 1.824$, $p = .181$ for intrinsic motivation; and did not demonstrate a significant effect $F(1,67) = 1.983$, $p = .164$ for extrinsic motivation between those participants who were in a cooperative condition and those who were in a competitive condition in which rewards were offered. These results match

those without game experience as a covariate, therefore for experiment 3 Research Question 1 is rejected, gaming experience did not have impact on the results.

Research Question 2: Competitive and Cooperative Strategies

This hypothesis predicted that Competition/Cooperation preferences will impact the goal orientation and motivation of players. The data generated for this analysis was a pre and post goal orientation measure and a pre and post motivation measure, as well as a competitive cooperative strategy survey. The results of this hypothesis were calculated for each experimental group as displayed in Tables 28 and 29 below.

Table 29 – Competitive Strategy Effects

	F	*df*	*Sig*
Experiment 1			
Mastery Goal Orientation x Coop v Comp	.989	74.00	.323
Performance Goal Orientation x Coop v Comp	.599	76.00	.441
Intrinsic Motivation x Coop v Comp Group	8.071	73.00	.006
Extrinsic Motivation x Coop v Comp Group	.053	73.00	.818
Experiment 2			
Mastery Goal Orientation x Coop v Comp	2.283	76.00	.135
Performance Goal Orientation x Coop v Comp	.412	77.00	.523
Intrinsic Motivation x Coop v Comp Group	.494	74.00	.485
Extrinsic Motivation x Coop v Comp Group	2.640	71.00	.109
Experiment 3			
Mastery Goal Orientation x Coop v Comp	1.128	76.00	.485
Performance Goal Orientation x Coop v Comp	.512	77.00	.477
Intrinsic Motivation x Coop v Comp Group	1.642	74.00	.204
Extrinsic Motivation x Coop v Comp Group	1.328	74.00	.253

For Experiment 1, results of a General Linear Model for repeated measures with competitive strategy as a covariate did not demonstrate a significant effect $F(1,74) = .989$, $p =$

.323 for mastery goal orientation; and did not demonstrate a significant effect F (1,76) = .599, p = .441 for performance goal orientation; and did demonstrate a significant effect F (1,73) = 8.071, p = .006 for intrinsic motivation; and did not demonstrate a significant effect F (1,73) = .053, p = .818 for extrinsic motivation between those participants who were in a cooperative condition and those who were in a competitive condition in which no verbal reinforcements or rewards were offered. These results match those without game experience as a covariate, therefore for experiment 1 Research Question 2a is rejected, competitive strategy did not have impact on the results.

For Experiment 2, results of a General Linear Model for repeated measures with competitive strategy as a covariate did not demonstrate a significant effect F (1,76) = 2.283, p = .135 for mastery goal orientation; and did not demonstrate a significant effect F (1,77) = .412, p = .523 for performance goal orientation; and did not demonstrate a significant effect F (1,74) = .494, p = .485 for intrinsic motivation; and did not demonstrate a significant effect F (1,71) = 2.640, p = .109 for extrinsic motivation between those participants who were in a cooperative condition and those who were in a competitive condition in which verbal reinforcements were offered. These results match those without game experience as a covariate, therefore for experiment 2 Research Question 2a is rejected; competitive strategy did not have impact on the results.

For Experiment 3, results of a General Linear Model for repeated measures with competitive strategy as a covariate did not demonstrate a significant effect F (1,76) = 1.128, p = .485 for mastery goal orientation; and did not demonstrate a significant effect F (1,77) = .512, p = .477 for performance goal orientation; and did not demonstrate a significant effect F (1,74) =

1.642, p = .204 for intrinsic motivation; and did not demonstrate a significant effect F (1,74) = 1.328, p = .253 for extrinsic motivation between those participants who were in a cooperative condition and those who were in a competitive condition in which rewards were offered. These results match those without game experience as a covariate, therefore for experiment 3 Research Question 2a is rejected; competitive strategy did not have impact on the results.

Table 30 – Cooperative Strategy Effects

	F	*df*	*Sig*
Experiment 1			
Mastery Goal Orientation x Coop v Comp	.860	75.00	.357
Performance Goal Orientation x Coop v Comp	.259	77.00	.612
Intrinsic Motivation x Coop v Comp Group	7.166	73.00	.009
Extrinsic Motivation x Coop v Comp Group	.568	74.00	.453
Experiment 2			
Mastery Goal Orientation x Coop v Comp	2.423	78.00	.124
Performance Goal Orientation x Coop v Comp	.278	79.00	.599
Intrinsic Motivation x Coop v Comp Group	.170	76.00	.681
Extrinsic Motivation x Coop v Comp Group	1.566	73.00	.215
Experiment 3			
Mastery Goal Orientation x Coop v Comp	1.347	76.00	.249
Performance Goal Orientation x Coop v Comp	.444	77.00	.507
Intrinsic Motivation x Coop v Comp Group	1.728	74.00	.193
Extrinsic Motivation x Coop v Comp Group	1.286	74.00	.260

For Experiment 1, results of a General Linear Model for repeated measures with cooperative strategy as a covariate did not demonstrate a significant effect F (1,75) = .860, p = .357 for mastery goal orientation; and did not demonstrate a significant effect F (1,77) = .259, p = .612 for performance goal orientation; and did demonstrate a significant effect F (1,73) = 7.166, p = .009 for intrinsic motivation; and did not demonstrate a significant effect F (1,74) =

.568, p = .453 for extrinsic motivation between those participants who were in a cooperative condition and those who were in a competitive condition in which no verbal reinforcements or rewards were offered. These results match those without game experience as a covariate, therefore for experiment 1 Research Question 2b is rejected, cooperative strategy did not have impact on the results.

For Experiment 2, results of a General Linear Model for repeated measures with cooperative strategy as a covariate did not demonstrate a significant effect F (1,78) = 2.423, p = .124 for mastery goal orientation; and did not demonstrate a significant effect F (1,79) = .278, p = .599 for performance goal orientation; and did not demonstrate a significant effect F (1,76) = .170, p = .681 for intrinsic motivation; and did not demonstrate a significant effect F (1,73) = 1.566, p = .215 for extrinsic motivation between those participants who were in a cooperative condition and those who were in a competitive condition in which verbal reinforcements were offered. These results match those without game experience as a covariate, therefore for experiment 2 Research Question 2b is rejected, cooperative strategy did not have impact on the results.

For Experiment 3, results of a General Linear Model for repeated measures with cooperative strategy as a covariate did not demonstrate a significant effect F (1,76) = 1.347, p = .249 for mastery goal orientation; and did not demonstrate a significant effect F (1,77) = .444, p = .507 for performance goal orientation; and did not demonstrate a significant effect F (1,74) = 1.728, p = .193 for intrinsic motivation; and did not demonstrate a significant effect F (1,74) = 1.286, p = .260 for extrinsic motivation between those participants who were in a cooperative condition and those who were in a competitive condition in which rewards were offered. These

results match those without game experience as a covariate, therefore for experiment 3 Research Question 2b is rejected, cooperative strategy did not have impact on the results.

CHAPTER FIVE: DISCUSSION

Hypothesis 1 predicted that there would be significantly higher or equal learning gains in the cooperative group. This hypothesis was upheld in that there was no significant difference between groups. Further, there was a significant increase in learning outcomes for all participants irrespective of cooperation or competition, showing the Acquisition Proposition! does teach the subject matter. This was true in all 3 experimental groups. Results related to learning outcomes in this study imply that learning games researchers concerned with learning outcomes can in fact safely use either a competitive or cooperative goal structure without concern for lowering test scores. This is an incredibly important finding. Many learning games employ the use of competitive strategies that could easily be categorized at appropriate competition and the findings of this study uphold that these games should still be valid and usable gaming solutions despite the literature that paints a bleaker outlook for competition in learning games.

Participants demonstrated a significant decrease in mastery goal orientation across both the cooperative and competitive conditions for all experimental groups. This did not support hypothesis 2 that mastery goal orientation would increase in cooperative groups. It is possible that this was not the case because the game itself featured tasks that were oriented more towards procedural knowledge and rote memorization than towards learning. That is, the game, like many casual arcade style games, may not have been complex enough to foster mastery goal orientation. An alternative conclusion is that the game's topic area was not interesting enough for the players. Mastery goal orientation is fostered by a desire to master new material and acquire new knowledge (VandeWalle et al., 1999). The player base came from University of Central Florida students who would not have any desire to master or gain knowledge of defense acquisition

material. This is difficult to assess as the result was not predicted and participants were not queried on their desire to learn the content of the game. It was expected that increasing competitive elements through rewards, as in experiment 2 and 3, would have resulted in a decreased mastery goal orientation and this did occur.

