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The Impact of Cooperative Video Games on Team Cohesion

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THE IMPACT OF COOPERATIVE VIDEO GAMES ON TEAM COHESION

A dissertation

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College of Technology

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by

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Training, Technology management

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ABSTRACT

In today's economy, productivity and efficiency require collaboration between employees. In order to improve collaboration the factors affecting teamwork must be examined to identify where changes can be made in order to increase performance. One factor contributing to teamwork is team cohesion and represents a process whereby members are joined by a common bond in the pursuit of a common objective.

A popular social bonding activity sweeping the world is playing cooperative video games. The purpose of this study was to determine the effect of playing cooperative video games on team cohesion. Subjects (N=56) were randomly placed into 15 teams of three to four members. A modified Group Environment Questionnaire (GEQ) pretest was administered to determine the initial degree of cohesiveness between team members and to examine a wide cross-section of correlates and cohesiveness. Each team was randomly assigned to a specific intervention length of either one or three weeks with the one week groups playing for one hour and the three week groups playing for six hours. After the randomly assigned length of game play was completed, team members completed the modified GEQ posttest.

The results of the posttest were compared with the pretest to determine the effect on the team's cohesion. The data were analyzed using descriptive statistics (means and standard deviations) and a 2 x 2 MANCOVA was used to determine if playing collaborative video games affected the level of cohesion. A mixed design was used as post hoc analyses for each GEQ cohesive factor and indicated that levels of cohesion increased due to the intervention but was

not dependent upon the length of the intervention. The results of this analysis indicated that video games can be used as a team building experience to improve cohesion regardless of how long the video game is played.

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CHAPTER 1

INTRODUCTION

Cohesion is the act or state of sticking together tightly and is understandably referenced in an environment where more than one individual is present such as in a team or group. Team cohesion has been a focus of many researchers in regards to its relationship with sports and gaining a competitive advantage (Weinberg & Gould, 2006). A key research question for sport psychology is to show whether teams with greater cohesion are more successful since having an ability to work as a cohesive unit blocks out distractions that inhibit performance and is often the difference between a team and their opponent (Weinberg & Gould, 2006).

Group cohesion has been a topic of considerable interest in many different environments. The military contends that cohesive groups are more effective in combat situations thus providing an advantage over the enemy (Ahronson & Cameron, 2007). Throughout the history of business, corporations have also been searching for ways to gain the upper hand over competitors and since cohesion determines job performance (Mullen & Cooper, 1994), industry and business have increasingly become more reliant upon teams within an organization (Salas & Fiore, 2004).

Teams are used everywhere and during the last two decades of the twentieth century collaborative teamwork has been sweeping through organizations (LaFasto & Larson, 2001). Almost anywhere people gather to accomplish a task will involve the use of teams. There are

many different tools used in the design and delivery of team training and it takes more than a technical skill to make an effective team (Salas, Burke, & Cannon-Bowers, 2002). Teams and teamwork have become an indispensable part of society (O'Connor, Johnson, & Khalil, 2004) and requires a workforce with high levels of training (Khalil, 2000). The U.S. Department of Labor identified teamwork as one of the top five work skills that should be taught in schools (Armstrong & Kleiner, 1996). Teamwork has been identified as an indispensable skill since it helps a company gain a competitive edge (Winter, Waner, & Neal-Mansfield, 2008) and compete in a global market (LaFasto & Larson, 2001).

Teamwork is a combined activity by more than one individual where each person puts his or her individual interests and opinions aside in deference to the unity and efficiency of the group. Teamwork involves many different dynamics with one of great interest being that of team cohesion. Team cohesion has been linked to team performance (Ensley & Pearson, 2005) and can have a positive impact not only on performance (Mullen & Copper, 1994) but also on team social interactions (Levi, 2007). It is “a dynamic process which is reflected in the tendency for a group to stick together and remain united in the pursuit of its goals and objectives” (Carron, 1982). Projects are commonly undertaken by teams and workers must be able to work together in order to accomplish organizational tasks (Khalil, 2000).

In order to increase team cohesiveness there must be a common purpose that can only be accomplished through interdependency with team members working cooperatively (Stewart, Manz, & Sims, 1999). A common purpose can be based upon a variety of activities that help develop good internal social interactions which are necessary for a team to increase cohesion (Levi, 2007). One such activity that has gained notoriety as a favorite social activity is playing video games. The promising results of human behavioral research based upon gaming and the

expanding gaming industry have resulted in an increased interest in identifying the effects of playing video games (Valluri, 2006) and could be considered a viable training strategy.

Playing video games is not just an activity for kids. In the past forty years the video game industry has changed from being nonexistent to a multi-billion dollar business (Deuze, Martin, & Allen, 2007). According to the Entertainment Software Association (ESA) video gaming is the fastest growing form of entertainment. ESA announced that total sales for 2007 were \$18.85 billion surpassing the motion picture industry which saw modest growth in 2007 with a total box office take of \$9.66 billion. The Entertainment Retailers Association (ERA) announced in 2008 that sales of video games have even surpassed music sales. According to the PEW Internet project in a memo from Amanda Lenhart and research assistant Alexandra Macgill “Nearly all American teens (97%), and more than half of adults age 18+ (53%) say they play video games, and about one-in-five adults (21%) plays video games every day or almost every day” (memo, December 7, 2008).

Research shows that playing an interactive game is an interactive social activity that can develop knowledge and also improve social and communication skills (Vorderer & Bryant, 2006). The perception exists that video gaming promotes antisocial behavior and isolation (Williams, 2004) but the solitary gaming of the past is transforming into social gaming and becoming a social experience (Swisher, 2008). Although the cultural perception of video gaming is that it negatively affects behavior, current research shows that there is definitely a social aspect to playing video games (Griffiths, Davies, & Chappell, 2003; Jones, 2003).

Advanced video game production technology is constantly being implemented and a new consumer is emerging that wants an interactive experience. As game developers implement more advanced computer graphics and put more effort on game artificial intelligence (Shen &

Zhou, 2006) each advance in technology enhances the possibilities of more realism in a video game (Dovey & Kennedy, 2006).

The popularity of video gaming not only is perceived as a popular form of entertainment but is being researched as a tool for improving organizational training results. All teams are different and therefore a myriad of instructional strategies should be researched and implemented (Salas, Burke, & Cannon-Bowers, 2002). As companies struggle to compete in a global economy the development of intellectual capital has become an organization's most valuable asset (Marquardt, Berger, & Loan, 2004). Developing capital such as organization workers involves the use of training to unleash the potential of human expertise (Swanson & Holton III, 2001) and improving the adult workforce. Simulations such as video games are bridging the gap between classrooms and real job skills and improving the learning process (Aldrich, 2004).

Fortune magazine reported that Motorola calculated that for every \$1 spent on training delivers \$30 in productivity gains within three years (Phillips, 1997). James Paul Gee, a prominent researcher of video games and their relationship to education, said "Video games have the potential to lead to active and critical learning" (Gee, 2003). As technology continues to improve the realism in video games in regards to graphics and artificial intelligence, organizations continue to use video games to train employees to become more efficient since this medium is cost effective, safe, and reproduces real-world environments (Phillips, 1997).

Along with a more advanced simulation game, social networks are being formed through game play. Humans are using video games to connect with each other (Williams, 2006). As a group of individuals develop into a team, members will identify the tasks necessary to be effective and to be organized into team roles (Kayes, Kayes, & Kolb, 2005). Collaborative video

games require team members to also assume certain roles based upon the genre of the game being played.

Video games are classified by genres with all sharing a common trait of being a different form of interactive entertainment (Jansz & Martens, 2008). A video game genre considers the characteristics of the interactive experience, the game's goals and objectives, the game characters and the player controls (Malliet & de Meyer, 2005). Males primarily play fast-action games either based upon sports or violence while girls primarily play fantasy or educational games (Wright et al., 2001). With the popularity of video gaming growing as a favorite leisure activity there is a necessity to research the effects it has on society (Funk, Germann, & Buchman, 1997). Simply put, whether good or bad, video games are a pervasive component of the social environment and have a significant impact on society and culture.

If one of the impacts can be identified as cohesion then collaborative video gaming could be a positive activity rather than the typical stereotyped adult perspective that it is a waste of time. Previous studies have suggested the need for further research investigating factors that influence cohesion, specifically in relation to group development (Cota, Evans, et al., 1995). Cohesion factors include member acceptance, information sharing, stick togetherness, leader dependence, and task orientation (Treadwell, Lavertue, Kumar, & Verrarahavan, 2001). It is postulated that since social relationships help teams generally develop into a more cohesive unit (Meyer, 1982) then playing cooperative video games could positively impact the cohesive factors thus helping promote group effectiveness.

Problem Statement

The problem of this research was to determine to what degree playing cooperative video games for one to three weeks increased team cohesion for individuals between the ages of 18 and 29.

Research Questions

This research conducted a study to have randomly formed teams consisting of up to four players on each play a cooperative video game and then utilized a modified Group Environment Questionnaire (GEQ) as a pre-test and a post-test to assess four specific factors of cohesiveness that can develop within a team. For this test, the alpha was set to 0.05. The study will aim to answer the following research questions:

- RQ1. What was the change in the degree (scale) of the cohesive factor individual attraction to the group-task (ATG-T) based upon the length of the intervention program?
- RQ2. What was the change in the degree (scale) of the cohesive factor individual attraction to the group-social (ATG-S) based upon the length of the intervention program?
- RQ3. What was the change in the degree (scale) of the cohesive factor group integration-task (GI-T) based upon the length of the intervention program?
- RQ4. What was the change in the degree (scale) of the cohesive factor group integration-social (GI-S) based upon the length of the intervention program?
- RQ5. What was the change in the degree (scale) of each GEQ cohesive factor based upon the length of the intervention program and the inclusion of the covariate estimate hours playing video games each week?

Assumptions

The following fourteen assumptions apply to the study. The purpose of this study was to examine the relationship and effect of playing collaborative video games on team cohesion. 1) It therefore assumed that a relationship exists and that as one plays collaborative video games, cohesion is increased. 2) All participants (n=56) were between the ages of 18 and 29 years old but the age of the game player within the range did not significantly influence the level of cooperation. 3) Since there are a wide variety of collaborative video games rated for different age groups that could have been used in the study the ESRB video game rating did not significantly influence the level of cooperation. 4) Along with the ESRB rating the video game genre did not significantly influence the level of cooperation. The popular video game, Halo, was selected because it is collaborative in nature. 5) A sample of video game players representing all game players were allowed to participate in the study so there is an assumption that within the random sample the participant's age, occupation, or gender did not significantly influence the level of cooperation. 6) The total number of study participants (n=56) in the random sample represents the population. 7) It is assumed that the subjects that volunteered to play have an interest in video gaming. 8) There is an assumption that the environment of playing competitive video games and team motivation is the same whether the participants are in an academic, business, military, or sports environment. 9) We will assume that very little time is needed in order to begin increasing cohesion through the use of cooperative video games and also that cohesion is a group property that can be assessed. 10) It is assumed that the win/loss record did not affect the team cohesion. 11) It is assumed that the experience or skill level of subjects did not affect the team cohesion. 12) It is assumed that if a member from one of the teams drops out of the study it will not affect game play and the remaining team members may continue to play and participate in the study.

- 13) It is assumed that the more time playing collaborative video games increases team cohesion.
- 14) The last assumption is that participants might be susceptible to the Hawthorne Effect which is that participants might be impacted and influenced in their responses due to the fact that they are participating in the study (Cooper & Schindler, 2003).

Limitations

The following seven limitations apply to this study. 1) The primary limitation for this study is that the random sample (n=56) being used in the study might not represent all ages. Other limitations that apply to the study are as follows. 2) The study is limited to video game players that spend free time playing interactive entertainment. 3) The sample used a modified Group Environment Questionnaire (GEQ) test where terms were changed to reflect the current research environment. 4) The data gathered was limited to December 1st, 2009 to December 19th, 2009. 5) Due to compensating the subjects and a need to keep the cost down along with a low level of risk, the maximum number of players on each team was four with the total study participants being at least forty eight. 6) This study may be limited by the reliance upon the perceptions of the individuals surveyed and the sample size. 7) The study may also be limited by the length of the intervention. It could be that the team-building activity was not allowed the necessary time to allow the long-term benefits of the team-building activity to develop.

Purpose and Need

Interactive entertainment has surpassed the music and film industry in revenue and news media and video gaming CEO's predict it will continue to grow even in times of economic difficulties. With the exorbitant number of hours spent on playing video games it would be beneficial to identify a reason to play rather than simply for fun. This research identifies that there is more to video gaming than entertainment. The purpose of this study will be twofold:

first, to provide an insight as to a non-entertainment benefit of playing cooperative video games, and second, to use this data to present industry with another team building activity that will increase team cohesion and thus provide a competitive edge in the workplace.

With interactive entertainment being a relatively new field of research and the ever growing popularity of playing video games increasing, “there is a breadth of research taking place that examines video games—and not just whether games are good or bad for the players” (Duffy, 2006). Both old and young are playing video games as a form of leisure entertainment and the popularity continues to grow at a tremendous rate (Duffy, 2006). Opponents of video gaming argue that it promotes social isolation, increased aggressive behavior, endorses gender bias, confuses reality with fantasy, and is simply a waste of time (Griffiths & Davies, 2005; Smith, 2006; Weber et al., 2006). Advocates of video gaming dispute the negative effects by pointing out the positive effects such as players are introduced to technology, encourages problem solving and increases logic skills, provides practice in motor and spatial skills, and is therapeutic (Lieberman, 2006; Ritterfeld & Weber, 2006).

The proposed study contributes to the academic discipline of interactive entertainment in three ways. First, the results of this research will help society better understand how the video gaming industry has evolved into the largest form of leisure entertainment and continues to expand into all genders and ages. Second, by understanding the growth of the industry and realizing the effects video game play has on society, we can recognize the changes occurring as it shifts towards cooperative game play thus requiring interaction with other individuals and possibly the societal effects. Third, the research will inform those concerned with video game play dominating leisure activity time as to whether or not something productive can be established by playing cooperative video games and as a result add to the body of knowledge.

All of these contributions will help future interactive entertainment researchers more easily conduct comprehensive literature reviews.

Procedures

Historically, cohesion has been considered one of the most important small group variables (Lott & Lott, 1965). Cohesion-performance is driven by a commitment to a task (Mullen & Cooper, 1994) and is a multidimensional dynamic process including task and social cohesion (Carron & Hausenblas, 1998). A number of studies have suggested that team building activities increase cohesion (Smith, 1997).

The proposed research was a pretest-posttest quantitative group's design (Boyle, 2002). The quantitative findings measure the longitudinal changes on team cohesion through the use of a pretest and posttest assessment for the participants playing collaborative video games. The research implements Carron, Widmeyer, and Brawley's instrument Group Environment Questionnaire (GEQ) which is a conceptual model for measuring cohesion (1985). Researchers Albert Carron and Lawrence Brawley created the GEQ based upon assumptions that cohesion can be evaluated through perceptions of individual group members. The test identifies four constructs related through different task and social interactions as viewed through the eyes of the individuals about them self and their team (Carron, Brawley, & Widmeyer, 2002). The authors clarify that the model is a framework that serves as a guideline and should be used in its original content. However, as necessary, revisions are acceptable including changes to words, the deletion of non-pertinent questions, and the addition of items that are more culturally meaningful to the study (Carron, Brawley, & Widmeyer, 2002).