While there was not a significant finding for hypothesis 3, performance goal orientation was also significantly decreased for all participants in all 3 experimental groups. Performance goal orientation is indicative of a desire to be succeed in comparison to other individuals (VandeWalle et al., 1999). One reason that performance goal orientation would be reduced for all participants is that the participants were in the cooperative group or in the competitive group and the competition can be categorized as appropriate competition. Appropriate competition is used to reduce the negative effects of competition. This type of competition is created when winning is unimportant, all participants have a chance to win, there are clear rules, and players are able to monitor each other's progress. The original experimental design (experiment 1) was most likely fostering appropriate competition, which was the reason to attempt to boost competition through experiment 2 and 3. It is possible that the increased competition was not enough to change its nature. Of course, like it was expected that experiment 2 and 3 would reduce mastery goal orientation, it was expected that experiment 2 and 3 would increase performance goal orientation. Similarly to the argument made for mastery based goal orientation the lack of relevance of material may have led to reduced performance goal orientation. This did not change performance goal orientation from decreasing to increasing for the same reason it was not a huge factor in mastery goal orientation, the effect of interest on goal orientation does not

vary with goal orientation. That is, it effects mastery and performance goal orientation equally (Horvath, Herleman, & Lee McKie, 2006).

Hypothesis 4 predicted that intrinsic motivation would be significantly increased for cooperative groups compared to competitive groups. This hypothesis was upheld for experiment 1. Looking at the means in Figure 5 below the cooperative group increases, while the competitive group decreases.

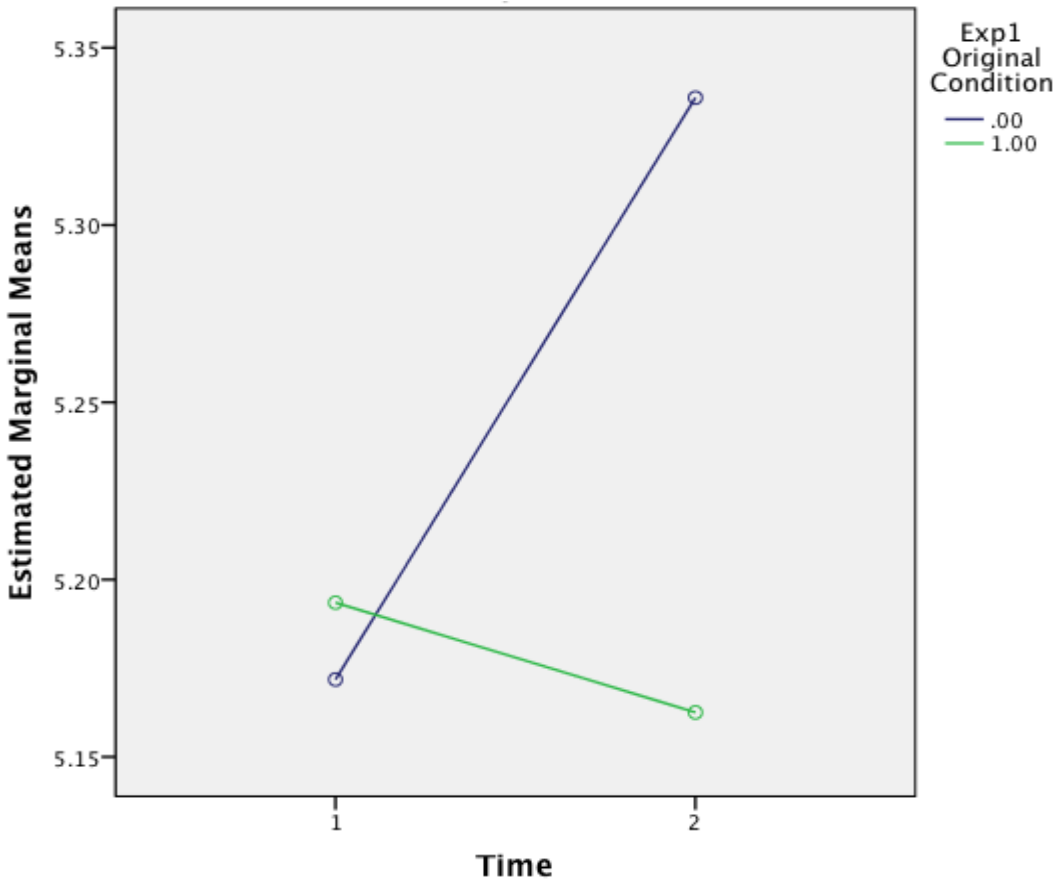


Figure 5: Means for Intrinsic Motivation in Experiment 1

This finding suggests that in experiment 1 there was a clear difference between cooperative and competitive groups although it was not present in all of the data. As predicted, in experiment 1 cooperative groups had higher intrinsic motivation. This was not the case in

experiment 2 and 3. The increase competition removed the effect on intrinsic motivation between the cooperative and competitive groups and all participants had a significant increase in intrinsic motivation. One the outside it seems remarkably unlikely that intrinsic motivation would increase with the addition of rewards. Though it is possible, while the lack of relevance could have skewed the performance goal orientation lower, the increased interest created by providing a reward might have skewed the intrinsic motivation higher. Intrinsic motivation is the product of three factors: autonomy, skill to achieve, and interest in the topic. The rewards offered, verbal or tangible, could have peaked interest without impacting the relevance of the material. Deci et al. found that intrinsic motivation was not hindered by rewards for dull tasks (Deci, Koestner, & Ryan, 1999). Further, Eisenberger et al. found that rewards can increase intrinsic motivation in cases requiring high task performance (Eisenberger, Pierce, & Cameron, 1999).

For self efficacy there was a significant difference between winners and losers of competitive games. This is to expected as winners will assume that they are better at the skills involved with the game. This is irrespective of the fact that they are not provided with a their test scores or given any indication that they may have done well compared to other participants in the study. When self efficacy is compared between winners of the competitive game and all cooperators this becomes even more interesting. While there was no significant effect for experiment 1 and 2, experiment 3 found a significant effect. In experiment 3 competitive winners had significantly higher self efficacy than all players of a cooperative game, including “winners” or those players that finished first in the cooperative groups. The reason this only occurred in experiment 3 most likely can be attributed to the presence of the physical reward.

CHAPTER SIX: CONCLUSIONS

> *Every gamer and game scholar knows that a great many gamers, including young ones, enjoy competition with other players in games, either one-on-one or team-based. It is striking that many young gamers see competition as pleasurable and motivating in video games, but not in school. Why this is so ought to be a leading question for research into games and learning. (Gee, 2007b)*

The primary intent of this study was to explore the use of cooperative and competitive goal structures in learning games as well as the effect of using the word game on player expectations. Games have embraced competition strongly sense the inception of the arcade. High score tables have been a mainstay of the arcade and have carried through to console and even Facebook games. This research has made a first step at exploring the effects of competitive and cooperative goal structures on learning games. The learning science literature had very little support for competition and suggested that cooperative goal structures might be preferable in learning games. While the outcomes for intrinsic motivation support the idea that cooperation might be superior, there were not significant differences for learning outcomes. There was also no support for expectations created by word game.

Limitations of the Current Study

This study had a number of limitations that should be identified. The subject pool was all collected from the University of Central Florida and as such was relatively young and unfamiliar with the learning content. While this could be considered a benefit, as this did not create a ceiling between the pre and post test, it may have been detrimental as the material may not have been relevant to the population, effecting scores in goal orientation and motivation.

Also, the players of all games were not explicitly linked within the game. That is, everyone was playing a single player game and being told that they were either cooperating or competing with the person playing next to them. This seemed to have been working for the cooperative group in the pilot study, and did produce significant results for intrinsic motivation. Unfortunately, these results did not hold true for the competitive groups. This could be a result of appropriate competition or possibly the lack of equivalent strategies for the cooperative groups. It was also difficult to ascertain if the players perceived themselves as competing or cooperating at all.

There was no change due to expectations. If players were told they were getting a game or a learning intervention there was no change in motivation or goal orientation. This study did not look at a wider level of demographics that might have different expectations of what a game or learning intervention is. This could be due to the fact that people have used alternative names for games in learning for many years, or that 19 year olds have grown up with games and are not surprised when they get them in their education.

While strategies were introduced to increase competition, the environment did not create an immediate expectation of competition. The situation created might have been perceived as appropriate competition even in the more explicit competitive groups, the result of which has not shown a significant difference from cooperation in other research.

Directions for Further Research

This study represents a first step in the exploration of competition and cooperation in learning games. Future studies should be performed to answer the questions that arose in the process of performing this study.

First, future work should consider using a game that it relevant to the population. It would need to be something complex enough and interesting enough to foster interest in the topic. It is conceivable that this game could be much longer and employed in a classroom setting or other context in which the participants know each other and would care who won in a competition.

Future studies should explore the ability to have a game that had both participants interacting in the same environment. The question of if they perceived themselves as competing would no longer be relevant at that point. If the internals of the game declared winners or provided failure states for the cooperative teams it would have been more explicit who was in what group. This would have eliminated the need for experiment 1 and 2.

The fact that there was a significant effect in the cooperative group given that there was no linkage implies that just suggestion of cooperation might be effective in single player games as well. It would be interesting to perform the same study on a single player using the cooperative version of the game. Further, these constructs could be applied to asynchronous multiplayer. This is where actions between players matter but not in real time. Examples of this for competition include high score tables, and social media based bragging. In the cooperative group it might include one player getting the group to one point in the progress and other players coming in to further the action later, or supplying the first player with information or resources they need for their next play. These strategies are commonly employed in social games.

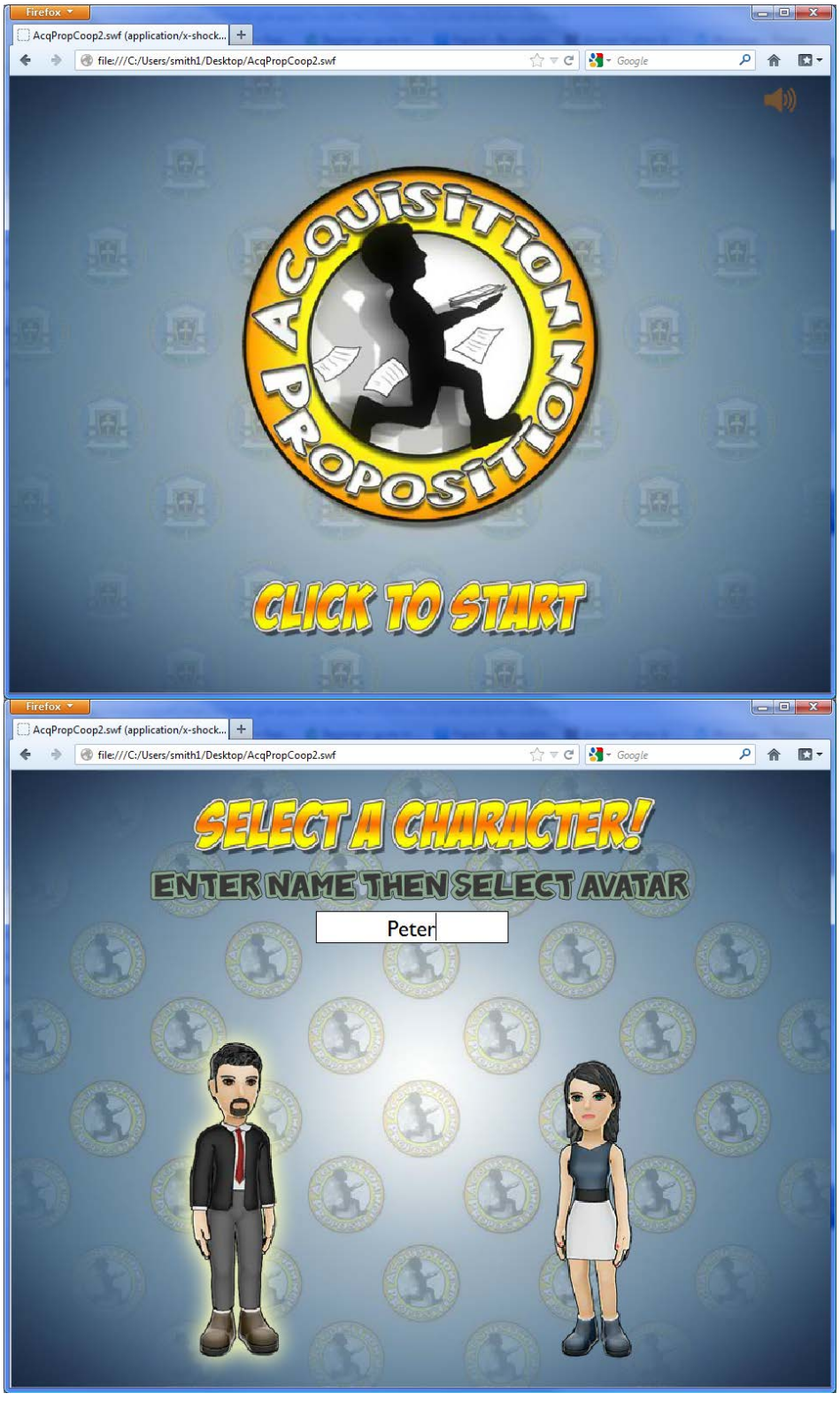
There is also an opportunity to explore other aspects of this issue that were not explored in this study. For example, improved communications is a common effect of cooperation, but

was not included in this study due to the short time frame the game was played. Also, competitive teams would be an interesting group to study.

Opportunity

Learning game researchers are on the precipice of understanding how learning game design actually works. This study is just a small part of what is possible with this medium, and there is a whole industry of people exploring the space. The key is to begin the process of formalizing what aspects of games should be explored and how to unify the research to advance the field. Opportunities are abound in learning game design.

APPENDIX A: ACQUISITION PROPOSITION! BREAKDOWN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ACQUISITION PROPOSITION
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Firefox
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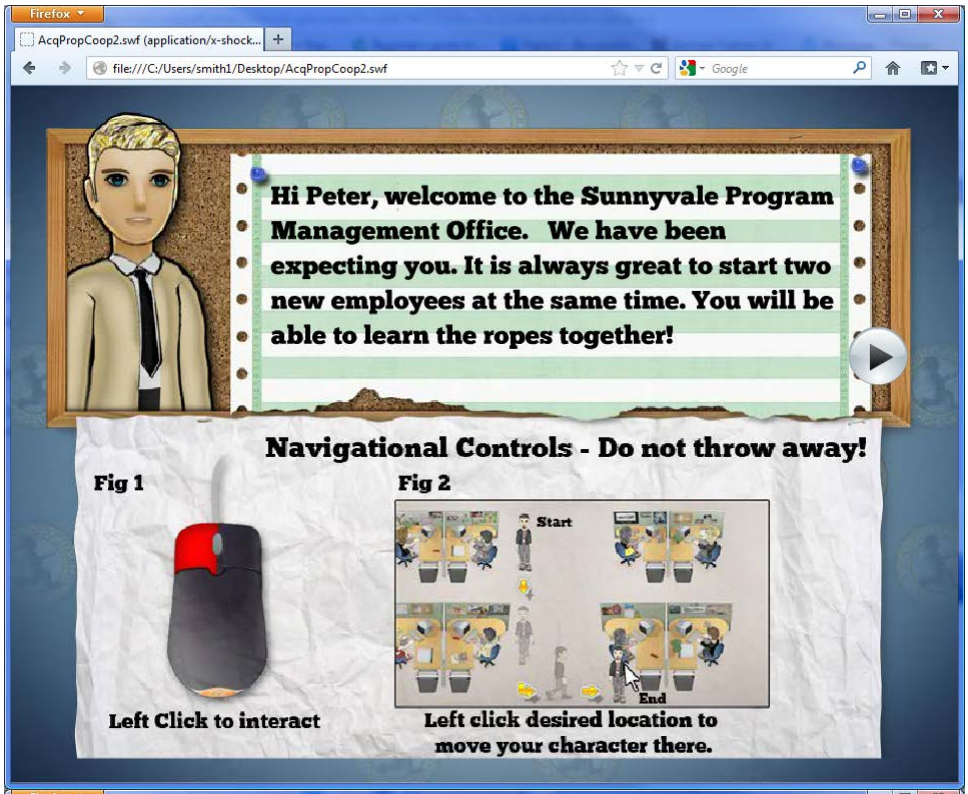
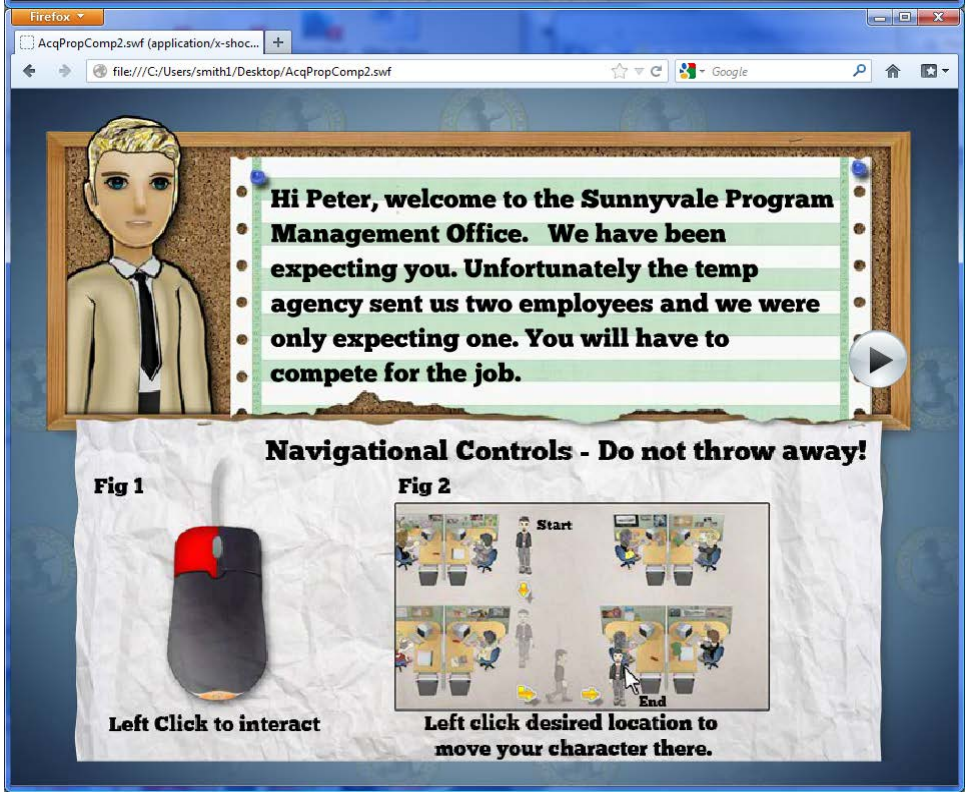
file:///C:/Users/smith1/Desktop/AcqPropCoop2.swf
Google
SELECT A CHARACTER!
ENTER NAME THEN SELECT AVATAR
Peter