The GEQ is an 18-item questionnaire based upon Carron's (1982) conceptual model of cohesion representing four constructs. The model divides cohesion into two categories: group

integration and interpersonal attractions to the group. The model then subdivides the two categories into 4 sub-scales by assessing the Group Integration-Task (GI-T), Group Integration-Social (GI-S), Individual Attractions to the Group-Task (ATG-T), and the Individual Attractions to the Group-Social (ATG-S). The GI-T and GI-S sub-scales represent the “us”, “our” and “we” perceptions while the ATG-T and ATG-S sub-scales represent the “I”, “my”, and “me” perceptions.

Four test questions refer to ATG-T, five questions assess ATG-S, five questions assess GI-T, and four questions assess GI-S. Responses are in the form of a 9-point Likert scale based on strongly disagree (1) and strongly agree (9) with the higher score reflecting stronger perceptions of cohesiveness. Some items on the questionnaire were slightly modified as suggested by the instrument authors to represent the culture of this study. Since team cohesion is a multidimensional construct, all four components of team cohesion do not need to be present in order to show a degree of change in cohesion (Carron, Brawley, & Widmeyer, 2002).

In this research, the sample (n=56) was selected from the population by advertising at a university campus, placing advertisements in the school newspaper, and by drawing upon Psychology students that have to participate in some form of research interventions each semester. Interested applicants were directed to a website to allow potential subjects to register to participate in the study. Registered subjects that met the criteria of being between the ages of 18 and 29 years old were able to specify time and day availability to participate in the study. Subjects were randomly assigned to participate in either the one or three week intervention. Participants were informed that the intervention could last up to three weeks but did not know the length of their intervention until it was completed and they had taken the modified posttest GEQ. Due to the cost of compensating subjects and a need to keep the cost down along with a

low level of risk, the study involved at least forty eight subjects. Teams of up to four were randomly formed using the registered participants to play the collaborative video game Halo. Each team was randomly assigned a specific length of game play within the study (one or three weeks). During the registration process, demographics were stored for each participant identifying skill level and estimated hours per week spent playing video games.

The video game Halo 3 is classified as cooperative play and was designed by Microsoft's Bungie Game Studio. It is the final game in the Halo trilogy with an ESRB rating of mature for blood and gore, violence and mild language. Halo 3 is an action game genre and is a first person shooter (FPS). One to four players participate on one of four teams thus creating a cooperative environment where team members must defend and protect each other against the enemy. If desired, four teams of four players can participate at one time playing against the other teams. Each team uses an Xbox 360 console networked to other consoles and competes against other teams for a specified number of rounds. A round is identified as the number of enemies killed. Players return to Earth to save mankind from the Covenant, an evil alien force. The multiplayer mode should be "slayer" which allows up to four teams of four players each to "rack up" a certain number of kills. The number of kills for each round should be at least twenty-five. The win/loss records were not kept. The teams selected for this study were similar in context and played as many rounds as possible within the one to two hour block time. Game play continued until the team's randomly assigned intervention schedule was completed.

In order to create a baseline of team cohesion used for comparisons, a modified GEQ pretest assessment was given to each team member as a pre-intervention procedure. At completion of each study, the modified GEQ was administered to participants as a posttest assessment. The results were compared against the initial pretest assessment data to determine

the degree or level of change in the four manifestations of team cohesion. The data collected through the pretest and posttest was helpful in determining any patterns of relationship among similar groups over time.

The following procedures were followed to provide the framework for the study:

1. Perform a literature review on team cohesion and cooperative game play by researching scholarly journals, books and other sources to provide an overview of the relevant literature that is pertinent to the research topic.
2. Create the registration web site that stores participant demographics and advertise for participants.
3. Determine which items and terms on the GEQ are relevant to the research and can be used without modification.
4. As suggested by the instrument's authors, modify the terms on the GEQ items so that the wording is more representative of the characteristics of the teams playing video games and the environment of the study.
5. Delete the non-essential items from the GEQ if applicable.
6. Add new items to the GEQ if applicable that are contextually more representative to the specific group and environment.
7. Randomly form the teams based upon date and time availability.
8. Randomly assign groups a length of game play (one or three weeks).
9. Create schedule for team play.
10. Contact participants and inform them of the schedule.
11. Begin the team play.

12. Store participant demographics and explain the purpose of the study along with participant expectations including the fact that if they miss a playing time they will be dropped from the study while play continues for the group's remaining members.
13. Explain the rules of Halo and settings to be used in the game play.
14. Conduct the GEQ pretest assessment.
15. Conduct the experiment.
16. Continue game play until team game play is completed.
17. Perform the GEQ posttest assessment.
18. Hold drawing for prizes.
19. Evaluate the quantitative (data retrieved) analyses by comparing the means of the pretest to the posttest.
20. Evaluate the results using MANCOVA.
21. Use repeated measures ANCOVA as post hoc analysis.
22. Test the null hypothesis for the dependent variables.
23. Finalize conclusions.

Definitions of Key Terms

The following terms are defined as they were used in this study:

Cohesiveness: A qualitative description of the network density and clustering within a network; a highly clustered network is often cohesive, whereas a random network is cohesive only if the connection probability between nodes is high (Albert & Barabasi, 2002).

Genre: A means of categorizing video games by game play interaction (Moore, 2007).

Group Integration-Social (GI-S): Individual team member's feelings about the closeness and bonding within the team around the group as a social unit (Carron, Brawley, & Widmeyer, 2002).

Group Integration-Task (GI-T): Individual team member's feelings about the closeness and bonding within the team around the group's task (Carron, Brawley, & Widmeyer, 2002).

Hawthorne Effect: Participants might be impacted and influenced in their responses due to the fact that they are participating in the study (Cooper & Schindler, 2003).

Individual Attractions to the Group-Social (ATG-S): Individual team member's feelings about his or her personal acceptance and social interactions with the group (Carron, Brawley, & Widmeyer, 2002).

Individual Attractions to the Group-Task (ATG-T): Individual team member's feelings about his or her personal involvement with the group's task, productivity, and goals and objectives (Carron, Brawley, & Widmeyer, 2002).

Outdoor Management Education (OME): A wilderness experience that removes individuals from day-to-day operations and places them in nature in the hopes improving communication, problem solving, teamwork, self-esteem, and organizational commitment (McEvoy, 1997).

Social Cohesion: Players are motivated toward developing and maintaining social affiliates with their teammates (Boyle, 2002).

Task Cohesion: Players are committed to achieving team goals and objectives and the degree to which members of a group work together to achieve a specific and identifiable goal (Boyle, 2002).

Team Building: A method to promote an increased sense of unity and cohesion to enable to team to work more effectively (Newman, 1984).

Team Cohesion: A dynamic process that is reflected in the tendency of a group to stick together and remain united in the pursuit of its goals and objectives (Carron, 1982).

Summary

Corporations, like athletic teams, are searching for methods to improve performance. Collaboration has become a standard practice within organizations in order to gain a competitive advantage and researchers are identifying means to improve teamwork and increase performance. In order to continually improve and increase performance, teams must be cohesive and collaborative focusing on a common task or goal. As with other interactive team building activities, playing collaborative video games is an activity that could build greater team cohesion within a minimal amount of time.

The purpose of this chapter was to provide a conceptual foundation for the proposed research. An introduction to the concept of team cohesion and cooperative video game play was presented along with the measurement tool that was used to determine the change in the degree of team cohesion. Next, the outline for the proposed research was described in terms of the problem statement, the research questions and hypotheses, and the assumptions and limitations that are related to the proposed methodology. The purpose and need for the research were stated

and the last sections of this chapter described the procedures to be implemented and identified terms that needed greater clarification.

CHAPTER 2

REVIEW OF LITERATURE

There is a societal war against video games from parents and educators (Smith, 2006) to the extreme that the federal government has passed legislation specifically directed at the video gaming industry (Pereira, 2003) by setting up a ratings board to the limitation of violent video game sales to minors. But what if there was a positive effect from playing cooperative video games that could benefit society by helping organizations develop more efficient teams via increasing team cohesion and the ability for individuals to work together as a team? In today's rapidly changing global economy organizations are looking to collaborative work to increase performance and the ability to compete in a global market (LaFasto & Larson, 2001).

This review of literature covers four major subtopics. We will first discuss teamwork and group dynamics including the team factors that drive process and performance. Second, we introduce cohesion as a team factor and explain the different models for measuring cohesion. We elaborate on the group environment questionnaire measurement which is used in this research, and discuss how knowledge is shared and learned through teamwork. Third, the video game industry's history is examined and trends are identified so that we can lay a foundation of how video game play has become a popular social activity and where the future of game play might be headed. Finally, the pros and cons of video game play are explored including how computer

games can disseminate knowledge and how the positive and negative effects continue to be identified as video game play morphs into something more than just a social activity.

Teamwork and Group Dynamics

Teams have become an increasingly important way of life within an organization and society (O'Connor, Johnson, & Khalil, 2004; Salas, Cooke, & Rosen, 2008). A team is a group of people working independently to accomplish a goal (Levi, 2007) with effective teams consisting of members that are technically competent and good at collaborating (LaFasto & Larson, 2001). Teamwork and collaboration are shaped by two societal forces: the need to find new and effective ways to accomplish a task and increasing social capacities of individuals in order to handle problems (LaFasto & Larson, 2001). Problems confronting organizations are becoming more complex requiring a coordinated team effort to confront and solve. Scientists suggest that individuals may be evolving into a capability for cooperative team behavior (Bower, 1995). Organizations structure work around teams since teams have the possible potential of improving performance and making individuals more productive (Stewart, Manz, & Sims, 1999). Working as a team cultivates faster solutions to problems than working as an individual (Hymnowitz, 2005).

Teams are used to perform a variety of functions. Sundstrom (1999) identified six different types of work teams as shown in Table 1.

The traditional and historical approach to completing a task by organizing people is called Scientific Management (Copley, 1923). Under this model managers would divide a task into smaller tasks and assign them to individuals. The perception is that each activity is linked thus implying that teamwork and collaboration has been achieved. Management would simply control the operations of the workers as they worked separately to complete a task (Levi, 2007).

However, modern organizations are shifting to a true team environment where no one person has all of the skills and knowledge needed to complete a task and instead, the team must work together to be successful (LaFasto & Larson, 2001). In order to foster an environment of teamwork and collaboration one must first understand what factors define a team.

Table 1 Different Types of Work Teams and Uses.

Team Type	Team Usage
Production	Factories.
Service	Repeated transactions with customers.
Management	Coordinating organizational activities.
Project	Specific task in a period of time.
Action	Brief performance requiring special skills.
Parallel	Temporary teams providing recommendations for an organization.

Teams can only be effective to the extent that team members work cooperatively with each other (Stewart, Manz, & Sims, 1999). In order to cooperate there needs to be a task aligned with an objective or goal. Not only should there be a common goal but team members must feel connected with one another and have some type activity that promotes interaction or socialization (Johnson & Johnson, 1997). Different types of interaction require teams to work cooperatively to achieve goals (Hayes, 1997). One of the most common applications of team building social interactions where there is an established body of knowledge is sports (Levi, 2007).

Group unity is essential to a sports team (Carron, Brawley, & Widmeyer, 2002) and team building strategies have been used in sports in the attempt to increase team effectiveness (Bloom, Loughead, & Newin, 2008). Team building is the method to “promote an increased sense of unity and cohesiveness and enable the team to function together more smoothly and effectively (Newman, 1984). Team building enables an organization to utilize the power of a team approach to accomplish objectives. “In recent years, team building has become one of the most popular and widely used interventions for improving management relations and organizational effectiveness in business and industry” (Yukelson, 1997).

In 1994, M. Woodcock and D. St Francis identified six benefits of team building: (1) the development of leadership; (2) the team member’s acceptance of roles and responsibilities; (3) the team dedication towards a common goal; (4) the development of a positive environment; (5) efficient work practices; and (6) the elimination or reduction of negative team influences. Through team building activities an attempt is made to improve a team and increase team unity. A variety of team building strategies have been implemented in order to examine the affect of cohesion in a variety of sports environments (Bloom, Stevens, & Wickwire, 2003; Senecal, Loughead, & Bloom, 2008; and Prapavessis, Carron, & Spink, 1996).

One effective strategy to improve a group member’s knowledge about effective communication, group problem solving and teamwork, self-esteem, and organizational commitment is the use of outdoor management education (OME) (McEvoy, 1997). OMEs involve a wilderness experience often using rope and challenge courses. The experience removes individuals from the day to day grind of society and places them in an environment void of business distractions but full of nature’s beauty (Boyle, 2002). Throughout the process, individuals are introduced to self and team reliance by experiencing a “level of anxiety, a sense

of the unknown, and a perception of risk” (McKenzie, 2000). Other benefits thus far not mentioned but have been identified from OME participation include trust, leadership, and the ability to get along with team members to accomplish an objective (McEvoy & Cragun, 1997). Meyer and Wenger (1998) identified that team cohesion increased as the team experienced OMEs. The team developed into a more cohesive unit with the realization that goal setting was critical and social relations must be improved.

Team Development

With corporations and sport teams searching for optimal levels of successful team collaboration, team building has been viewed as a medium to achieve this objective (Boyle, 2002). The traditional stages of group development model were outlined by Tuckman and Jensen (1977). This foundational model originally established in a 1965 paper titled 'Developmental sequence in small groups' and later modified in 1977, identifies five stages as shown in Table 2 that focus on the development of team member relations (Levi, 2007). The Tuckman and Jensen model has been criticized for being too rigid but most have accepted it as the foundation for group development (Levi, 2007).

The forming stage is where group members get to know each other, how the group interacts, and discovery of member's strengths and weaknesses. This is a time of uneasiness with group members trying to ascertain how to act and interact. Group goals are defined and tasks are identified (Levi, 2007).

The storming stage is characterized by group conflicts. Team members struggle to define roles and requirements for the project. Making sure the group has open communication during this time is critical since it can either build trust or polarize the group. This stage, if resolved correctly, begins to increase group unity (Tuckman & Jensen, 1977; Levi, 2007).

Table 2 Stages of Group Development.

Stage	Description
Forming	Members get to know each other.
Storming	Conflict between members.
Norming	Members work to achieve a common goal.
Performing	Team functions as a unit for team success.
Adjourning	Team is disbanded.

The norming stage exemplifies the team beginning to work together to accomplish a task and reach goals. Since conflict is diminishing the group becomes more cohesive and effective. As the team works towards a common objective the members develop social relations. Team members demonstrate a level of respect for peers and a foundation is laid to begin having a successful team (Tuckman & Jensen, 1977; Levi, 2007).

Performing is the fourth stage and is characterized by the group functioning as a cohesive unit. Group rules have been established and social relations have been developed. The group focuses on performance and the success of reaching team goals. The team members focus on the task to be completed since individuals know what is expected and how to help one another succeed (Tuckman & Jensen, 1977; Levi, 2007).

The last stage is adjourning (or dissolution) and involves the disbanding of the group. This stage can be stressful since social relations are ending. Assessments should occur with the feedback being used for future performance improvements. A debriefing session is helpful since

it permits a team to review implemented processes and methods, successes, and failures (Tuckman & Jensen, 1977; Levi, 2007).

Cohesion

Cohesion has been defined as “a dynamic process that is reflected in the tendency for a group to stick together and remain united in the pursuit of its instrumental objectives and/or for the satisfaction of member affective needs” (Carron, Brawley, & Widmeyer, 1998). Carron, Colman, Wheeler and Stevens (2002) confirmed in their research that a relationship exists between cohesion and performance and that cohesion affects sports teams in a positive manner (Eys, 2002).

It has been demonstrated that a sports team’s success is not dependent solely upon physical skills. The storming stage in the Tuckman and Jensen model explains that the team begins to become more unified or cohesive. Team cohesion can be accomplished through a variety of team building activities (Senecal, Loughead, & Bloom, 2008) such as sports or OMEs. Team unity or cohesion through sports helps members complete a common goal such as trying to win the competition (Bloom, Loughead, & Newin, 2008).

Many researchers credit Kurt Lewin and Leon Festinger along with their colleagues at the Research Center for Group Dynamics at the Massachusetts Institute of Technology as founders of the concept of cohesion being a factor to keep a group intact (Forsyth, 1999). The first use of the term cohesion to describe the factors that help a group have a sense of unity was introduced by Kurt Lewin in a 1943 National Research Council report entitled “Forces behind food habits and methods of change”. The report investigated the social forces behind eating habits including “Why people eat what they eat” and how to change eating habits. The experiments conducted in the research focused on the effects of group decisions upon a group.

Cohesion is a primary factor to remain in the group (Rempel & Fisher, 1997) and provides members with a sense of belonging (Armstrong, 2001). Festinger, Schacter and Back (1950) defined cohesion as “the total field of forces which act upon members to remain in the group”. Gross and Martin (1952) defined cohesion as “the resistance of a group to disruptive forces”. The common characteristic between all definitions of cohesion is that it addresses how a team handles stress as it completes goals.

There are two dimensions to cohesion: social and task (Mullen, Anthony, Salas, & Driskell, 1994). Task cohesion is defined as the level of motivation to complete the team’s goal or objective. Social cohesion is the level of motivation to develop and maintain group social interaction (Carless & De Paola, 2000). However, Mullen and Cooper (1994) showed that task cohesion had a positive effect on performance but social cohesion did not show a significant relationship on performance. They concluded that task cohesion improved group decision quality while social cohesion impaired the quality. This study re-investigates task and social cohesion by measuring the individual integration and attractions to the group through the social interaction of playing cooperative video games.

As shown in Table 3, cohesion is affected by a variety of factors (Murphy, 2001) including personal, leadership, team, and environmental (Weinberg & Gould, 2006).

Personal factors refer to the characteristics of group members and what attracts them to be in the group (Boyle, 2002). These factors include: individual orientation as to duties within the group, satisfaction of performing to one’s ability, and individual differences with other group members (Weinberg & Gould, 2006).

Table 3 Cohesion Factors.

Factor	Description
Personal	Individual characteristics of group members.
Leadership	Quality of leadership and leader influence.
Team	Desire for group success.
Environmental	Family expectations and obligations.

Leadership factors focus on the type of leadership strategies being implemented along with the relationship between the leader and the members. The key factors include: leadership behavior, leadership style, and the leader/team member personalities (Weinberg & Gould, 2006).

The team factors consider the social forces, task forces, and the balance necessary to achieve a strong cohesion while still being focused on achieving the team goal. The team factors include: group task, desire for group success, group orientation, group productivity norm, team ability, and team stability (Weinberg & Gould, 2006).

The last factor is environment and refers to the forces that hold the group together. These forces include items such as but not limited to: geographic location, age, gender, and race. The factors include a contractual responsibility to the team and organizational orientation (Weinberg & Gould, 2006).

Measuring Cohesion

Due to the complexity of cohesion it has been difficult to measure (Murphy, 2001). Research has resulted in a number of instruments used in an attempt to measure team cohesion (as shown in Table 4).

Table 4 Cohesion Measurement Tools.

Factor	Description
Seashore Cohesion Index (1954)	Seashore
Sport Cohesiveness Questionnaire (1972)	Martens, Landers, & Loy influence
Group Environment Questionnaire (1985)	Carron, Brawley, & Widmeyer
Platoon Cohesion Index (1988)	Siebold & Kelly
Unit Cohesion Index (1989)	Mangelsdorff
Perceived Cohesion Index (1990)	Bollen & Hoyle
Group Cohesion Scale-Revised (2001)	Treadwell

In 1954 Stanley Seashore conducted a study to examine the cohesiveness in industrial work groups. The research investigated the relationship between cohesion and productivity along with the mental health and adjustment of the team members. Seashore examined the strength of the social relations of members and also the conditions and consequences of achieved cohesion (Seashore, 1954). It was later revised for student groups to measure the attraction to the group.

Martens, Landers, and Loy developed the Sports Cohesiveness Questionnaire (SCQ) in 1972 to measure team cohesion. The SCQ measured team cohesion using a seven-item rating system. However, reliability and validity measures were not established for the tool and it was perceived as less than rigorous (Carron et al., 1998).

Thus in 1985, Carron, Brawley, and Widmeyer created the Group Environment Questionnaire (GEQ). This model is an eighteen-item assessment focusing on two important cohesive factors: group integration and interpersonal attractions to the group. Group integration

is defined as “closeness, similarity, and bonding as a whole” (Carron, Widmeyer, & Brawley, 1985). Interpersonal attraction is defined as “the interaction of motives working on the individual to remain in the group” (Carron, Widmeyer, & Brawley, 1985).

Each of these cohesive factors has been divided into two subscales with each containing two cohesive aspects. The four sub-scales factors of cohesion measure and identify the levels of cohesion with a developing team and the attraction of team members to the teams. The GEQ is based upon the assumption that cohesion can be evaluated through perceptions of team members. The tool has become the most widely used instrument for determining team cohesion (Moran, 2004).

Siebold and Kelly created the Platoon Cohesion Index (PCI) in 1988 which measured cohesion in army units. The twenty-item instrument focuses on bonding as well as performance. The bonding relationships examined are: soldier to soldier, soldier to leader, and soldier to organization (O’Mara, 1989).

Using the PCI as a foundation, Mangelsdorff created the Unit Cohesion Index in 1989. The study was applied in situations comparable to the PCI and found to be psychometrically sound (Jacobs, 1990).

The Perceived Cohesion Study was created in 1990 and is a six-item instrument developed by Bollen & Hoyle which focused on relational cohesion and measures an individual’s sense of belonging and morale. However the instrument was validated only using large groups and leaves some doubt as to reliability. (Chin, Salisbury, Pearson, & Stollak, 1999).

Treadwell created the Group Cohesion Scale (GCS) and then in 2001 revised it and called it the Group Cohesion Scale – Revised (GCS-R). The GCS-R consists of twenty five-items and is

used to assess group cohesion and showed an acceptably high reliability for use in research (Treadwell, T., Lavertue, N., Kumar, V. K., & Veeraraghavan, V., 2001).

Group Environment Questionnaire

The widely accepted instrument selected to measure cohesion for this research is the Group Environment Questionnaire (GEQ). The GEQ has been tested and confirmed as a valid instrument for the past twenty-four years. It is not a tool to be used to assist in the team selection process but instead can be used to help understand group processes. The instrument is based upon three fundamental assumptions: cohesion can be evaluated through the perception of group members; the group satisfies personal needs and objectives, and a group's concern to the group and members by focusing on task and social factors helping to create unity (Carron, Brawley, & Widmeyer, 2002).

The belief in current and past research is that cohesion can be measured. A group has observable characteristics where members experience a social aspect of belonging to a team. Group members develop a set of beliefs about the group and form perceptions of the group properties and relationships (Carron, Brawley, & Widmeyer, 2002).

The group member uses the established perceptions to form opinions about the cohesiveness of the group and whether or not the group satisfies individual needs and objectives. The group integration reflects the individual's perception about the unity and bonding within the group while the individual's attraction to the group represents an individual's feelings about the group (Carron, Brawley, & Widmeyer, 2002).

The group focuses on a task to be completed and a social aspect of creating relationships (Festinger et al., 1950). The task orientation represents the motivation to complete the group's goal. The social orientation represents the motivation to develop and maintain social

relationships within the group (Carron, Brawley, & Widmeyer, 2002). If team members stick together outside of the associated environment due to common likes and attractions then there exists social cohesion. Even if the members do not like each other there can still be task cohesion if the members have a common goal to complete the task and without social cohesion a team can still be successful in completing the task at hand (Cashmore, 2002).

As a result, the GEQ model identified four correlated constructs representing the task and social orientations as perceived through the group member about them self and about the team. As shown in Figure 1, the base constructs for measuring cohesion are: Group Integration-Task (GI-T), Group Integration-Social (GI-S), Individual Attractions to the Group-Task (ATG-T), and Individual Attractions to the Group-Social (ATG-S).

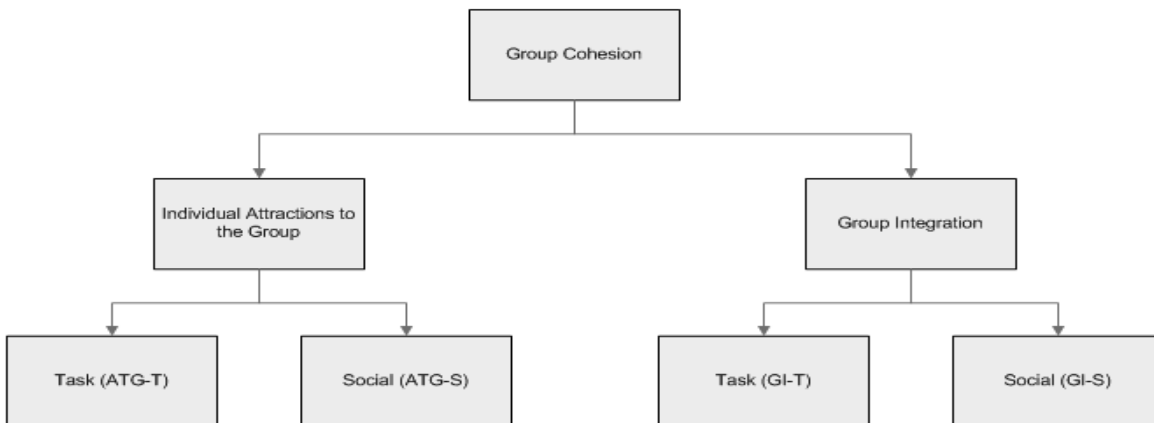


Figure 1. The Factors that Define Group Cohesion.

The GI-T and GI-S represent the “us”, “our”, and “we” individual perceptions of the group such as the closeness, similarity and bonding. The ATG-T and ATG-S represent the “I”, “my”, and “me” individual perceptions of self and the motives to remain in the group (Carron, Brawley, & Widmeyer, 2002). The “S” represents the social relationships within the group and

how an individual views the group as a social aspect. The “T” identifies the individual’s perception towards achieving a specific goal or objective (Smith, 1997).

Validity of Instrument

For the past twenty years various reports have examined the validity of the GEQ and have found the tool to be valid in assessing the level of cohesion achieved within a group (Carron, Brawley, & Widmeyer, 2002). The original Cronbach alpha values for the GEQ during the development and acceptance of the tool are listed in Table 5.

Table 5 Cronbach Alpha Values for GEQ.

Factor	Value
Individual Attractions to Group-Task (ATG-T)	$\alpha = .75$
Individual Attractions to the Group-Social (ATG-S)	$\alpha = .64$
Group Integration-Task (GI-T)	$\alpha = .70$
Group Integration-Social (GI-S)	$\alpha = .76$

In 1995, Paskevich reported even higher values where Salminen and Luhtanen in 1998 report lower values. The accepted criterion for acceptable reliability is $\alpha = .70$ (Nunnally, 1978). The authors of the instrument present substantial evidence of research from 1985 to 1996 pertaining to the validity of the GEQ with forty four of fifty four analyses supporting predictions and taking exception to those studies that fail to support the analysis (Carron et al., 1998).

Learning By Playing Video Games

Many researchers have linked cohesion to group performance (Costello, 2004; Boyle, 2002; Ahronson & Cameron, 2007; Senecal et al, 2008). As stated previously, team building

activities are designed to increase a group member's knowledge about effective communication, improve group problem solving skills, increase self-esteem, and solidify organizational commitment. However, one other advantage of team building activities and team work is the ability to transfer skills learned in one activity to other activities (Murphy, 2001).

Learning is the ultimate goal in the use of OMEs and team building activities (Miles & Priest, 1999). "Learning can be defined as the extent to which participants change attitudes, improve knowledge, and/or increase skill as a result of attending the program" (Kirkpatrick & Kirkpatrick, 2006). Learning has occurred as long as one or more of the following has transpired: attitudes are changed, knowledge is increased, or a skill is improved (Kirkpatrick & Kirkpatrick, 2006). Due to the aforementioned benefits of team building exercises one can see that opportunities for a learning experience to take place are evident.

History and Trends of Video Gaming Industry

OMEs and other team building activities can be used to create a harmonious environment of team cohesion but as demonstrated in the literature review there must be a group common goal combined with a social bonding activity or task that instills a need to belong or be needed. One of the more popular social bonding activities currently sweeping the world is playing video games. The video game industry has been a rollercoaster ride with many ups and downs. It has changed from being nonexistent to a multi-billion dollar business (Deuze, Martin, & Allen, 2007). The Entertainment Software Association (ESA) reported that video gaming is the fastest growing form of entertainment. The Entertainment Retailers Association (ERA) announced in 2008 that sales of video games have surpassed music sales. According to the PEW Internet project "Nearly all American teens (97%), and more than half of adults age 18+ (53%) say they play video games, and about one-in-five adults (21%) plays video games every day or almost

every day”. Although deemed unstoppable, NPD market research announced that the recession in 2009 put a dent in video game sales with sales falling 17% from the previous year in March 2009 (Modine, 2009). However, NPD notices that one must take into account that during March 2008 the video game Super Smash Bros. was released on the Wii which became the fourth best selling game that year (Modine, 2009).

Research shows that playing an interactive game is an interactive social activity that can develop knowledge and also improve social and communication skills (Vorderer & Bryant, 2006). Robert Kotick, chairman and chief executive of Activision Inc. explained in a 2008 Wall Street Journal interview that there is a transformation of solitary gaming to social gaming (Swisher, 2008). Games used to be played alone but more and more require a social interaction in order to be successful in completing the game.

“New technologies do not simply spring out of thin air. They need to be associated with familiar industries or ideas” (Kent, 2001). Although it seems like video games have recently become more popular due to the interactivity and social interaction promoted by consoles like the Nintendo Wii, they actually began with the amusement industry (Kent, 2001). No one really knows when the first computer game was designed and written but the invention of the Intel microprocessor in 1971 paved the way to use computing power in ways that had never been tried before (Adams, 2003).

But even before the invention of the microprocessor an engineer named Ralph Baer applied for and received a patent in 1968 for TV games. He is commonly known as the father of video games (Herman, 2001). Baer contacted television manufacturer Magnavox representative Bill Enders, who used to work for RCA. Enders was impressed with Baer’s work and entered an

agreement to create the Odyssey which was a device that allowed an individual to play video games on a TV (Herman, 2001).

Approximately at the same time Nolan Bushnell, known as the father of the game industry, was working at an amusement park in Utah as a manager of an arcade department. He wondered if people would pay to play coin operated video games (Herman, 2001). In 1972, Bushnell formed Atari with Ted Dabney and hired Al Alcorn to create a simple video ping-pong game called Pong. By 1973 more than twenty-five competing companies released 90,000 units of their own spin-offs of video tennis and ping-pong. When Pong was released, Magnavox sued Atari for copyright infringement claiming that Baer's technology was used and won. Based upon this ruling, all companies using Baer's technology in released videogames from that time forth had to pay Magnavox a royalty.