Firefox
AcqPropCoop2.swf (application/x-shock...
file:///C:/Users/smith1/Desktop/AcqPropCoop2.swf
Hi Peter, welcome to the Sunnyvale Program Management Office. We have been expecting you. It is always great to start two new employees at the same time. You will be able to learn the ropes together!
Navigational Controls - Do not throw away!
Fig 1
Fig 2
Start
End
Left Click to interact
Left click desired location to move your character there.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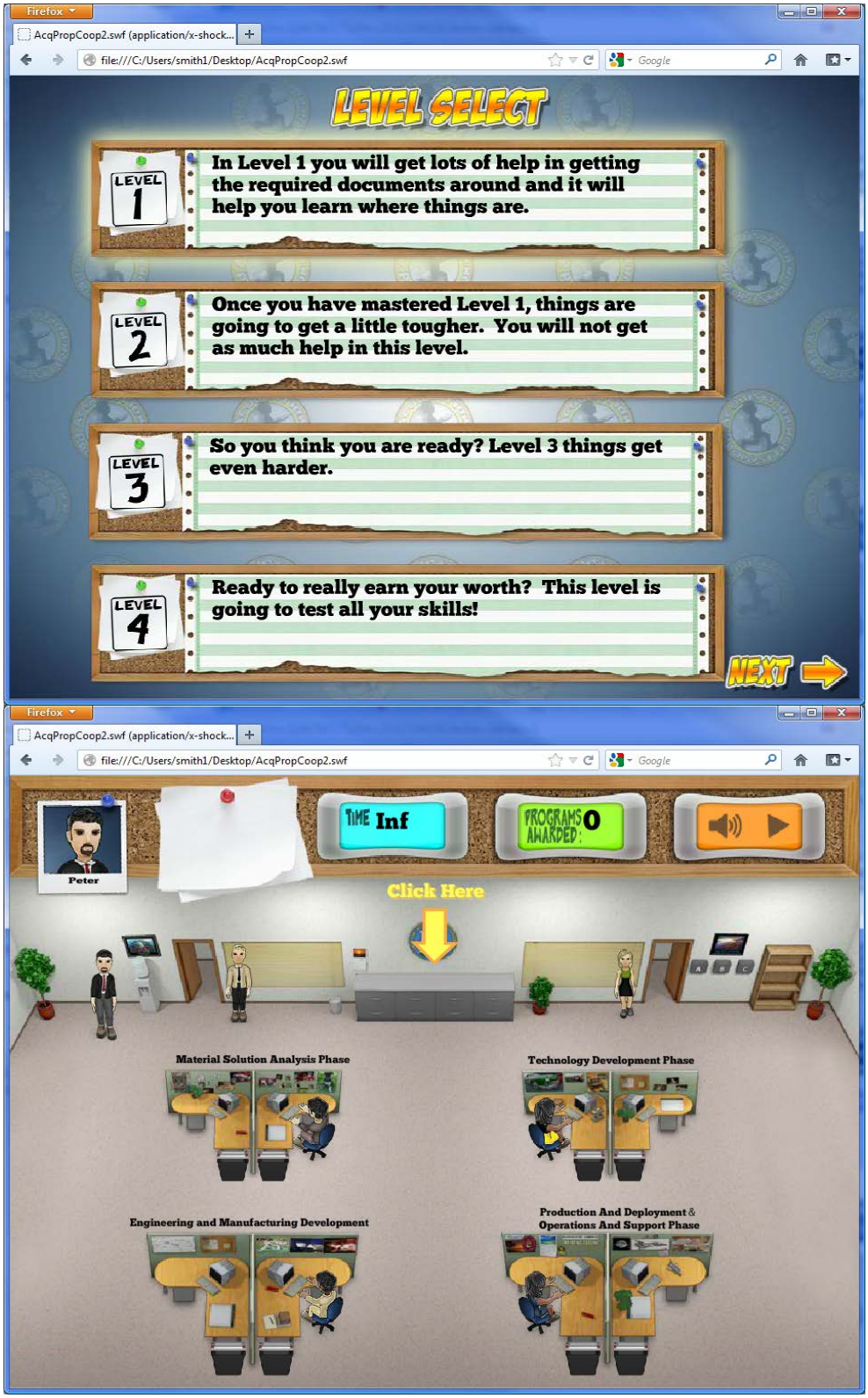
file:///C:/Users/smith1/Desktop/AcqPropComp2.swf
Hi Peter, welcome to the Sunnyvale Program Management Office. We have been expecting you. Unfortunately the temp agency sent us two employees and we were only expecting one. You will have to compete for the job.
Navigational Controls - Do not throw away!
Fig 1
Fig 2
Start
End
Left Click to interact
Left click desired location to move your character there.


Firefox
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file:///C:/Users/smith1/Desktop/AcqPropCoop2.swf
Google
LEVEL SELECT
LEVEL 1
In Level 1 you will get lots of help in getting the required documents around and it will help you learn where things are.
LEVEL 2
Once you have mastered Level 1, things are going to get a little tougher. You will not get as much help in this level.
LEVEL 3
So you think you are ready? Level 3 things get even harder.
LEVEL 4
Ready to really earn your worth? This level is going to test all your skills!
NEXT
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Peter
TIME Inf
PROGRAMS AWARDED: 0
Click Here
Material Solution Analysis Phase
Technology Development Phase
Engineering and Manufacturing Development
Production And Deployment & Operations And Support Phase


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Material Solution Ana
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Engineering and Manufacturing Development
Production And Deployment & Operations And Support Phase
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Google
Peter
TIME Inf
PROGRAMS AWARDED: 0
Great job getting the Material Solutions Analysis Phase started! In each of the phases a number of documents will be required.
Engineering and Manufacturing Development
Production And Deployment & Operations And Support Phase


Firefox
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file:///C:/Users/smith1/Desktop/AcqPropCoop2.swf
Peter
Airborn System Operation Payload
TIME Inf
PROGRAMS AWARDED: 0
Hi Peter, I am Ms. Sabre. I have approved this program to start the Material Solution Analysis Phase.
Engineering and Manufacturing Development
Production And Deployment & Operations And Support Phase
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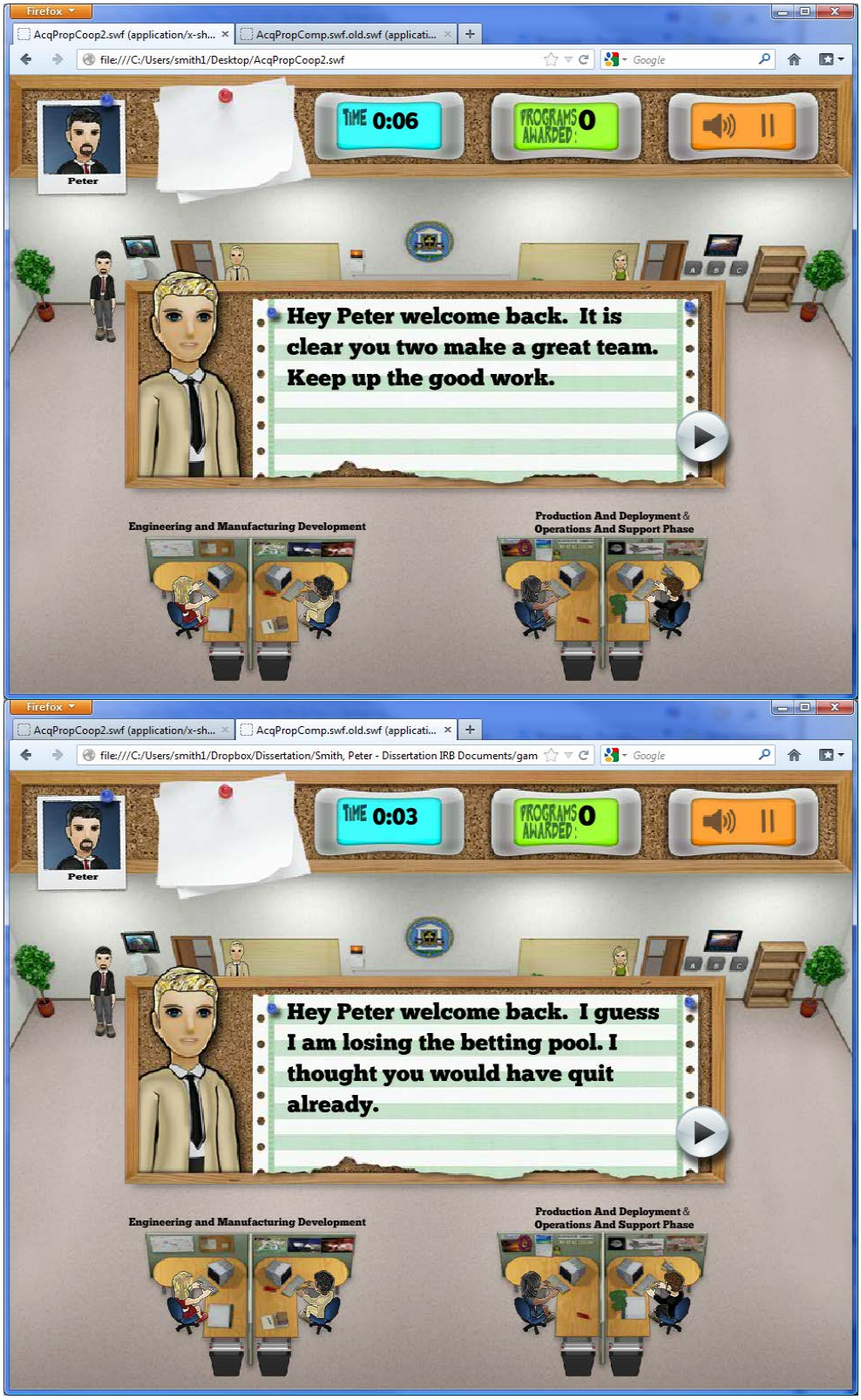
LEVEL SELECT
LEVEL 1
In Level 1 you will get lots of help in getting the required documents around and it will help you learn where things are.
LEVEL 2
Once you have mastered Level 1, things are going to get a little tougher. You will not get as much help in this level.
LEVEL 3
So you think you are ready? Level 3 things get even harder.
LEVEL 4
Ready to really earn your worth? This level is going to test all your skills!
NEXT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Google
TIME 0:06
PROGRAMS AWARDED: 0
Peter
Hey Peter welcome back. It is clear you two make a great team. Keep up the good work.
Engineering and Manufacturing Development
Production And Deployment & Operations And Support Phase
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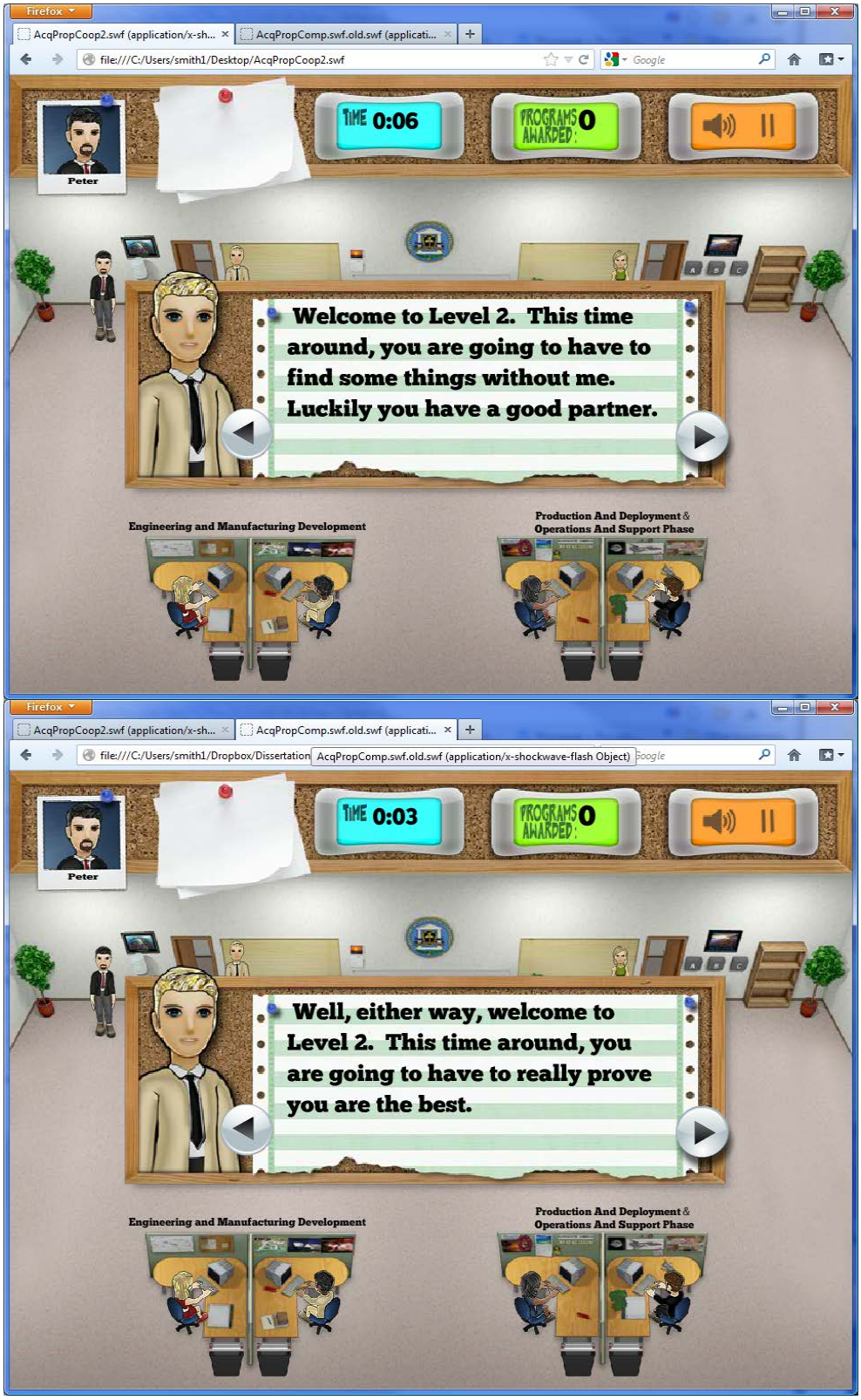
Google
TIME 0:03
PROGRAMS AWARDED: 0
Peter
Hey Peter welcome back. I guess I am losing the betting pool. I thought you would have quit already.
Engineering and Manufacturing Development
Production And Deployment & Operations And Support Phase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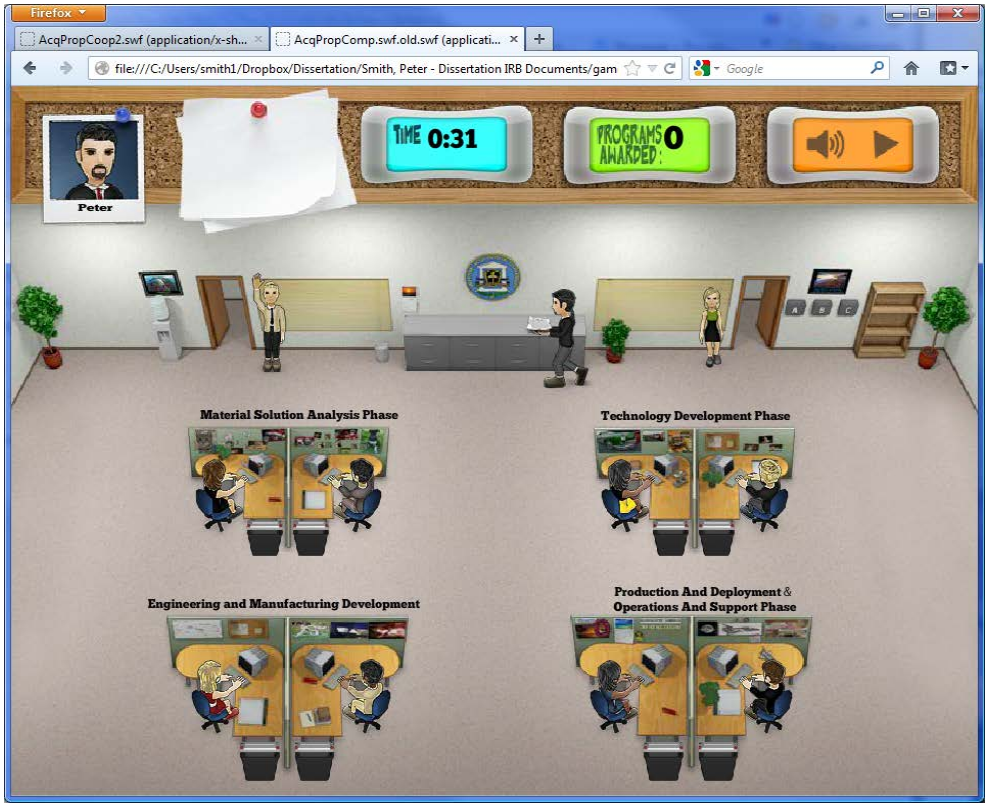
AcqPropComp.swf.old.swf (applicati...
file:///C:/Users/smith1/Desktop/AcqPropCoop2.swf
Google
TIME 0:06
PROGRAMS AWARDED: 0
Peter
Welcome to Level 2. This time around, you are going to have to find some things without me. Luckily you have a good partner.
Engineering and Manufacturing Development
Production And Deployment & Operations And Support Phase
Firefox
AcqPropCoop2.swf (application/x-sh...
AcqPropComp.swf.old.swf (applicati...
file:///C:/Users/smith1/Dropbox/Dissertation
AcqPropComp.swf.old.swf (application/x-shockwave-flash Object)
Google
TIME 0:03
PROGRAMS AWARDED: 0
Peter
Well, either way, welcome to Level 2. This time around, you are going to have to really prove you are the best.
Engineering and Manufacturing Development
Production And Deployment & Operations And Support Phase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Peter
TIME 0:31
PROGRAMS AWARDED: 0
Material Solution Analysis Phase
Technology Development Phase
Engineering and Manufacturing Development
Production And Deployment & Operations And Support Phase