By 1975, the home version of Pong had been created and marketed. In 1976, Warner Communications bought Atari and due to the fact that they had financial backing, a new era in home video gaming began (Herman, 2001). With Fairchild Camera's 1976 introduction of a machine that accepted ROM cartridges, a means was established for game players to buy a new game without having to buy a new gaming console (Adams, 2003). Atari released the Video Computer System (VCS) in 1977 which allowed the home user to play video games on a TV with interchangeable gaming cartridges. Joysticks were the controllers, a step up from paddles, which now allowed the game player to move in any of eight directions. This provided a friendly and easy interface for users to play video games.

The year 1977 was one where video game companies were folding due to disappointing sales. The only major company to survive was Warner Communications with the Atari VCS.

Video games had evolved in eight years from what had been complex in 1971 to a technology using joysticks, multiple buttons, and vector graphics (Herman, 2001).

The first first-person game was released in 1980. A new gaming classification or genre had been born. Battlezone was a VCS game where the player felt like they were taking part in the game by driving a tank, avoiding enemy fire, and destroying enemy tanks. Defender was also released which is a horizontal-scrolling game where action actually could take place off the screen. As time progressed more video games were designed representing different play modes and gaming experiences. However, due to poor sales, competition, and the fact that home video games were becoming a thing of the past, the video game industry by 1984 appeared to be dead (Herman, 2001; Adams, 2003).

Nintendo entered the market with the Nintendo Entertainment System (NES) and by 1986 had brought new life to the video game industry. Nintendo established three important changes to help resurrect the gaming industry: 1) they controlled who could and could not make games for their system, 2) they implemented quality standards, and 3) they instituted content standards (Adams, 2003). Two years later in 1988 the videogame market was alive and well when NEC, a large manufacturer of computers released a videogame console with a 16 bit graphics processor called the PC Engine. The technological bar was raised and competitors realized they would need to follow suit in order to compete (Herman, 2001).

Sony released the PlayStation in 1991 which consisted of a CD player and a Nintendo Super NES (SNES). The CD-ROM was manufactured quicker and for less money than the cartridge while at the same time storing over 650 Mb of data (Adams, 2003). Competitors followed suit by announcing another technological advance with the 32 bit console to be released in 1992. Through the rest of 1991, videogames were a hot commodity and doing better than ever

before. Like other forms of entertainment, video games were classified into genres. Although not completely standardized a commonality has been identified from which new video game developers must consider while designing a game to be released (Adams, 2003) the genres (Table 6) identify the style of game play (Bergeron, 2006).

Table 6 Video Game Genres.

Genre	Description
Action	Involves fast action and good hand-eye coordination.
Adventure	Exploration.
Arcade	Mimics early arcade games.
Combat	Fighting.
Driving	Simulated driving and racing.
First-Person Shooter (FPS)	Action genre from a first person perspective.
Multiplayer	Supports more than one game player simultaneously.
Puzzle	Solving problems, mazes, and puzzles.
Role Playing Game (RPG)	Storyline stressed over action.
Simulation	Mimics reality.
Sports	Traditional sports.
Strategy	Planning and resource management.
Third-Person Shooter (TPS)	Action genre from a perspective above and/or behind the player.
Trivia	Intellectual testing knowledge.

New video games continued to appear on the market and advanced technology was incorporated to gaming systems regularly with the advent of Nintendo's mouse in 1993. The next year a company named Catapult introduced a modem for gaming systems. The modem would allow video gamers to compete with other players across a network (Herman, 2001).

By now, video games were becoming more and more violent. Fighting games and other games with violence and mature content were becoming more popular. State and Federal Legislatures began to show greater interest in the gaming industry and wanted manufacturers to adopt a rating system for their games. The Entertainment Software Rating Board (ESRB) was proposed in 1994 which would require gaming companies to submit video games to be rated identifying the recommended classification of game player (Herman, 2001). The ESRB (as shown in Table 7) rated packaged video games and the Internet Content Rating Association (ICRA) rated online games (as outlined in Table 8).

In 1994 Sony launched the PlayStation-X (PS-X) which no longer played Nintendo game cartridges and instead only played CD-ROMs (Kent, 2001). In order to counter the competition Nintendo released their 64 bit processor gaming console in 1995 which was the fastest processor at the time. Gaming consoles continued to expand technological advances with one company constantly out-doing the next.

Throughout the next years, video games became more violent. In 1997, Nintendo released *Golden Eye 007* and by the end of the year had sold almost 1.1 million copies. Over the next two years the sales would reach more than 5 million copies worldwide (Kent, 2001). Nintendo was the last gaming company to shed its wholesome "Disney-style" image in pursuit of a more mature rated game (Kent, 2001).

Table 7 Entertainment Software Rating Board (ESRB) Ratings.

Rating	Description
EC	Early childhood: suitable for ages 3 and older. Contains no material parents would find objectionable.
E	Everyone: suitable for ages 6 and older. May contain minimal fantasy or mild violence, mild language, and/or infrequent use of mild language.
E10+	Everyone 10 and older: suitable for ages 10 and older. May contain some cartoon fantasy, or mild violence, mild language, and/or minimal suggestive themes.
T	Teen: suitable for ages 13 and older. May contain violence, suggestive themes, crude humor, minimal blood and/or infrequent use of strong language.
M	Mature: suitable for ages 17 and older. May contain intense violence, blood and gore, sexual content, and/or strong language.
AO	Adults Only: suitable for ages 18 and older. May contain prolonged scenes of intense violence and/or explicit sexual content and nudity.
RP	Rating Pending: content has been submitted to the ESRB and waiting a final rating.

Table 8 Internet Content Rating Association (ICRA) Ratings.

Rating	Description
Nudity and Sexual Material	May contain genitals, breasts, and explicit sexual acts.
Violence	May include sexual violence, blood and gore, killing, and deliberate killing of humans, animals, or fantasy characters.
Language	May include explicit sexual language, crude words or profanity, or mild expletives.
Other Topics	May promote tobacco, alcohol, or drug use, gambling, use of weapons, discrimination, or otherwise set a bad example for young children.
Chat	May support un-moderated chat or moderated chat suitable for children and teens.

Beginning in 1997 there began to be a rash of violent and aggressive acts perpetuated by youth. On October 1, 1997, a 16 year old boy in Mississippi used a baseball bat, butcher knife, and a rifle to murder his mother and three High School students. On December 1, in the same year, a 14 year old boy shot and killed three Kentucky High School students along with wounding five others. In March 1998, a 13 year old boy and an 11 year old boy opened fire on Middle School students in Arkansas. Two months later in May, a 15 year old boy in Oregon shot his parents and twenty four students, killing 2. In April of 1999, an 18 year old boy and 17 year old boy in Colorado killed twelve High School students, one teacher, and wounded twenty three

more students. In June 2003, two step brothers, a 15 year old and a 13 year old, blamed video games for their act of shooting a passing car killing the driver. In April, 2007 video games were insinuated as the motivating culprit for a campus shooting in Virginia leaving thirty-two dead and many more wounded.

Although not convicted, video games have been implicated in motivating and inspiring these young men to perform the acts of violence they had experienced while playing video games (Kent, 2001). Due to the popularity of aggressive and violent video games the State and Federal Legislators continued to look at the gaming industry attempting to decipher further rules and regulation to control video game content.

With the advances in technology, video games become more and more realistic with graphics mimicking real-life. In 1998, Sony announced the PlayStation 2 which would include 3D graphics. Although it was not released to the public until 2000, it was one of the best selling consoles ever with over 136 million units being sold as of December 2008 (Paul, 2009). The next year Microsoft released its gaming console X-Box powered by a 600 MHz Intel Pentium III processor, 64 MB of memory, a custom NVIDIA graphics chip, and an 8G hard drive. The system resembled a gaming console but was really a PC game machine (Herman, 2001). Not to be outdone by competitors, Nintendo released their successor to the Nintendo 64 in 2001 and called it the GameCube (Malliet & de Meyer, 2005).

In 2005 Microsoft released the Xbox 360, successor to the Xbox, with an Xbox Live feature enabling game players to log on to a network and play against other gamers around the world, download games and music, and watch movies. As history as shown, competition drives the technology so Sony released the PlayStation 3 in 2006. The console includes robust processing and graphics along with the incorporation a Blu-Ray disc player. In 2006, Nintendo

released the Wii gaming console which included many of the features from other consoles but dramatically changed game play by incorporating an interactive feel where the game player must move the controller rather than just pushing buttons.

Gaming manufacturers continue to advance gaming technology and try to predict future trends. One of the trends that has already proved successful is online gaming (Hall, 2005). With the explosion of Internet service the game industry went full force to massively-multiplayer online role-playing games (MMORPG) (Adams, 2003). With over 10 million world-wide subscribers, games like World of Warcraft have established another form of entertainment as a dominant force in social interactivity (Raby, 2008). Online shooters and online RPGs have large followings but there is room for growth and change (Malliet & de Meyer, 2005).

Cell phone technology and its societal adoption show signs that cell phone game usage is increasing. At the end of 2005, the U.S. cellular network, still lagging behind European and Asian counterparts, reported on average one million gaming downloads per month (Bergeron, 2006). If history really does repeat itself, technology will continue to develop to enhance the game play not only on cell phones but gaming consoles to provide more realistic and collaborative interactive social gaming experiences. As more and more game players turn to massively multiplayer online games (MMOGs) and other forms of online multiplayer games, there will be a growing support to harness the power of games for good (Tucker, 2008).

Pros and Cons of Playing Video Games

Until recently, video game studies in academia would have been considered laughable (Adams, 2003) but more and more studies are being investigated to determine the pros and cons of playing video games. According to Johan Huizinga (1955), “Play is older than culture”. Play and games are the very center of what makes a human (Huizinga, 1955). He emphasized that all

play means something. Playing a game means a game player has to make choices and endure the consequences (Salen & Zimmerman, 2005).

Video games are a popular form of entertainment but they are also a powerful learning tool (Prensky, 2005) and are shaping the way we learn. “Ever since Pong arrived in 1974, our kids have been adjusting or programming their brains to the speed, interactivity, and other factors in computer and video games, much as their parents the boomers reprogrammed their brains to accommodate TV” (Prensky, 2005). But the main reason people play games is because it is engaging (Prensky, 2005). The real measure of learning is a change in behavior (Prensky, 2005; Kirkpatrick & Kirkpatrick, 2006). Advances in technology games are becoming more realistic with learning through a simulated video game experience feeling exactly like it would in real life (Prensky, 2005).

James Paul Gee (2003) said that video games are inherently social and that they have the potential to lead to active and critical learning. He went on to say that the real potential of games is “to get people to think, value, and act in new ways”. Dr. Spock said of video games, “The best that can be said of them is that they may help promote eye-hand coordination in children. The worst that can be said is that they sanction, and even promote aggression and violent responses to conflict. But what can be said with much greater certainty is this: most computer games are a colossal waste of time” (Johnson, 2006). However, in his book “Everything Bad is Good for You”, Steven Johnson said “The most debased forms of mass diversion – video games and violent television dramas and juvenile sitcoms – turn out to be nutritional after all” (Johnson, 2006). Some of the positive effects that have been identified by researchers are shown in Table 9.

Table 9 Some Positive Effects of Playing Video Games.

Effect	Description
Cognitive Performance	Video game play can improve short-term working memory, visual attention, mathematical decision making, and auditory perception.
Cooperative Play	Working together to win the game.
Entertainment	Enjoyment of play.
Socially Therapeutic	Playing video games can help players relax, vent frustration, distract pain and help learn.

Cognitive performance can be improved by playing video games. This includes better short-term working memory, visual attention, mathematical decision making, problem solving, and auditory perception (Miller, 2005; Barlett, Vowels, Shanteau, Crow, & Miller, 2009). Certain types of video games can even improve perceptual skills such as sharpening surgical skills (LeBlanc, 2008).

Cooperative play is when two or more individuals work collaboratively to succeed in achieving a task in a video game. “There is a social aspect to almost all game play” (Axelsson & Regan, 2006). There is evidence that when video gamers collaborate there is a developing collective knowledge (O’Connell, Choong, Grantham, Moriaty, & Wong, 2008). Video games are a form of interactive entertainment that result in (a) sensory delight; (b) suspense, thrill, and relief; or (c) achievement, control, and self-efficacy (Vorderer & Ritterfeld, 2004).

Playing video games can be considered by some as being socially therapeutic. Video games can be used as training aides for certain disorders and psychotherapy sessions (Gunter, 2005). Video games can also be a distracter of pain and help develop social skills in children that are learning disabled (Griffths, 2005).

Along with positive effects of game play there are also negative effects. Some of these effects have been identified in Table 10.

Table 10 Some Negative Effects of Playing Video Games.

Effect	Description
Addiction	Players may become game dependent.
Aggressive Behavior	Playing violent video games could cause aggressive behavior.
Physical Health Risks	Some video games could cause seizures.
Social Health Risks	Players may become socially dependent upon game play and be socially isolated.

Addiction to video games can be viewed as a compulsive behavior where individuals will do what it takes to feed the habit (Gunter, 2005). Along with an addiction comes withdrawals and irritability when video games are abandoned (Gunter, 2005).

Some researchers believe that playing violent video games can cause aggressive behavior. As stated earlier, there have been many cases where youth have acted violently only to find out that they were seriously entrenched in the video game world. However, studies are

unable to establish a cause and effect in regards to playing video games and aggressive behavior (Goldstein, 2005). Some say it does while others counter that it does not.

Some cases have been reported that children have had epileptic seizures following certain game play (Gunter, 2005). Although rare, the seizures could be brought on by the actual television screen rather than the game play (Gunter, 2005).

Social health risks and withdrawal from social interactions could be a result from spending too much time playing video games (Gunter, 2005). Playing too much could result in children not being able to develop social skills (Gunter, 2005).

Summary

The purpose of this chapter was to provide a review of the literature detailing four areas of consideration that are critical to the understanding and interpretation of the effects of cooperative video games on cohesion. First, teamwork and group dynamics including the team factors that drive process and performance were presented. Second, cohesion, as a team factor, was explained along with the different models for measuring cohesion. Third, the video game industry's history was examined and trends were identified to lay a foundation of how video game play has become a dominant social activity and form of entertainment. Lastly, some of the pros and cons of video game play and how computer games can disseminate knowledge were identified.

CHAPTER 3

METHODOLOGY

This chapter details the methods in order to conduct the study of having randomly formed teams play collaborative video games. This study utilizes the Group Environment Questionnaire (GEQ) as the chosen instrument in a pretest posttest design to assess four specific factors of cohesiveness that could develop within a team. Topics discussed in this chapter include the research design, subjects, the test instrument, and the collection of data.

The research questions that were investigated are:

- RQ1. What was the change in the degree (scale) of the cohesive factor individual attraction to the group-task (ATG-T) based upon the length of the intervention program?
- RQ2. What was the change in the degree (scale) of the cohesive factor individual attraction to the group-social (ATG-S) based upon the length of the intervention program?
- RQ3. What was the change in the degree (scale) of the cohesive factor group integration-task (GI-T) based upon the length of the intervention program?
- RQ4. What was the change in the degree (scale) of the cohesive factor group integration-social (GI-S) based upon the length of the intervention program?

- RQ5. What was the change in the degree (scale) of each GEQ cohesive factor based upon the length of the intervention program and the inclusion of the covariate estimate hours playing video games each week?

Research Design

Team building activities are an intervention used to increase team cohesion (Bloom, Stevens, & Wickwire, 2003; Senecal, Loughhead, & Bloom, 2008; and Prapavessis, Carron, & Spink, 1996). A common strategy implemented as a team building activity is the outdoor management education. OMEs can improve a group member's knowledge about effective communication, group problem solving and teamwork, self-esteem, and organizational commitment (McEvoy, 1997) and commonly involve the use of a rope and challenge course. The purpose of the OME is to remove an individual from the worries caused by society and place them in an environment void of worldly distractions (Boyle, 2002). The individuals learn to rely upon others in order to achieve a goal and experience a level of risk for failure (McKenzie, 2000).

Instead of using the traditional OME challenge course, this study introduces the use of cooperative video games as a tool to mimic the OME environment. The participant is removed from the worries of society by being immersed into a fantasy world effectuated by the genre of the game. The ultimate goal for the participant game player is to beat the video game. The risk involved when losing is a state of emotional discouragement for having not succeeded. By using a cooperative video game, no one participant can win the game for the team. All members must cooperate, communicate, problem solve, and be committed to the team in order to have a chance at winning. When members do well their self-esteem is buoyed.

With the environment aping the OME, this study implemented a quantitative approach using a pretest/posttest design. The instrument used was a modified Group Environment Questionnaire (GEQ) which has the approval from the authors of the test to make changes in wording and minimal additions or subtractions as needed.

Subjects

The subjects were selected from the population of video gamers by advertising around a university campus, placing advertisements in the school newspaper, and advertising to Psychology students who are required to participate in an intervention. Interested applicants were directed to a website created to allow potential subjects to register to participate in the study. The website also stored participant demographic information. Registered subjects that met the criteria of being between the ages of 18 and 29 years old were able to specify time and day availability to participate in the study. Teams were randomly formed using the registered participants to play the collaborative video game Halo 3. At least forty eight subjects were randomly selected to participate in the study with at most four members randomly assigned to teams.

Site

The intervention occurred in the video gaming lab located on the Weber State University campus in the Computer Science department. The equipment used and provided by the university included three to four networked Xbox 360s allowing twelve to sixteen subjects to play Halo 3 concurrently in cooperative play mode. The monitors, controllers, projectors and TV were also provided on site by the university.

Test Instrument

Quantitative Procedure

The Group Environment Questionnaire (GEQ) examines four constructs of cohesion as it pertains to task and social interactions. The results are the individual's perception about themselves and their team (Carron, Brawley, & Widmeyer, 2002). The authors of the instrument clarify in their literature that the model is to be used as a framework or guideline. It should be used in its original content but as necessary, revisions are acceptable including changes to words, the deletion of non-pertinent questions, and the addition of items that are more culturally meaningful to the study (Carron, Brawley, & Widmeyer, 2002).

The 18-item GEQ assesses the participant's perceptions of group integration and interpersonal attractions to the group. The model is subdivided into two categories (Table 11) assessing the Group Integration-Task (GI-T), Group Integration-Social (GI-S), Individual Attractions to the Group-Task (ATG-T), and the Individual Attractions to the Group-Social (ATG-S). The GI-T and GI-S sub-scales represent the "us", "our" and "we" perceptions of the closeness, similarity and bonding of the group. The ATG-T and ATG-S sub-scales represent the "I", "my", and "me" perceptions of the motives for an individual to remain in the group (Carron, Brawley, & Widmeyer, 2002). The "S" represents the social aspect of the intervention while the "T" represents the commitment to the task of the intervention.

There are four items in the questionnaire that refer to ATG-T, five items to assess the ATG-S, five items to assess the GI-T, and four items that assess the GI-S. The participant responses are in the form of a 9-point Likert scale based on strongly disagree (1) and strongly agree (9) with the higher score reflecting stronger perceptions of cohesiveness.

Table 11 Cohesive Sub-Scales.

Sub-Scale	Description
Interpersonal Attraction to the Group ATG-T (task)	Individual's feelings about personal involvement in the group's task, productivity, goals, and objectives.
Interpersonal Attraction to the Group ATG-S (social)	Individual's feelings about personal acceptance and social interactions within the group.
Group Integration GI-T (task)	Individual's feelings about the closeness, similarity, and bonding within the team based upon group's task (playing Halo).
Group Integration GI-S (social)	Individual's feelings about the closeness, similarity, and bonding within the team based upon the group's social unit.

Reliability of the Instrument

The validity and reliability of the GEQ has been examined for over twenty years (Carron, Brawley, & Widmeyer, 2002). Reliability and validity has been established by the authors through a series of systematic studies and has been widely used to assess cohesion (Morrow et al., 2005). The reliability for the GEQ, which includes the test-retest reliability and internal consistency, has been examined by analyzing the covariance of items within the instrument. In their initial 1985 research, Carron, Brawley, and Widmeyer tested 247 athletes from 26 different sport teams. The Cronbach alpha values for the GEQ were Individual Attractions to the Group-

Task (ATG-T, $\alpha=.75$), Individual Attractions to the Group-Social (ATG-S, $\alpha=.64$), Group Integration-Task (GI-T, $\alpha=.70$), and Group Integration-Social (GI-S, $\alpha=.76$). However, there have been few exceptions confirming the results. In 1995, Paskevich reported even higher values where Salminen and Luhtanen in 1998 report lower values. Supporting research has indicated that subsequent results were within acceptable value of $\alpha = .70$ as defined by Nunnally in 1978.

Validity of Instrument

Authors of the GEQ reported that forty four of fifty four validity analyses supported predictions (Carron et al., 1998). The authors of the instrument agree that there is an absence of support for predictions in the studies when the research is combined with other variables such as communication, coordination, and duration of membership (Carron et al., 2002). Even though some researchers (Schutz et al., 1994) have concerns about the validity, most researchers support the use of the GEQ to measure cohesion.

Data Collection

The cooperative video game used in the study is Halo 3 which is a first person shooter (FPS) genre and a popular video game that allows multiple players to participate as a team. The video game is a shooting genre where team members must defend and protect each other against other teams. The game play mode was “Slayer” and each round consisted of at least twenty-five kills. Teams played as many rounds as possible within the assigned intervention length. Teams also defined their own colors and team names for the game.

Each subject consented to participating in the intervention and signed an informed consent form (Appendix E). As shown in Figure 2, teams were randomly assigned a length of intervention of either one or three weeks of game play with the intervention length ranging from one hour to six hours. The initial meeting with participants explained the purpose of the study,

Halo 3 and its content, the rules of game play, and allowed five minutes for team members to introduce themselves to their respective team. Participants were informed that if they miss a game playing session their results would be eliminated from the study. They were also informed that their name would be entered into a drawing for to win one of two Xbox gaming consoles. The pretest was given and used as a baseline starting point to measure the initial level of team cohesion.

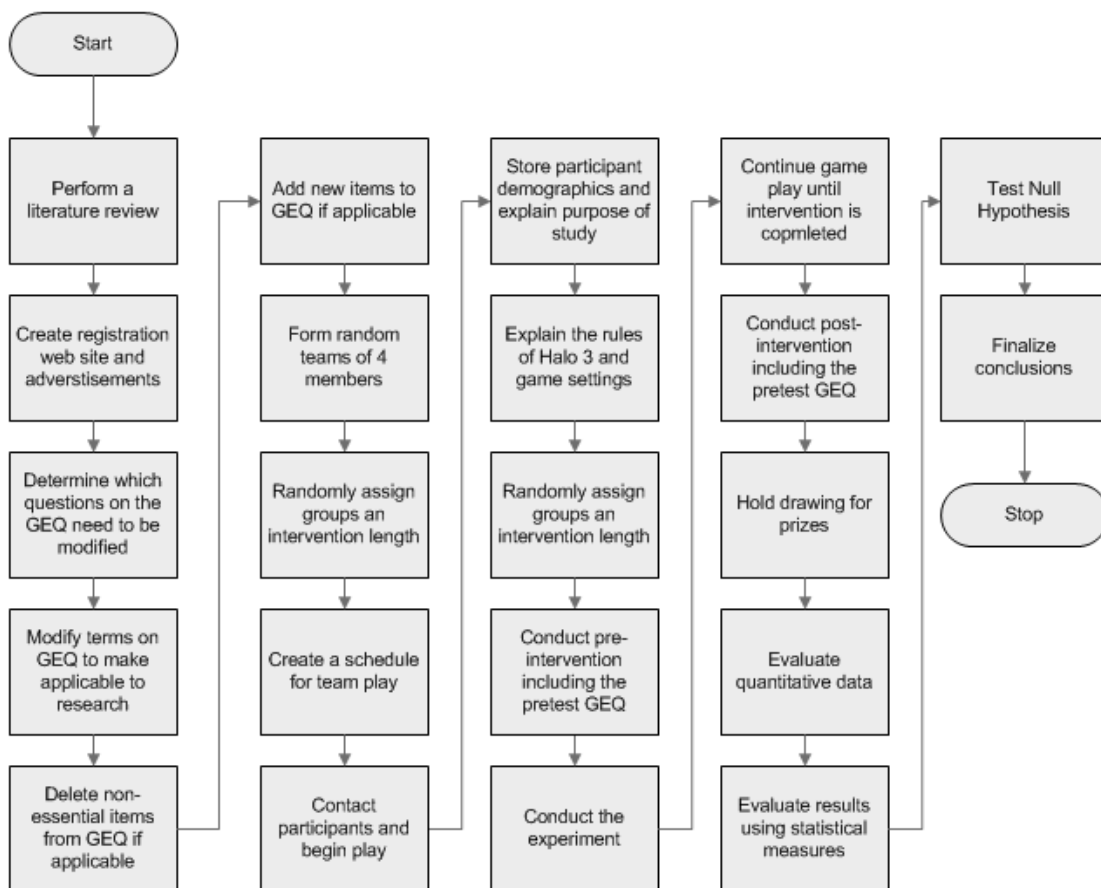


Figure 2. Flow of Procedure.

The one week study consisted of one hour of cooperative game play for that current day. At the completion of play, a posttest was administered using the same modified GEQ survey. A copy of the modified GEQ pretest and posttest can be found in Appendix F and Appendix G

respectively. The subjects experienced a debriefing where appreciation was given for their help and allowing them to ask any questions regarding the intervention.

The three week study consisted of two hours of cooperative game play each week for three weeks totally six hours of intervention. The subjects participated on the same team as they were randomly assigned for the entire study. At completion of the six hours during the three weeks a posttest was administered using the same modified GEQ survey. As with the one week intervention, the subjects then experienced a debriefing allowing them to ask questions about the intervention.

The debriefing was conducted at the end of the investigation to allow participants to comment on their perspectives of the study. Although data was not collected during the debriefing, interviews and comments by the subjects are viewed as an effective method of triangulating with other methods since they add the “human element of voices” (Fontana & Frey, 1993).

The data was collected via a paper and pencil GEQ survey with each question referencing a specific cohesive factor (Table 12). Each survey required the subject to identify their data through the use of a subject number instead of name so as to maintain anonymity. Along with the subject number each subject also stated the estimated number of hours the individual plays video games per week. The scores for each individual were obtained for the pretest and the posttest.

The statistical package for social scientists (SPSS) was utilized to perform the necessary data analysis. The scores were separated into the four cohesive sub-scales and data analysis were conducted using SPSS computing the mean and standard deviation to compare the pretest and posttest scores for each subscale cohesive factor. The mean values for each factor revealed any

strong differences between the pretest and posttest results and indicated the level of team cohesion.

Table 12 Items in the GEQ.

Sub-Scale	Item #
Interpersonal Attraction to the Group ATG-T (task)	10, 12, 14, 16, 18
Interpersonal Attraction to the Group ATG-S (social)	11, 13, 15, 17
Group Integration GI-T (task)	2, 4, 6, 8
Group Integration GI-S (social)	1, 3, 5, 7, 9

NOTE: Items 1, 2, 3, 4, 6, 7, 8, 11, 13, 14, 17, and 18 must be reversed-scored (i.e. 9 = 1, 8 = 2, 7 = 3, and so forth).

The SPSS General Linear Models: 2 (Time: Pre vs. Post) x 2 (Group: one week vs. three week) MANCOVA was computed using SPSS to determine whether or not the intervention of playing collaborative video games affected the degree of cohesion. The cohesive factors pretest and posttest variables were used as the within-subject variables, the intervention group was used as the between-subject factor, and the subject's estimated hours a week playing video games outside the intervention time as a covariate. The purpose using the hours subjects play video games each week as the covariate was to exclude any variance it might have on the dependent variables and adjust the results for differences among subjects before the intervention. The confidence level used to predict the reliability of the estimate in this study was 95%.

The SPSS General Linear Models: Repeated Measures ANCOVA was used as a post hoc analysis to analyze the data. The within-subject variables was labeled "Time" with two as the

specified number of levels and used the Pretest and Posttest means for each of the GEQ cohesive factors (ATG-T, ATG-S, GI-T, and GI-S). The intervention variable Group (one or three weeks) was used as the between-subjects factor. The Hrs/Wk Playing Video Games outside the intervention data was used as the covariate. The analysis was repeated for each of the four GEQ cohesive sub-scales. The fixed effect model adjusted for the covariate was used to display the means for each of the cohesive factors and the results were used to test each hypothesis within the research. The confidence level used to predict the reliability of the estimate in this study was 95%.

The means indicated the level of cohesion and whether there was a significant improvement from the pretest to the posttest based upon the intervention. The results were used to reject the hypotheses identified within the research, indicate the level of cohesion achieved, indicate the change in cohesion, and also whether a longer intervention was necessary to achieve greater levels of cohesion.

Summary

This chapter explained the basis for the method of researching the effect of cooperative video games on team cohesion. The GEQ instrument is widely used and deemed valid by researchers. The research was a pretest/posttest method using descriptive statistics, a 2 (Time: Pre vs. Post) x 2 (Group: one week vs. three week) MANCOVA along with hours playing video games per week outside the intervention as a covariate to analyze the data collected. A repeated measures 2 x 2 ANCOVA was used as a post hoc analysis to confirm the MANCOVA results. The data was collected during a one to three week period while random teams played Halo 3. The GEQ was administered before the game play begins and also when it ends. The four sub-

scales of the GEQ were analyzed using descriptive statistics to measure any quantitative changes in team cohesion and to determine the degree or level of team cohesion.

CHAPTER 4

RESULTS

This chapter presents the findings of the study to determine to what degree playing cooperative video games for one to three weeks increases team cohesion for individuals between the ages of 18 and 29. The statistical analysis model was designed to utilize the hours played per week outside the intervention as a covariant, effectively subtracting the effects of the estimated number of hours subjects played video games each week from the effect group and time (independent variables) had on the team cohesion task (dependent variables). The research data was recorded by the researcher and entered into the SPSS software. The statistical analysis 2 (Time) x 2 (Group) MANCOVA was utilized to test the degree of cohesion. A repeated measures 2 x 2 ANCOVA was utilized as a post hoc analysis to confirm the results of the MANCOVA and to analyze the recorded data for each of the GEQ sub-scales:

- Individual Attractions to the Group-Task (ATG-T)
- Individual Attractions to the Group-Social (ATG-S)
- Group Integration-Task (GI-T)
- Group Integration-Social (GI-S)

Different analytical measures were implemented to examine the data:

1. Descriptive statistics (means and standard deviations)
2. Repeated-measures analysis: Multivariate testing (observed power)

3. Test for Homogeneity: Levene's test for error variances
4. Multivariate analysis of covariance (MANCOVA)
5. Post hoc analysis (ANCOVA)
6. Analysis of variance results (ANOVA)

Research Questions

RQ1. What was the change in the degree (scale) of the cohesive factor individual attraction to the group-task (ATG-T) based upon the length of the intervention program?

RQ2. What was the change in the degree (scale) of the cohesive factor individual attraction to the group-social (ATG-S) based upon the length of the intervention program?