APPENDIX B: IRB PERMISSION

University of Central Florida Institutional Review Board
Office of Research & Commercialization
12201 Research Parkway, Suite 501
Orlando, Florida 32826-3246
Telephone: 407-823-2901 or 407-882-2276
www.research.ucf.edu/compliance/irb.html

Approval of Human Research

From: **UCF Institutional Review Board #1**
FWA00000351, IRB00001138

To: **Peter A. Smith** and Co-PI: **Clint A. Bowers**

Date: **March 02, 2012**

Dear Researcher:

On 3/2/2012, the IRB approved the following human participant research until 3/1/2013 inclusive:

Type of Review:	UCF Initial Review Submission Form
Project Title:	Group Based interactive Learning Interventions
Investigator:	Peter A Smith
IRB Number:	SBE-12-08232
Funding Agency:	
Grant Title:	
Research ID:	N

The Continuing Review Application must be submitted 30days prior to the expiration date for studies that were previously expedited, and 60 days prior to the expiration date for research that was previously reviewed at a convened meeting. Do not make changes to the study (i.e., protocol, methodology, consent form, personnel, site, etc.) before obtaining IRB approval. A Modification Form **cannot** be used to extend the approval period of a study. All forms may be completed and submitted online at https://iris.research.ucf.edu .

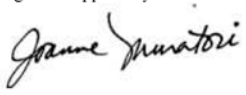
If continuing review approval is not granted before the expiration date of 3/1/2013, approval of this research expires on that date. When you have completed your research, please submit a Study Closure request in iRIS so that IRB records will be accurate.

Use of the approved, stamped consent document(s) is required. The new form supersedes all previous versions, which are now invalid for further use. Only approved investigators (or other approved key study personnel) may solicit consent for research participation. Participants or their representatives must receive a copy of the consent form(s).

In the conduct of this research, you are responsible to follow the requirements of the Investigator Manual.

On behalf of Sophia Dziegielewski, Ph.D., L.C.S.W., CF IRB Chair, this letter is signed by:

Signature applied by Joanne Muratori on 03/02/2012 04:53:04 PM EST



IRB Coordinator

University of Central Florida Institutional Review Board
Office of Research & Commercialization
12201 Research Parkway, Suite 501
Orlando, Florida 32826-3246
Telephone: 407-823-2901 or 407-882-2276
www.research.ucf.edu/compliance/irb.html

Approval of Human Research

From: **UCF Institutional Review Board #1**
FWA00000351, IRB00001138

To: **Peter A. Smith** and Co-PI: **Clint A. Bowers**

Date: **May 11, 2012**

Dear Researcher:

On 5/11/2012, the IRB approved the following minor modifications to human participant research until 03/01/2013 inclusive:

Type of Review:	IRB Addendum and Modification Request Form
Modification Type:	Two new experimental conditions (V and VI) have been added to the study. A revised Informed Consent and Debriefing Statement have been approved for use with these study participants.
Project Title:	Group Based interactive Learning Interventions
Investigator:	Peter A Smith
IRB Number:	SBE-12-08232
Funding Agency:	
Grant Title:	
Research ID:	

The Continuing Review Application must be submitted 30days prior to the expiration date for studies that were previously expedited, and 60 days prior to the expiration date for research that was previously reviewed at a convened meeting. Do not make changes to the study (i.e., protocol, methodology, consent form, personnel, site, etc.) before obtaining IRB approval. A Modification Form **cannot** be used to extend the approval period of a study. All forms may be completed and submitted online at https://iris.research.ucf.edu .

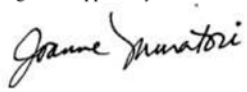
If continuing review approval is not granted before the expiration date of 03/01/2013, approval of this research expires on that date. When you have completed your research, please submit a Study Closure request in iRIS so that IRB records will be accurate.

Use of the approved, stamped consent document(s) is required. The new form supersedes all previous versions, which are now invalid for further use. Only approved investigators (or other approved key study personnel) may solicit consent for research participation. Participants or their representatives must receive a copy of the consent form(s).

In the conduct of this research, you are responsible to follow the requirements of the Investigator Manual.

On behalf of Sophia Dziegielewski, Ph.D., L.C.S.W., CF IRB Chair, this letter is signed by:

Signature applied by Joanne Muratori on 05/11/2012 04:33:55 PM EDT



IRB Coordinator

APPENDIC C: INFORMED CONSENT AND DEBRIEF

Group Based Interactive Learning Interventions

Informed Consent

Principal Investigator(s): Mr. Peter Smith

Faculty Supervisor: Dr. Clint Bowers

Investigational Site(s): University of Central Florida, Department of Psychology Lab

Introduction: Researchers at the University of Central Florida (UCF) study many topics. To do this we need the help of people who agree to take part in a research study. You are being invited to take part in a research study which will include about 200 people at UCF. You have been asked to take part in this research study because you are a student at UCF. You must be 18 years of age or older to be included in the research study. All respondents to the recruitment will be invited to participate. All races, nationalities, all age groups 18 and older and both genders are eligible. Since this is a multimedia environment, participant must be able to see and hear. The only other exclusion criterion will be individuals' familiarity with the research project and its aims as this may bias their performance.

The person doing this research is Mr. Peter Smith of UCF Modelling and Simulation. Because the researcher is a graduate student he is being guided by Dr. Clint Bowers, a UCF faculty supervisor in Modeling and Simulation. UCF students learning about research are helping to do this study as part of the research team. Their names are: Shan Lakhmani, Brian Eddy, Benjamin Repkay, Arun George, Ryan Yordon, and Skilan Ortiz

What you should know about a research study:

- Someone will explain this research study to you.
- A research study is something you volunteer for.
- Whether or not you take part is up to you.
- You should take part in this study only because you want to.
- You can choose not to take part in the research study.
- You can agree to take part now and later change your mind.

- Whatever you decide it will not be held against you.
- Feel free to ask all the questions you want before you decide.

Purpose of the research study: The purpose of this study is to explore the use of group based interactive learning interventions for education and training. This research will look at what is learned in a group based intervention and what role learner attitudes play in the process.

What you will be asked to do in the study: In this study you will take part in a number of brief surveys describing demographics, attitudes, and experiences related to interactive learning interventions, as well as taking a test related to the content of a group based interactive learning intervention. You will then be placed randomly in a group of two and asked to participate in a group based learning intervention on the computer called "Acquisition Proposition." This intervention is a simulation of a common office where you will take on the role of an acquisition professional's tasks by helping others in the office complete their day to day tasks. The task will be completed through the use of mouse clicks and following the instructions of your simulated boss. During this time you will be allowed to interact with your group member. Following the intervention you will take a post test to see what was learned, and complete more surveys to determine your current attitudes, expectations, and previous experience related to interactive technologies. At the end of the surveys you will be debriefed on the experience. You do not have to answer every question or complete every task. You will not lose any benefits if you skip questions or tasks.

Location: UCF Department of Psychology Lab

Time required: We expect that you will be in this research study for 1 hour.

Risks: There are no reasonably foreseeable risks or discomforts involved in taking part in this study.

Benefits: There are no expected benefits to you for taking part in this study.

Compensation or payment:
There is no direct compensation for taking part in this study. It is possible, however, that extra credit may be offered for your participation, but this benefit is at the discretion of your instructor.