RQ3. What was the change in the degree (scale) of the cohesive factor group integration-task (GI-T) based upon the length of the intervention program?

RQ4. What was the change in the degree (scale) of the cohesive factor group integration-social (GI-S) based upon the length of the intervention program?

RQ5. What was the change in the degree (scale) of each GEQ cohesive factor based upon the length of the intervention program and the inclusion of the covariate estimate hours playing video games each week?

Null Hypothesis

H₀1: There was no difference in the team cohesion factor ATG-T based upon the intervention.

H₁1: There was a difference in the team cohesion factor ATG-T based upon the intervention.

H₀2: There was no difference in the team cohesion factor ATG-S based upon the intervention.

H₁2: There was a difference in the team cohesion factor ATG-S based upon the intervention.

H₀3: There was no difference in the team cohesion factor GI-T based upon the intervention.

H₁3: There was a difference in the team cohesion factor GI-T based upon the intervention.

H₀4: There was no difference in the team cohesion factor GI-S based upon the intervention.

H₁4: There was a difference in the team cohesion factor GI-S based upon the intervention.

H₀5: There was no difference in the team cohesion factor ATG-T based upon the number of hours a subject played video games each week outside the intervention.

H₁5: There was a difference in the team cohesion factor ATG-T based upon the number of hours a subject played video games each week outside the intervention.

H₀6: There was no difference in the team cohesion factor ATG-S based upon the number of hours a subject played video games each week outside the intervention.

H₁6: There was a difference in the team cohesion factor ATG-S based upon the number of hours a subject played video games each week outside the intervention.

H₀7: There was no difference in the team cohesion factor GI-T based upon the number of hours a subject played video games each week outside the intervention.

H₁₇: There was a difference in the team cohesion factor GI-T based upon the number of hours a subject played video games each week outside the intervention.

H₀₈: There was no difference in the team cohesion factor GI-S based upon the number of hours a subject played video games each week outside the intervention.

H₁₈: There was a difference in the team cohesion factor GI-S based upon the number of hours a subject played video games each week outside the intervention.

Demographics

The population for this study was university students between the ages of 18 and 29 years old. No previous gaming experience was required to participate in the study. The subjects (n=56), randomly selected to participate, completed a registration form that gathered the name, contact information, video game playing skill level (easy, medium, hard), major, gender, and estimated hours playing video games each week outside the intervention. All subjects had to confirm that they were between the ages of 18 and 29 and that they were aware of the mature rating of Halo3 due to violence for the video game being used in the study. The subjects were randomly assigned to one of two groups. Group 1 was required to play the collaborative video game Halo3 for one hour. Group 2 was required to play the same game in a time block of two hours each week for three weeks totaling six hours of collaborative video game play.

Group 1 consisted of 29 participants with 25 being male and 4 being female. Group 2 consisted of 27 participants with 24 being male and 3 being female. The average estimated hours playing video games each week outside the intervention for the sample was approximately 10 with a standard deviation rounded to 10. The average estimated hours that the group 1 subjects played video games each week outside the intervention was 9.66 hours with a standard deviation of 9.762 and is positively skewed. The estimated hours playing video games

each week outside the intervention for group 2 ranged from 0 to 60. The average estimated hours that the group 2 subjects played video games each week outside the intervention was 16.11 hours with a standard deviation of 13.263 and is positively skewed.

Testing of Hypotheses

The means for the four sub-scales (Table 13) of the GEQ were compared for the pretest and posttest results (Table 14). The standard deviations were small with little variability and an effect of approximately a point. The degree of change in cohesive factors was measured using the GEQ likert scale of 1 to 9 with 1 being the lowest and 9 being the highest. The degree was disseminated through the change in the pre-test value as compared to the post-test value for each of the cohesive factors.

Table 13 GEQ Cohesive Factors.

Sub-Scale	Description
ATG-T	Attraction to the team to achieve goals.
ATG-S	Attraction to the team by its social environment.
GI-T	How the team functions to achieve goals.
GI-S	How the team functions at a social level.

The simple mean comparisons shown in Table 14 indicated a positive degree increase from pre-test to post-test in team cohesion for each of the interventions for group 1 and group 2. All means for both groups were above the midpoint (i.e. 5) of the GEQ rating scales and had a positive degree of change.

Table 14 Group 1 & 2 Pretest and Posttest Means and Gain Scores.

Group 1 – One Hour of Video Game Play Intervention								
	ATG-T		ATG-S		GI-T		GI-S	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Pretest	6.62	1.30	4.86	1.04	5.48	0.90	5.00	0.86
Posttest	7.53	1.42	5.85	1.04	6.57	0.94	5.60	1.32
Positive Gain	0.91	38%	0.99	24%	1.09	31%	0.60	15%

Group 2 – Six Hours of Video Game Play Intervention								
	ATG-T		ATG-S		GI-T		GI-S	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Pretest	6.19	1.15	4.88	1.29	5.10	0.59	5.19	0.76
Posttest	7.38	1.45	5.98	1.36	6.30	0.91	5.63	1.03
Positive Gain	1.19	42%	1.10	27%	1.20	31%	0.44	12%

In order to confirm the analysis of sample means to see if there were significant differences within the comparisons in the analysis a 2 x 2 MANCOVA was used to analyze the data. The GEQ cohesion factors ATG_T, ATG_S, GI_T, and GI_S were used as the DVs. The within-subject factors (factor means IV) was the pre/post tests. The between-subject factor is the group representing the 29 subjects that participated in the one week study and the 27 subjects that participated in the three week study.

The multivariate test using Hotelling's Trace between-subjects indicated that the covariate AvgHrsWk, representing the hours a subject played video games outside the intervention, did not have statistical significance with a value of 0.405 which was well above the 0.05 alpha (Table 15).

Table 15 2 X 2 MANCOVA Using Hotelling's Trace Coefficient.

Effect	Value	F	Hypothesis df	Error df	Sig.
Between Subjects					
Intercept	58.126	726.577(a)	4.000	50.000	.000
AvgHrsWk	.082	1.022(a)	4.000	50.000	.405
Group	.126	1.576(a)	4.000	50.000	.195
Within Subjects					
Time	.610	7.628(a)	4.000	50.000	.000
Time * AvgHrsWk	.061	.764(a)	4.000	50.000	.554
Time * Group	.030	.369(a)	4.000	50.000	.829

a Exact statistic

b Design: Intercept+AvgHrsWk+Intervention

Within Subjects Design: Time

Because the covariate was not found to be significant to the statistical model the researcher dropped the covariant AvgHrsWk from the statistical analysis.

The between-subjects effects table for the Group factor indicates that group has no effect on cohesion ($F(4, 50) = 1.576, p=0.195$). The within-subjects effects table indicated that Time * Group ($F(4, 50) = 0.764, p=0.554$) has no effect on cohesion. However, the within-subjects effects table indicated that the Time, referring to the pre and post and not to the length of the intervention, variable ($F(4, 50) = 7.628, p<.01$) has a main effect on cohesion. It did not matter if a subject played for one hour or six hours. All that was required in order to have an effect upon cohesion was to simply play collaborative video games by taking part in the intervention.

Because Time was a main effect a mixed design analysis was used as a post hoc analysis for the MANCOVA. The within-subject factor variable was labeled "Time" with two levels representing the pre and post tests means associated with each GEQ cohesive factor. The

between-subjects factor was the intervention group (one or three weeks) with a covariate of Hrs/Wk Playing Video Games.

Individual Attractions to the Group-Task Subscale Results (ATG-T)

A summary of the descriptive statistics for the ATG-T sub-scale is shown in Table 16. The mean and standard deviations are representative of the pre and post tests completed for each of the ATG-T GEQ cohesive factor.

Table 16 Descriptive Statistics for ATG-T (Attraction to the Team to Achieve Goals).

	Group	Mean	Std. Deviation	N
Pre ATG-Task	1	6.621	1.2984	29
	2	6.185	1.1448	27
	Total	6.411	1.2353	56
Post ATG-Task	1	7.526	1.4226	29
	2	7.380	1.4501	27
	Total	7.455	1.4247	56

The descriptive statistics shown in Table 16 indicate that group 1 had an individual attraction to the group's task (ATG-T) pre-test mean of 6.621 with a post-test mean of 7.526 for a gain score of 0.905. The pre-test and post test means were significantly greater than the GEQ median of 5 for the Likert scale questions. Group 2 had an individual attraction to the group's task (ATG-T) pre-test mean of 6.185 with a post-test mean of 7.380 for a gain score of 1.195. The pre-test and post test means were significantly greater than the GEQ median of 5 for the Likert scale questions.

Levene's test for error variances for the ATG-T cohesive factor show the variances to be equal (Table 17). The significance levels (Sig.) are greater than the alpha level (.05) so the equal variances hypothesis is not rejected and equal variances are assumed for this cohesive factor.

Table 17 Levene's Test of Equality for the ATG-T Cohesive Factor.

	F	df1	df2	Sig.
Pre ATG-Task	1.077	1	54	.304
Post ATG-Task	.001	1	54	.972

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a Design: Intercept+avghrswk+group

Within Subjects Design: Time

A repeated measures ANCOVA with an alpha level of 0.05 was used and the results tested each hypothesis within the research. Table 18 shows the Tests of Within-Subjects Effects with a covariate for the ATG-T.

Table 18 Tests of Within-Subjects Effects for ATG-T With a Covariate Using the Greenhouse-Geisser Correction.

Measure: ATG_T

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Time	21.968	1.000	21.968	13.293	.001
Time * AvgHrsWk	1.767	1.000	1.767	1.069	.306
Time * Group	1.201	1.000	1.201	.727	.398
Error(Time)	87.592	53.000	1.653		

The within-subjects effects table for the ATG-T cohesive factor with the covariate AvgHrsWk indicates there is a main effect using the Greenhouse-Geisser correcting the violation of sphericity for the Time variable ($F(1, 53)=13.293$, $p=.001$). There is not a significant interaction between the two variables Time/AvgHrsWk ($F=1.069$; $p=.306$) or Time/Group ($F=0.727$; $p=.398$).

Table 19 indicates that the covariant AvgHrsWk has a statistical significance of 0.307 which is well above the 0.05 alpha, effectively demonstrating that the covariant is not significant to the interaction between the independent variables (time and group) and the dependent variable (ATG-T). The null hypothesis H_{05} is not rejected since the covariate AvgHrsWk is not significant to the intervention.

Table 19 Tests of Between-Subjects Effects for ATG-T.

Measure: ATG_T					
Transformed Variable: Average					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	2482.899	1	2482.899	1300.023	.000
AvgHrsWk	2.033	1	2.033	1.064	.307
group	1.199	1	1.199	.628	.432
Error	101.224	53	1.910		

Because the covariant was not found to be significant to the statistical model the researcher dropped the covariant from the statistical analysis (see Table 20). This lack of significance is the rationale that has led the researcher to retain null hypothesis number five and reject alternative hypothesis number five.

The within-subjects effects table for the ATG-T cohesive factor without the covariate AvgHrsWk indicates there is a main effect using Greenhouse-Geisser for the Time variable ($F(1, 54)=18.624, p<.01$). There is not a significant interaction between the variables Time/Group ($F=0.354; p=.555$).

The multivariate test using Hotelling's Trace for Time as a main effect shows the observed power is 0.989 for the ATG-T cohesive factor (Table 21). The conventional desired power value researchers have adopted when there is no other basis for setting the desired power

is 0.80 (Cohen, 1988) confirming that the study has the sufficient statistical power to accept the alternative hypothesis H_{11} in that there was a difference in the team cohesion factor ATG-T based upon the intervention.

Table 20 Tests of Within-Subjects Effects for ATG-T Without Covariate Using the Greenhouse-Geisser Correction.

Measure: ATG_T					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Time	30.819	1.000	30.819	18.624	.000
Time * Group	.585	1.000	.585	.354	.555
Error(Time)	89.359	54.000	1.655		

Table 21 Observed Power for ATG-T Using Hotelling's Trace Coefficient.

Effect	Value	F	Hypothesis df	Error df	Sig.	Observed Power(a)
Time	.345	18.624(b)	1.000	54.000	.000	.989
Time * Group	.007	.354(b)	1.000	54.000	.555	.090

a Computed using alpha = .05

b Exact statistic

c Design: Intercept+group
Within Subjects Design: Time

Individual Attractions to the Group-Social Subscale Results (ATG-S)

A summary of the descriptive statistics for the ATG-S sub-scale is shown in Table 22.

The mean and standard deviations are representative of the pre and post tests completed for each of the ATG-S GEQ cohesive factor.

Table 22 Descriptives for ATG-S (Attraction to the Team by its Social Environment).

	group	Mean	Std. Deviation	N
Pre ATG-Social	1	4.855	1.0391	29
	2	4.881	1.2893	27
	Total	4.868	1.1557	56
Post ATG-Social	1	5.848	1.0442	29
	2	5.978	1.3648	27
	Total	5.911	1.2000	56

The descriptive statistics shown in Table 22 indicate that group 1 had an individual attraction to the group's task (ATG-S) pre-test mean of 4.855 with a post-test mean of 5.848 for a gain score of 0.993. The post test mean was greater than the GEQ median of 5 for the Likert scale questions. Group 2 had an individual attraction to the group's task (ATG-S) pre-test mean of 4.881 with a post-test mean of 5.978 for a gain score of 1.097. The post test mean was greater than the GEQ median of 5 for the Likert scale questions.

Levene's test for error variances for the ATG-S cohesive factor show the variances to be equal (Table 23). The significance levels (Sig.) are greater than the alpha level (.05) so the equal variances hypothesis is not rejected and equal variances are assumed for this cohesive factor.

Table 23 Levene's Test of Equality for the ATG-S Cohesive Factor.

	F	df1	df2	Sig.
Pre ATG-Social	.076	1	54	.784
Post ATG-Social	1.144	1	54	.290

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a Design: Intercept+avghrswk+group

Within Subjects Design: Time

A repeated measures ANCOVA with an alpha level of 0.05 was used and the results tested each hypothesis within the research. Table 24 shows the Tests of Within-Subjects Effects with a covariate for the ATG-S.

Table 24 Tests of Within-Subjects Effects for ATG-S With a Covariate Using Greenhouse-Geisser Correction.

Measure: ATG_S					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Time	12.883	1.000	12.883	14.267	.000
Time * AvgHrsWk	.014	1.000	.014	.015	.902
Time * Group	.053	1.000	.053	.059	.809
Error(Time)	47.860	53.000	.903		

The within-subjects effects table for the ATG-S cohesive factor with the covariate AvgHrsWk indicates there is a main effect using the Greenhouse-Geisser correcting the violation of sphericity for the Time variable ($F(1, 53)=14.267$, $p<.01$). There is not a significant interaction between the two variables Time/ AvgHrsWk ($F=0.015$; $p=.902$) or Time/Group ($F=0.059$; $p=.809$).

Table 25 indicates that the covariant AvgHrsWk has a statistical significance of 0.594 which is well above the 0.05 alpha, effectively demonstrating that the covariant is not significant to the interaction between the independent variables (time and group) and the dependent variable (ATG-S). The null hypothesis H_{06} is not rejected since the covariate AvgHrsWk is not significant to the intervention.

Because the covariant was not found to be significant to the statistical model the researcher dropped the covariant from the statistical analysis (Table 26). This lack of

significance is the rationale that has led the researcher to retain null hypothesis number six and reject alternative hypothesis number six.

Table 25 Tests of Between-Subjects Effects for ATG-S.

Measure: ATG_S

Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	1397.564	1	1397.564	712.403	.000
AvgHrsWk	.564	1	.564	.288	.594
Group	.037	1	.037	.019	.891
Error	103.973	53	1.962		

Table 26 Tests of Within-Subjects Effects for ATG-S Without Covariate Using Greenhouse-Geisser Correction.

Measure: ATG_S

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Time	30.520	1.000	30.520	34.425	.000
Time * Group	.074	1.000	.074	.084	.773
Error(Time)	47.874	54.000	.887		

The within-subjects effects table for the ATG-S cohesive factor without the covariate AvgHrsWk indicates there is a main effect using Greenhouse-Geisser for the Time variable ($F(1, 54)=34.425$, $p<.01$). There is not a significant interaction between the variables Time/Group ($F=0.084$; $p=.773$).

The multivariate test using Hotelling's Trace for Time as a main effect shows the observed power is 1.000 for the ATG-S cohesive factor (Table 27). Since the value is greater than the desired power 0.80 the study has the sufficient statistical power to accept the alternative

hypothesis H₁₂ in that there was a difference in the team cohesion factor ATG-S based upon the intervention.

Table 27 Observed Power for ATG-S Using Hotelling's Trace Coefficient.

Effect	Value	F	Hypothesis df	Error df	Sig.	Observed Power(a)
Time	.638	34.425(b)	1.000	54.000	.000	1.000
Time * Group	.002	.084(b)	1.000	54.000	.773	.059

a Computed using alpha = .05

b Exact statistic

c Design: Intercept+group

Within Subjects Design: Time

Group Integration-Task Subscale Results (GI-T)

A summary of the descriptive statistics for the GI-T sub-scale is shown in Table 28. The mean and standard deviations are representative of the pre and post tests completed for each of the GI-T GEQ cohesive factor. The descriptive statistics shown in Table 28 indicate that group 1 had an individual attraction to the group's task (GI-T) pre-test mean of 5.483 with a post-test mean of 6.572 for a gain score of 1.089. The pre-test and post test means were greater than the GEQ median of 5 for the Likert scale questions. Group 2 had an individual attraction to the group's task (GI-T) pre-test mean of 5.104 with a post-test mean of 6.296 for a gain score of 1.192. The pre-test and post test means were greater than the GEQ median of 5 for the Likert scale questions.

Levene's test for error variances for the GI-T cohesive factor show the variances to be equal (Table 29). The significance levels (Sig.) are greater than the alpha level (.05) so the equal variances hypothesis is not rejected and equal variances are assumed for this cohesive factor.

Table 28 Descriptives for GI-T (How the Team Functions to Achieve Goals).

	group	Mean	Std. Deviation	N
Pre GI-Task	1	5.483	.9000	29
	2	5.104	.5880	27
	Total	5.300	.7825	56
Post GI-Task	1	6.572	.9377	29
	2	6.296	.9121	27
	Total	6.439	.9275	56

Table 29 Levene's Test of Equality for the GI-T Cohesive Factor.

	F	df1	df2	Sig.
Pre GI-Task	2.361	1	54	.130
Post GI-Task	.003	1	54	.957

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a Design: Intercept+avghrswk+group

Within Subjects Design: Time

A repeated measures ANCOVA with an alpha level of 0.05 was used and the results tested each hypothesis within the research. Table 30 shows the Tests of Within-Subjects Effects with a covariate for the GI-T.

Table 30 Tests of Within-Subjects Effects for GI-T With a Covariate Using Greenhouse-Geisser Correction.

Measure: GI_T					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Time	22.365	1.000	22.365	28.792	.000
Time * AvgHrsWk	.913	1.000	.913	1.175	.283
Time * Group	.271	1.000	.271	.349	.557
Error(Time)	41.170	53.000	.777		

The within-subjects effects table for the GI-T cohesive factor with the covariate AvgHrsWk indicates there is a main effect using the Greenhouse-Geisser correcting the violation of sphericity for the Time variable ($F(1, 53)=28.792, p<.01$). There is not a significant interaction between the two variables Time/AvgHrsWk ($F=1.175; p=.283$) or Time/Group ($F=0.349; p=.557$).

Table 31 indicates that the covariant AvgHrsWk has a statistical significance of 0.449 which is well above the 0.05 alpha, effectively demonstrating that the covariant is not significant to the interaction between the independent variables (time and group) and the dependent variable (GI-T). The null hypothesis H_{07} is not rejected since the covariate AvgHrsWk is not significant to the intervention.

Table 31 Tests of Between-Subjects Effects for GI-T.

Measure: GI_T					
Transformed Variable: Average					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	1665.414	1	1665.414	2490.100	.000
AvgHrsWk	.389	1	.389	.581	.449
Group	3.372	1	3.372	5.042	.029
Error	35.447	53	.669		

Because the covariant was not found to be significant to the statistical model the researcher dropped the covariant from the statistical analysis (Table 32). This lack of significance is the rationale that has led the researcher to retain null hypothesis number seven and rejects alternative hypothesis number seven.

Table 32 Tests of Within-Subjects Effects for GI-T Without Covariate Using Greenhouse-Geisser Correction.

Measure: GI_T					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Time	36.414	1.000	36.414	46.726	.000
Time * Group	.074	1.000	.074	.095	.759
Error(Time)	42.083	54.000	.779		

The within-subjects effects table for the GI-T cohesive factor without the covariate AvgHrsWk indicates there is a main effect using Greenhouse-Geisser for the Time variable ($F(1, 54)=46.726, p<.01$). There is not a significant interaction between the variables Time/Group ($F=0.095; p=.759$).

The multivariate test using Hotelling's Trace for Time as a main effect shows the observed power is 1.000 for the GI-T cohesive factor (Table 33). Since the value is greater than the desired power 0.80 the study has the sufficient statistical power to accept the alternative hypothesis H_{13} in that there was a difference in the team cohesion factor GI-T based upon the intervention.

Group Integration-Social Subscale Results (GI-S)

A summary of the descriptive statistics for the GI-S sub-scale is shown in Table 34. The mean and standard deviations are representative of the pre and post tests completed for each of the GI-S GEQ cohesive factor.

The descriptive statistics shown in Table 34 indicate that group 1 had an individual attraction to the group's task (GI-S) pre-test mean of 5.000 with a post-test mean of 5.595 for a gain score of 0.595. The post test mean was greater than the GEQ median of 5 for the Likert

scale questions. Group 2 had an individual attraction to the group's task (GI-S) pre-test mean of 5.185 with a post-test mean of 5.630 for a gain score of 0.445. The pre-test and post test means were greater than the GEQ median of 5 for the Likert scale questions.

Table 33 Observed Power for GI-T Using Hotelling's Trace Coefficient.

Effect	Value	F	Hypothesis df	Error df	Sig.	Observed Power(a)
Time	.865	46.726(b)	1.000	54.000	.000	1.000
Time * Group	.002	.095(b)	1.000	54.000	.759	.061

a Computed using alpha = .05

b Exact statistic

c Design: Intercept+group

Within Subjects Design: Time

Table 34 Descriptives for GI-S (How the Team Functions at a Social Level).

	group	Mean	Std. Deviation	N
Pre GI-Social	1	5.000	.8609	29
	2	5.185	.7583	27
	Total	5.089	.8110	56
Post GI-Social	1	5.595	1.3151	29
	2	5.630	1.0246	27
	Total	5.612	1.1735	56

Levene's test for error variances for the GI-S cohesive factor show the variances to be equal (Table 35). The significance levels (Sig.) are greater than the alpha level (.05) so the equal variances hypothesis is not rejected and equal variances are assumed for this cohesive factor.

A repeated measures ANCOVA with an alpha level of 0.05 was used and the results tested each hypothesis within the research. Table 36 shows the Tests of Within-Subjects Effects with a covariate for the GI-S.

Table 35 Levene's Test of Equality for the GI-S Cohesive Factor.

	F	df1	df2	Sig.
Pre GI-Social	1.219	1	54	.274
Post GI-Social	.680	1	54	.413

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a Design: Intercept+avghrswk+group

Within Subjects Design: Time

Table 36 Tests of Within-Subjects Effects for GI-S With a Covariate Using Greenhouse-Geisser Correction.

Measure: GI_S

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Time	3.181	1.000	3.181	4.777	.033
Time * AvgHrsWk	.004	1.000	.004	.006	.941
Time * Group	.159	1.000	.159	.239	.627
Error(Time)	35.293	53.000	.666		

The within-subjects effects table for the GI-S cohesive factor with the covariate AvgHrsWk indicates there is a main effect using the Greenhouse-Geisser correcting the violation of sphericity for the Time variable ($F(1, 53)=4.777$, $p=0.033$). There is not a significant interaction between the two variables Time/AvgHrsWk ($F=0.006$; $p=.941$) or Time/Group ($F=0.239$; $p=.627$).

Table 37 indicates that the covariant AvgHrsWk has a statistical significance of 0.268 which is well above the 0.05 alpha, effectively demonstrating that the covariant is not significant to the interaction between the independent variables (time and group) and the dependent variable (GI-S). The null hypothesis H_{08} is not rejected since the covariate AvgHrsWk is not significant to the intervention.

Table 37 Tests of Between-Subjects Effects for GI-S.

Measure: GI_S					
Transformed Variable: Average					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	1345.765	1	1345.765	959.141	.000
AvgHrsWk	1.761	1	1.761	1.255	.268
Group	.040	1	.040	.029	.866
Error	74.364	53	1.403		

Because the covariant was not found to be significant to the statistical model the researcher dropped the covariant from the statistical analysis (Table 38). This lack of significance is the rationale that has led the researcher to retain null hypothesis number eight and reject alternative hypothesis number eight.

The within-subjects effects table for the GI-S cohesive factor without the covariate AvgHrsWk indicates there is a main effect using Greenhouse-Geisser for the Time variable ($F(1, 54)=11.552, p=.001$). There is not a significant interaction between the variables Time/Group ($F=0.242; p=.625$).

Table 38 Tests of Within-Subjects Effects for GI-S Without Covariate Using Greenhouse-Geisser Correction.

Measure: GI_S					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Time	7.551	1.000	7.551	11.552	.001
Time * Group	.158	1.000	.158	.242	.625
Error(Time)	35.297	54.000	.654		

The multivariate test using Hotelling's Trace for Time as a main effect shows the Observed Power is 0.916 for the GI-S cohesive factor (Table 39). Since the value is greater than

the desired power 0.80 the study has the sufficient statistical power to accept the alternative hypothesis H₁₄ in that there was a difference in the team cohesion factor GI-S based upon the intervention.

Table 39 Observed Power for GI-S Using Hotelling's Trace Coefficient.

Effect	Value	F	Hypothesis df	Error df	Sig.	Observed Power(a)
Time	.214	11.552(b)	1.000	54.000	.001	.916
Time * Group	.004	.242(b)	1.000	54.000	.625	.077

a Computed using alpha = .05

b Exact statistic

c Design: Intercept+group

Within Subjects Design: Time

Summary

Group cohesion was affected by video game play but the time played did not have a significant effect. The GEQ variables all showed a significant increase and the quantitative results indicated that the groups experienced some kind of group cohesion change during the intervention. The results will be addressed in the conclusions chapter.

CHAPTER 5

CONCLUSIONS

The purpose of this study was to determine whether the intervention of having subjects play collaborative video games would impact team cohesion. It was hypothesized that for each of the Group Environment Questionnaire (GEQ) cohesive factors the intervention would achieve a greater degree of cohesion. It was also hypothesized that the estimated hours a subject played video games outside of the intervention was a factor affecting the results of the intervention. Since team cohesion has been linked to team performance (Ensley & Pearson, 2005) and can have a positive impact on performance (Mullen & Copper, 1994) and social interactions (Levi, 2007), playing video games was hypothesized to increase team cohesion and provide organizations with a competitive advantage to help teams and workers accomplish organizational tasks.

The 2 x 2 MANCOVA results indicate that number of hours subjects played video games outside the intervention were not significant. It also did not matter whether the subject participated in the one hour or the six hour intervention. What did matter was that the subject participated in the intervention by playing collaborative video games which positively increased the degree of cohesion. The repeated measures 2 x 2 ANCOVA and ANOVA results were used as a post hoc analysis for each GEQ cohesive factor confirmed by the MANCOVA results.

Post Hoc Conclusions for Individual Attraction to the Group – Task (ATG-T)

The ATG-T cohesive factor evaluates the subject's feelings about personal involvement in the group's task, productivity, goals, and objectives. The first research question was linked to the ATG-T cohesive factor answering what was the change in the degree (scale) of the cohesive factor individual attraction to the group-task (ATG-T) based upon the intervention program.

Based upon the analysis both groups showed a significant degree increase in the degree of team cohesion that explained the personal involvement an individual felt pertaining to the group's task productivity and meeting the goals and objectives associated with the task. Quantitative results showed a significant increase in the means and gain scores for each group. Group 2, which had six hours of intervention, had a gain score increase of 42%. Group 1, which had one hour of intervention, had a gain score increase of 38%.

The repeated measures ANCOVA indicated that the covariant AvgHrsWk had a statistical significance of 0.307 effectively demonstrating that the covariant was not significant to the interaction and resulting in the null hypothesis H_{05} not being rejected.

The Greenhouse-Geisser value for the Time variable was $p < .01$ with an observed power of 0.989 indicating that Time has a main effect of the cohesive factor ATG-T and that the null hypothesis H_{01} should be rejected and H_{11} should be accepted in that the intervention did make a difference in the level of team cohesion. Whether a subject participated in the one hour or six hour intervention there was a significant increase in their feelings about personal involvement in the group's task, productivity, goals, and objectives.

However, the results did not verify that the actual length of the intervention translated into higher degrees of cohesion. It was the act of participating in the intervention that caused an increase.

Post Hoc Conclusions for Individual Attraction to the Group – Social (ATG-S)

The ATG-S cohesive factor evaluates the subject's perception about their personal involvement, acceptance, and social interaction within the group. The second research question was linked to the ATG-S cohesive factor answering what was the change in the degree (scale) of the cohesive factor individual attraction to the group-social (ATG-S) based upon the intervention program.

Based upon the analysis both groups showed a significant degree increase in the degree of team cohesion that explained the personal involvement, acceptance, and social interaction an individual felt pertaining to the group's task productivity and meeting the goals and objectives associated with the task. Quantitative results showed a significant increase in the means and gain scores for each group. Group 2, which had six hours of intervention, had a gain score increase of 27%. Group 1, which had one hour of intervention, had a gain score increase of 24%.

The repeated measures ANCOVA indicated that the covariant AvgHrsWk had a statistical significance of 0.594 effectively demonstrating that the covariant was not significant to the interaction and resulting in the null hypothesis H_06 not being rejected.

The Greenhouse-Geisser value for the Time variable was $p < .01$ with an observed power of 1.000 indicating that Time has a main effect of the cohesive factor ATG-S and that the null hypothesis H_02 should be rejected and H_12 should be accepted in that the intervention did make a difference in the level of team cohesion. Whether a subject participated in the one hour or six hour intervention there was a significant increase in their feelings about personal involvement, acceptance, and social interaction within the group.

However, the results did not verify that the actual length of the intervention translated into higher levels of cohesion. It was the act of participating in the intervention that caused an increase.

Post Hoc Conclusions for Group Integration – Task (GI-T)

The GI-T cohesive factor evaluates the subject's perception about the similarity, closeness, and bonding within the group around the task. The third research question was linked to the GI-T cohesive factor answering what was the change in the degree (scale) of the cohesive factor group integration-task (GI-T) based upon the intervention program.