Anonymous research: This study is anonymous. That means that no one, not even members of the research team, will know that the information you gave came from you.

Study contact for questions about the study or to report a problem: If you have questions, concerns, or complaints, or think the research has hurt you, talk to Peter Smith, Graduate Student, Modeling and Simulation, (407) 929 - 3722 or Dr. Clint Bowers, Faculty Supervisor, Department of Modeling and Simulation at (407) 462 - 6618 or by email at psmith@knights.ucf.edu.

IRB contact about your rights in the study or to report a complaint: Research at the University of Central Florida involving human participants is carried out under the oversight of the Institutional Review Board (UCF IRB). This research has been reviewed and approved by the IRB. For information about the rights of people who take part in research, please contact: Institutional Review Board, University of Central Florida, Office of Research & Commercialization, 12201 Research Parkway, Suite 501, Orlando, FL 32826-3246 or by telephone at (407) 823-2901. You may also talk to them for any of the following:

- Your questions, concerns, or complaints are not being answered by the research team.
- You cannot reach the research team.
- You want to talk to someone besides the research team.
- You want to get information or provide input about this research.

Withdrawing from the study:
You have the right to withdraw from this study at anytime with no penalty. If you decide to leave the study, notify the investigator so that the investigator can debrief you. The person in charge of the research study or the sponsor can remove you from the research study without your approval. Possible reasons for removal include failure to follow instructions of the research staff, or if the person in charge decides that the research study is no longer in your best interest. We will tell you about any new information that may affect your health, welfare or choice to stay in the research.

Debriefing Statement

For the study entitled:
"Group Based Interactive Learning Intervention"

Dear Participant;

During this study, you were asked to take part in a number of brief surveys describing demographics, attitudes, and experiences related to interactive learning interventions, as well as taking a test related to the content of a group based interactive learning intervention. You were placed randomly in a group of two and asked to participate in a group based learning intervention on the computer called "Acquisition Proposition." Following the intervention you took a post test to see what was learned, and completed more surveys to determine your current attitudes, expectations, and previous experience related to interactive technologies. You were told that the purpose of the study was to explore the use of group based interactive learning interventions for education and training looking at what is learned in a group based intervention and what role learner attitudes play in the process. The actual purpose of the study was to also examine the affect of the use of the word game on goal orientation and motivation in an interactive game based educational intervention.

We did not tell you everything about the purpose of the study because we are exploring the use of the word game and could not use it with all participants during the study.

You are reminded that your original consent document included the following information: You have the right to withdraw from this study at anytime with no penalty. If you have any concerns about your participation or the data you provided in light of this disclosure, please discuss this with us. We will be happy to provide any information we can to help answer questions you have about this study.

Now that you know the true nature of the study, you have the option of having your data removed from the study. Please contact the PI if you do not want your data to be used in this research and it will be withdrawn.

Study contact for questions about the study or to report a problem: If you have questions, concerns, or complaints or think the research has hurt you, talk to Peter Smith, Graduate Student, Modeling and Simulation, (407) 929 - 3722 or Dr. Clint Bowers, Faculty Supervisor, Department of Modeling and Simulation at (407) 462 - 6618 or by email at psmith@knights.ucf.edu.

IRB contact about your rights in the study or to report a complaint: Research at the University of Central Florida involving human participants is carried out under the oversight of the Institutional Review Board (UCF IRB). This research has been reviewed and approved by the IRB. For information about the rights of people who take part in research, please contact: Institutional Review Board, University of Central Florida, Office of Research & Commercialization, 12201 Research Parkway, Suite 501, Orlando, FL 32826-3246 or by telephone at (407) 823-2901.

If you have experienced distress as a result of your participation in this study, a referral list of mental health providers is attached to this document for your use.[6] (Please remember that any cost in seeking medical assistance is at your own expense.)

Please again accept our appreciation for your participation in this study.

APPENDIC D: DEMOGRAPHICS

Participant ID _____

Demographic Info

1) **Gender:** Male ⬭ Female ⬭

2) **Age:** _____

3) **Race:** Asian ⬭ Caucasian ⬭

Black ⬭ Hispanic ⬭

Other _____

4) **Highest level of education**

High School ⬭ Associates: ⬭ Bachelors: ⬭ Masters: ⬭ Doctorate: ⬭

If currently in college, what class level are you in:

Freshman: ⬭ Sophomore: ⬭ Junior: ⬭ Senior: ⬭ Graduate Student: ⬭

5) **Which of these fields best describes your major?**

Business	⬭	Engineering	⬭
Computer Science	⬭	Accounting	⬭
Biology	⬭	Art	⬭
Music	⬭	Psychology	⬭
Sports/Fitness	⬭	Nutrition	⬭
Education	⬭	Social Work	⬭
Math	⬭	Natural Science	⬭
Chemistry	⬭	Anthropology	⬭

Other _____

6) **Are you employed by the DoD as a civilian, a contractor or as Military Personnel?**

Yes ⬭ No ⬭

7) **Have you ever served as an active duty military member?**

Yes ⬭ No ⬭

APPENDIX E: COMPETITIVE / COOPERATIVE STRATEGY SCALE

C/C SS

For each of the following statements, please indicate how true it is for you, using the following scale	Not at all True		Somewhat True		Very True
1. It is important to me to do better than others.	①	②	③	④	⑤
2. Success is not very important to me.	①	②	③	④	⑤
3. Individual success can be achieved while working with others.	①	②	③	④	⑤
4. People who are successful face a constant struggle to remain successful.	①	②	③	④	⑤
5. By achieving success I also get other things which are important to me.	①	②	③	④	⑤
6. To succeed, one must compete against others.	①	②	③	④	⑤
7. Joint effort is the best way to achieve success.	①	②	③	④	⑤
8. People who succeed are more likely to have satisfying lives.	①	②	③	④	⑤
9. Success is something I am willing to work hard for.	①	②	③	④	⑤
10. The costs of success are often much greater than the rewards.	①	②	③	④	⑤
11. To succeed one must cooperate with others.	①	②	③	④	⑤

12. Success is only achieved through individual effort.	①	②	③	④	⑤
13. People who succeed often lead unhappy lives.	①	②	③	④	⑤
14. I enjoy the challenge of competing against others to succeed.	①	②	③	④	⑤
15. Success is best achieved through cooperation rather than through competition.	①	②	③	④	⑤
16. The rewards of success outweigh the costs.	①	②	③	④	⑤
17. Success is my major goal in life.	①	②	③	④	⑤
18. I am happier when I am not striving to succeed.	①	②	③	④	⑤
19. In the end, cooperation with others is not compatible with success.	①	②	③	④	⑤
20. In order to be successful, one has to be willing to give up too many other important aspects of life.	①	②	③	④	⑤
21. Success can best be defined as a situation in which there are both winners and losers.	①	②	③	④	⑤
22. I feel better about myself when I am working toward success.	①	②	③	④	⑤
23. I enjoy working with others to achieve joint success.	①	②	③	④	⑤

APPENDIX F: CONTENT KNOWLEDGE PRETEST AND POSTTEST

Pretest:

1- What is the first document needed to kick off a program? (Circle One)

a. AOA
b. ADM
c. ICD
d. ISD

2- In what order do the following phases occur? (Fill in numers 1-4 in order)

_____ Production and Deployment & Operations & Support Phase
_____ Material Solution Analysis Phase
_____ Engineering and Manufacturing Development Phase
_____ Technology Development Phase

3- Which of these documents belong in the Production and Deployment & Operations & Support Phase? (Circle all that apply)

TEMP	OA
PBL	MDD
ISD	TDS
CPD	DT
RAM	LRIP

4- Which of these documents belong in the Technology Development Phase? (Circle all that apply)

TEMP	OA
PBL	MDD
ISD	TDS
CPD	DT
RAM	LRIP

Posttest:

1- What is the first document needed to kick off a program (Circle One)

a. AOA
b. ADM
c. ICD
d. ISD

2- In what order do the following phases occur? (Fill in numers 1-4 in order)

_____ Production and Deployment & Operations & Support Phase
_____ Material Solution Analysis Phase
_____ Engineering and Manufacturing Development Phase
_____ Technology Development Phase

3- Which of these documents belong in the Production and Deployment & Operations & Support Phase? (Circle all that apply)

IOTE	AOA
SEP	PDR
FOC	ADM
CDD	CDR
IOC	APB

4- Which of these documents belong in the Technology Development Phase? (Circle all that apply)

IOTE	AOA
SEP	PDR
FOC	ADM
CDD	CDR
IOC	APB

APPENDIX G: GOAL ORIENTATION MEASURE

Participant ID _____

GO

For each of the following statements, please indicate how true it is for you, using the following scale	Not at all True			Somewhat True			Very True
1. I prefer to do things that I can do well rather than things that I do poorly.	①	②	③	④	⑤	⑥	⑦
2. I'm happiest at work when I perform tasks on which I know that I won't make any errors.	①	②	③	④	⑤	⑥	⑦
3. The things I enjoy the most are the things I do the best.	①	②	③	④	⑤	⑥	⑦
4. The opinions others have about how well I can do certain things are important to me.	①	②	③	④	⑤	⑥	⑦
5. I feel smart when I do something without making any mistakes.	①	②	③	④	⑤	⑥	⑦
6. I like to be fairly confident that I can successfully perform a task before I attempt it.	①	②	③	④	⑤	⑥	⑦
7. I like to work on tasks that I have done well on in the past.	①	②	③	④	⑤	⑥	⑦
8. I feel smart when I can do something better than most other people.	①	②	③	④	⑤	⑥	⑦
9. The opportunity to do challenging work is important to me.	①	②	③	④	⑤	⑥	⑦

APPENDIX H: INTRINSIC / EXTRINSIC MOTIVATION MEASURE

Participant ID _____

IEM

For each of the following statements, please indicate how true it is for you, using the following scale	Not at all True			Somewhat True			Very True
1. I like hard work because it's a challenge.	①	②	③	④	⑤	⑥	⑦
2. I don't like to figure out difficult problems.	①	②	③	④	⑤	⑥	⑦
3. I like to learn as much as I can.	①	②	③	④	⑤	⑥	⑦
4. I like to learn just what I have to.	①	②	③	④	⑤	⑥	⑦
5. I like to go on to new tasks at a more difficult level.	①	②	③	④	⑤	⑥	⑦
6. I don't like difficult tasks because I have to work too hard.	①	②	③	④	⑤	⑥	⑦
7. I like tasks that make me think pretty hard and figure things out.	①	②	③	④	⑤	⑥	⑦
8. I like easy tasks that I'm sure I can do.	①	②	③	④	⑤	⑥	⑦
9. I like difficult problems because I enjoy trying to figure them out.	①	②	③	④	⑤	⑥	⑦
10. I like to stick to the tasks which are pretty easy to do.	①	②	③	④	⑤	⑥	⑦
11. I like difficult tasks because I find it more interesting.	①	②	③	④	⑤	⑥	⑦
12. I like topics where it's pretty easy to just learn the answers.	①	②	③	④	⑤	⑥	⑦

APPENDIX I: GAMEPLAY SESSION SELF EFFICACY

Participant ID _____

GSE

For each of the following statements, please indicate how true it is for you, using the following scale	Not at all True			Somewhat True			Very True
1. I think I am pretty good at this activity.	①	②	③	④	⑤	⑥	⑦
2. I think I did pretty well at this activity, compared to other students.	①	②	③	④	⑤	⑥	⑦
3. After working at this activity for a while, I felt pretty competent.	①	②	③	④	⑤	⑥	⑦
4. I am satisfied with my performance at this task.	①	②	③	④	⑤	⑥	⑦
5. I was pretty skilled at this activity.	①	②	③	④	⑤	⑥	⑦
6. This was an activity that I couldn't do very well.	①	②	③	④	⑤	⑥	⑦

APPENDIX J: SESSION SATISFACTION AND EXPECTATIONS

GSAT-EX

For each of the following statements, please indicate how true it is for you, using the following scale	Not at all True			Somewhat True			Very True
1. All games contain competition.	①	②	③	④	⑤	⑥	⑦
2. I expected to play a game during this study.	①	②	③	④	⑤	⑥	⑦
3. I expected to compete with my partner in this study.	①	②	③	④	⑤	⑥	⑦
4. I expected to cooperate with my partner in this study.	①	②	③	④	⑤	⑥	⑦
5. My score mattered to me.	①	②	③	④	⑤	⑥	⑦
6. I am satisfied with the game.	①	②	③	④	⑤	⑥	⑦
7. I am satisfied with how much I learned.	①	②	③	④	⑤	⑥	⑦
8. I am satisfied with how I did on the test.	①	②	③	④	⑤	⑥	⑦
9. I am satisfied with this experience as a whole.	①	②	③	④	⑤	⑥	⑦

APPENDIX K: PREVIOUS GAMING EXPERIENCE

Appendix B. Gaming Experience Measure

Answer the questions below to characterize your previous experience with video and computer games. For each question select the appropriate choice that most accurately describes your experience. Please consider all five choices in making your selection, including those that do not have descriptive labels. Answer questions independently in the order that they appear. Do not skip questions or return to a previous question to change your answer.

Participant Number _____

		Low		Average		High
1.	What is your level of confidence with video games in general?	O	O	O	O	O

Hours per week

2. How many hours per week do you currently play video games?
   - O 0-9 hours
   - O 10-19 hours
   - O 20-29 hours
   - O 30-39 hours
   - O 40+ hours

Hours per week

3. What is the maximum number of hours per week you've ever played?
   - O 0-9 hours
   - O 10-19 hours
   - O 20-29 hours
   - O 30-39 hours
   - O 40+ hours

Number of times

4. About how many times have you read a video game magazine or website to find out tips to improve your gaming skill?
   - O 0-9 times
   - O 10-19 times
   - O 20-29 times
   - O 30-39 times
   - O 40+ times

5. How often do you play:

	Never	Rarely	Monthly	Weekly	Daily
Adventure - Graphical (e.g., Myst, Fable)	O	O	O	O	O
Adventure - Text-based (e.g., ZORK)	O	O	O	O	O
Puzzle (e.g., Minesweeper, Tetris)	O	O	O	O	O
Racing (e.g., Need for Speed, Test Drive)	O	O	O	O	O
Role-playing (e.g., Final Fantasy)	O	O	O	O	O
Simulation (e.g., Flight Simulator, Trains)	O	O	O	O	O
Sports (e.g., Madden Football, FIFA Soccer)	O	O	O	O	O
Strategy Real-time (e.g., Age of Empires)	O	O	O	O	O
Strategy - Turn-Based (e.g., X-Com: Apocalypse)	O	O	O	O	O
First Person Shooter (e.g., Half-Life, Unreal)	O	O	O	O	O
Multiplayer (e.g., World of Warcraft)	O	O	O	O	O
Online (any of the above titles in online mode)	O	O	O	O	O

6. List your recent favorite 5 game titles in the blanks.

A _____
B _____
C _____
D _____
E _____

7. Indicate your experience with each game you listed in question 6 above.

	None	Very Little	Average	High	Expert
A	O	O	O	O	O
B	O	O	O	O	O
C	O	O	O	O	O
D	O	O	O	O	O
E	O	O	O	O	O

APPENDIX L: GENERAL GAMES SELF EFFICACY

Games SE

Please answer the following questions about how you play videogames using the provided response scale.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Disagree
1. I feel like I am a good video game player.	①	②	③	④	⑤
2. I like playing video games.	①	②	③	④	⑤
3. I like to try new games.	①	②	③	④	⑤
4. I am confident in my ability to successfully complete all kinds of games.	①	②	③	④	⑤
5. I can always manage to solve difficult problems within a videogame if I try hard enough.	①	②	③	④	⑤
6. In a videogame, if someone opposes me, I can find the means and ways to get what I want.	①	②	③	④	⑤
7. It is easy for me to stick to my plans and accomplish my goals in a videogame.	①	②	③	④	⑤
8. I am confident that I could deal efficiently with unexpected events in a videogame.	①	②	③	④	⑤
9. Thanks to my resourcefulness, I know how to handle unforeseen situations in a videogame.	①	②	③	④	⑤
10. I can solve most problems in a videogame if I invest the necessary effort.	①	②	③	④	⑤
11. I can remain calm when facing difficulties in a videogame because I can rely on my coping abilities.	①	②	③	④	⑤
12. When I am confronted with a problem in a videogame, I can usually find several solutions.	①	②	③	④	⑤
13. If I am in trouble in a videogame, I can usually think of a solution.	①	②	③	④	⑤
14. I can usually handle whatever comes my way in a videogame.	①	②	③	④	⑤
15. What are the names of a few of the games you like to play most:					
16. What are the names of a few of the games you like to play least or don't want to try to play:					

APPENDIX M: ATTITUDES TOWARDS GAMES FOR LEARNING

GVNG

1) Would you consider yourself a gamer?

⬭ Yes ⬭ No

GP4L

Please answer the following questions about how you feel about using videogames for learning using the provided response scale.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Disagree
1. I would like to use video games to help me learn.	①	②	③	④	⑤
2. I would prefer to use games only for practicing what I've already learned.	①	②	③	④	⑤
3. I could learn from video games.	①	②	③	④	⑤
4. Video Games will give me an opportunity to practice my skills.	①	②	③	④	⑤
5. I would like to play video games that would help me do better at my job.	①	②	③	④	⑤
6. Video games would not be able to help me on the job.	①	②	③	④	⑤
7. I think playing video games is a waste of time.	①	②	③	④	⑤
8. If I was given the choice between video games and a text book, I would choose the video game.	①	②	③	④	⑤
9. I get too distracted to remember what I'm supposed to learn in a video game.	①	②	③	④	⑤
10. I think video games are too hard.	①	②	③	④	⑤

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