Based upon the analysis both groups showed a significant degree increase in the degree of team cohesion that explained the individual feelings pertaining to the perception about the similarity, closeness, and bonding within the group around the task. Quantitative results showed a significant increase in the means and gain scores for each group. Both Group 2, which had six hours of intervention, and Group 1, which had one hour of intervention, showed a 31% gain score increase.

The repeated measures ANCOVA indicated that the covariant AvgHrsWk had a statistical significance of 0.449 effectively demonstrating that the covariant was not significant to the interaction and resulting in the null hypothesis H_{07} not being rejected.

The Greenhouse-Geisser value for the Time variable was $p < .01$ with an observed power of 1.000 indicating that Time has a main effect of the cohesive factor GI-T and that the null hypothesis H_{03} should be rejected and H_{13} should be accepted in that the intervention did make a difference in the level of team cohesion. Whether a subject participated in the one hour or six hour intervention there was a significant increase in their feelings about perception about the similarity, closeness, and bonding within the group around the task.

However, the results did not verify that the actual length of the intervention translated into higher levels of cohesion. It was the act of participating in the intervention that caused an increase.

Post Hoc Conclusions for Group Integration – Social (GI-S)

The GI-S cohesive factor evaluates the subject's perception about the similarity, closeness, and bonding within the group around the social aspects. The fourth research question was linked to the GI-S cohesive factor answering what was the change in the degree (scale) of the cohesive factor group integration-social (GI-S) based upon the intervention program.

Based upon the analysis both groups showed a significant degree increase in the degree of team cohesion that explained the individual feelings pertaining to the perception about the similarity, closeness, and bonding within the group around the social aspect. Quantitative results showed a significant increase in the means and gain scores for each group. In this analysis Group 1, which had one hour of intervention, showed a 15% gain score increase. Group 2, which had six hours of intervention, showed a 12% gain score increase. This was the only cohesive factor where the group that had a shorter intervention actually showed greater signs of increase in the levels of cohesion.

The repeated measures ANCOVA indicated that the covariant AvgHrsWk had a statistical significance of 0.268 effectively demonstrating that the covariant was not significant to the interaction and resulting in the null hypothesis H_{08} not being rejected.

The Greenhouse-Geisser value for the Time variable was $p < .01$ with an observed power of 0.916 indicating that Time has a main effect of the cohesive factor GI-S and that the null hypothesis H_{04} should be rejected and H_{14} should be accepted in that the intervention did make a difference in the level of team cohesion. Whether a subject participated in the one hour or six

hour intervention there was a significant increase in their feelings about perception about the similarity, closeness, and bonding within the group around the social aspect.

However, the results did not verify that the actual length of the intervention translated into higher levels of GI-S cohesion. It was the act of participating in the intervention that caused an increase.

Implications

Today's global economy requires that organizations constantly seek for ways to improve and surpass their competition. A variety of strategies could be implemented to improve different aspects of the organization and if team cohesion could be strengthened the result could be improved team performance. Organizations continue to search for mechanisms to improve teamwork by finding and implementing new methods for effectively accomplishing a task and increasing social capacities for individuals to handle problems. Strategies for improvement include making a team more cohesive so that the members are more committed thus increasing productivity and performance.

A reasonable deduction in the origination of this dissertation was that if playing collaborative video games increases team cohesion then playing for more hours would result in greater increases. The results of this study confirmed that playing collaborative video games could indeed increase team cohesion in every GEQ cohesive factor. However, it appears that if you play one hour or six hours you could still achieve an increase in team cohesion. This would imply that if an organization would like to increase the different aspects of cohesion as measured by the GEQ then a team building activity of playing collaborative video games could be implemented.

The six hours of video game play did produce greater increase in cohesion but only marginally. The ATG-T and ATG-S which measured the individual attraction to the task and social aspect had slight increases in the gain score percentages but one must consider whether or not the amount of game play to achieve that gain justified the intervention time.

The one hour of video game actually received the same level of increase for the GI-T cohesive factor and scored a greater increase on the GI-S meaning that if the ultimate goal was to increase the group member's perception of closeness, similarity, and bonding with the group then only one hour of game play could be implemented to achieve the organization's goal.

Playing collaborative video games as a group could be a mechanism for a positive change in cohesion. It did not matter if the subjects have not played video games before or if they consider themselves masters at video game play. Something unique occurred to teams participating in this intervention and results indicate that the increases in cohesion resulted simply from playing a collaborative video game.

Further Studies

If an organization could increase team cohesion then groups could be more effective. Groups are commonly used throughout a variety of environments including but not limited to industry, academia, military, and sports. Increasing team cohesion leads to increased performance. This study examined whether or not playing collaborative video games increases cohesion. Although the study focused on two timed interventions of one hour and six hours over a one to three week span, it may provide opportunities for researchers to implement other interventions to determine the most productive length of the video game play intervention and environments where the intervention contributes to increased performance and productivity.

Recommendation #1

Recommend a follow-up study be conducted to determine whether or not a group watching someone playing video games could achieve the same levels of cohesion. The premise is based upon the idea that watching sports teams fosters feelings of belongingness and self worth. This study indicated that cohesion was increased due to the intervention but the recommended research would examine whether it was the video game mechanism or the act of playing the video game responsible for increasing cohesion.

Recommendation #2

Conduct a study that would determine the length of time required to achieve increases in cohesion and level which is most productive. This study revealed that both the one hour and six hours of intervention resulted in increased cohesion. The recommended study could analyze if the same level of cohesion could occur in less time thus allowing organizations to implement shorter interventions for greater returns on cohesion increases.

Recommendation #3

The video game used in this intervention was Halo3 with an ESRB rating of 'M' for mature. Conduct a study using a variety of collaborative video game genres to identify whether a specific genre or game results in higher levels of cohesion. Organizations look for ways to garner a greater return on their investment. Employee time participating in an intervention is an investment of resources. An organization might be able to achieve greater increases in cohesion based upon a specific video game genre being implemented.

Recommendation #4

Implement a video game play intervention analyzing a variety of settings such as industry, academia, military, and sports to determine the change in performance before and after

the intervention. This study examined whether or not the act of playing collaborative video games increased team cohesion. The proposed research could implement an intervention based upon a variety of environments such as the quality on the job related to a specific task, increased academic scores, effectiveness of a military operation, or the success of a sports team.

Recommendation #5

Recommend conducting a study to determine if winning or losing while playing the collaborative video game affects team cohesion. This study did not record wins and losses nor did it reward the team for performing the best and defeating other teams.

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APPENDIX A: LIST OF ACRONYMS

ANCOVA:	Analysis of Covariance
ANOVA:	Analysis of Variance
ATG-S:	Individual Attraction to the Group-Social
ATG-T:	Individual Attraction to the Group-Task
ERA:	Entertainment Retailers Association
ESA:	Entertainment Software Association
ESRB:	Entertainment Software Rating Board
FPS:	First Person Shooter
GCS:	Group Cohesion Scale
GCS-R:	Group Cohesion Scale-Revised
GEQ:	Group Environment Questionnaire
GI-S:	Group Integration-Social
GI-T:	Group Integration-Task
ICRA:	Internet Content Rating Association
MANCOVA:	Multivariate Analysis of Covariance
MMOG:	Massively-Multiplayer Online Game
MMORPG:	Massively-Multiplayer Online Role-Playing Game
OME:	Outdoor Management Education
PCI:	Platoon Cohesion Index

SCQ:	Sports Cohesiveness Questionnaire
SNES:	Super Nintendo Entertainment System
SPSS:	Statistical Package for Social Scientists
VCS:	Video Computer System

APPENDIX B: IRB APPROVAL LETTER



Institutional Review Board

*Terre Haute, Indiana 47809
812-237-3088
Fax 812-237-3092
Federal Wide Assurance Number:
FWA00001884*

November 12, 2009

Gregory Anderson
George Maughn, Ph.D.
Department of Technology Management
College of Technology
Indiana State University

RE: The effects of collaborative video games on team cohesion (IRB # 10-069)

Dear Mr. Anderson:

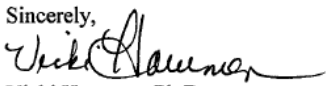
The Institutional Review Board has conducted an expedited review of your proposed research project listed above. Your proposed study is approved. The approval for this study expires on **October 30, 2010**. Prior to the approval expiration date, if you plan to continue this study you will need to submit a continuation request (Form E) for review and approval by the IRB. Additionally, once you complete your study, you will need to submit the Completion of Activities report (Form G).

Informed Consent: I have enclosed your informed consent form with the IRB stamp. Please either copy this form for use or type the IRB number, approval date, and expiration information at the bottom of the informed consent form. As a reminder, the signed informed consent forms must be kept for at least three years after your study is completed.

Reporting of Problems: Any problems involving risk to subjects or others, injury or other adverse effects experienced by subjects, and incidents of noncompliance must be reported to the IRB Chairperson or Vice Chairperson via phone or e-mail immediately. Additionally, you must submit Form F to the Office of Sponsored Programs within 5 working days after first awareness of the problem.

Modifications: Any modifications to this proposed study or to the informed consent form will need to be submitted using Form D for review and approval by the IRB prior to implementation.

If you have any questions, please contact the Office of Sponsored Programs at 812-237-3088 or irb@indstate.edu, your question will be directed to the appropriate person. I wish you well in completing your study.

Sincerely,

Vicki Hammen, Ph.D.
Vice Chair, Institutional Review Board

cc: Dawn Underwood, IRB Administrator

APPENDIX C: IRB MODIFICATION APPROVAL LETTER

December 7, 2009

Gregory Anderson

George Maughan, Ph.D.

Department of Technology Management

College of Technology

Indiana State University

RE: The effects of collaborative video games on team cohesion (IRB # 10-069)

Dear Mr. Anderson:

The modification request for the above referenced research project has been reviewed by the Institutional Review Board (IRB) through the minor modification review procedure. Your modification request that includes:

- Reduction in subjects' participation time.

has been approved. The IRB approval expiration date for this study, including these modifications, remains the same as that granted by the IRB after its review of your original application, October 30, 2010. Prior to the approval expiration date, if you plan to continue this study, you will need

to submit a continuation request (Form E) for review and approval by the IRB. Lastly, once you complete your study, please submit the completion of activities report (Form G).

Informed Consent: If there were revisions to your informed consent document a stamped copy has been enclosed. Please either copy this form or type the IRB number, approval date, and expiration date at the bottom of the revised informed consent form.

Reporting of Problems: If an adverse event occurs or risk to participants is increased, you must report it to the IRB Chairperson or Vice Chairperson via phone or e-mail immediately and submit Form F to the Office of Sponsored Programs within 5 working days after first awareness of the problem.

Modifications: If you would like to make additional modifications to this study or to the informed consent forms, please submit another Form D for review and approval before implementation.

If you have any questions, please contact the Office of Sponsored Programs at 812-237-3088 or irb@indstate.edu, your question will be directed to the appropriate person. I wish you well in completing your study.

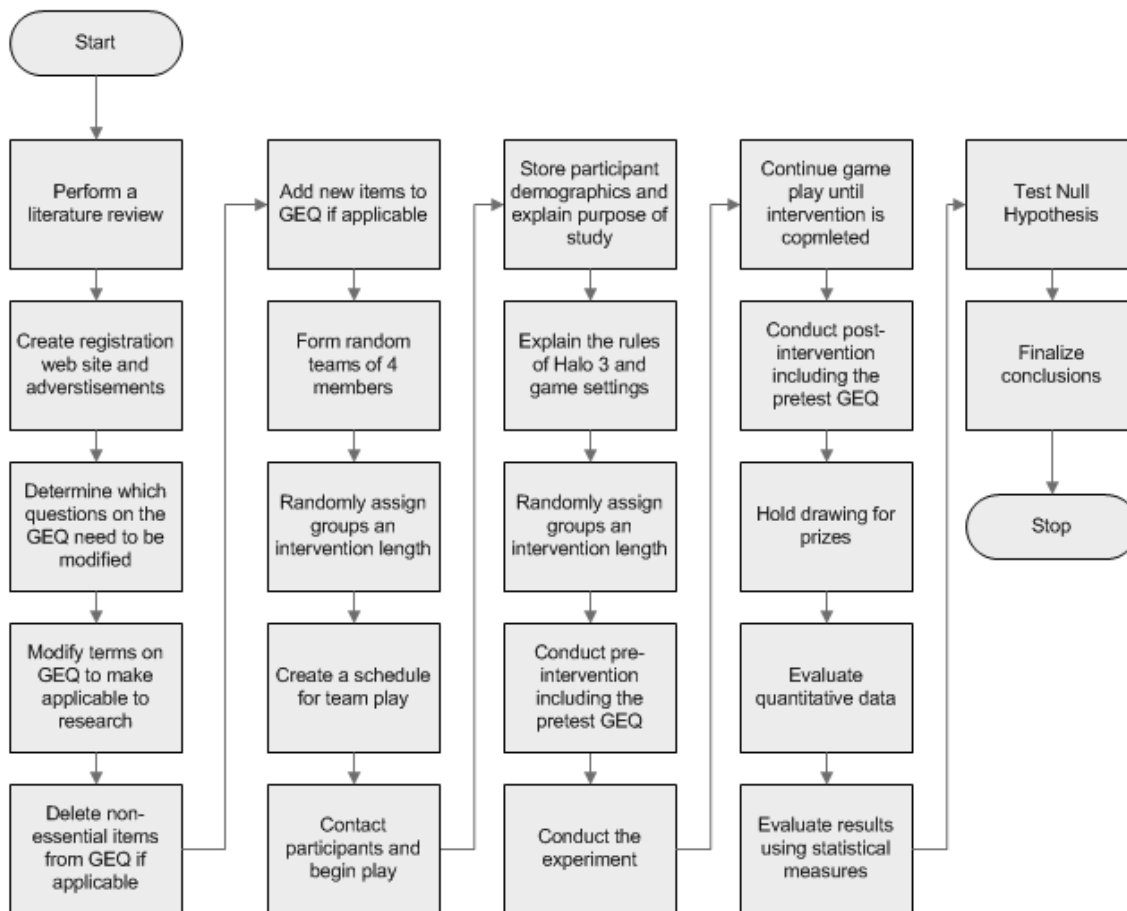
Sincerely,

Vicki Hammen, Ph.D.

Vice Chair, IRB

cc: Dawn Underwood, IRB Administrator

APPENDIX D: FLOWCHART OF PROCEDURES



APPENDIX E: INFORMED CONSENT FORM

CONSENT TO PARTICIPATE IN RESEARCH **Collaborative Video Game Play Study**

You are invited to participate in a research study conducted by Greg Anderson, who is a doctoral student from the Technology Management Department at Indiana State University. Mr. Anderson is conducting this study for his doctoral dissertation. Dr. George Maughan is his faculty sponsor for this project.

Your participation in this study is entirely voluntary. You should read the information below and ask questions about anything you do not understand, before deciding whether or not to participate. You are being asked to participate in this study because you are a Weber State University student between the ages of 18 and 29.

PURPOSE OF THE STUDY

The purpose of this study is to see how if playing collaborative video games increases a sense of team cohesion We hope to use what we learn from the study inform society of a benefit from playing collaborative video games and provide another means for industry to achieve greater team cohesion.

PROCEDURES

If you volunteer to participate in this study, we will ask you to do the following:

1. We will ask you to take part in playing Halo 3 for 2 hours, one day a week as a group competing against other teams. The study will last up to 3 weeks requiring at most 6 hours of video game play.
2. You will be required to take an 18 question pre-test before game play begins and an 18 question post-test when game play ends.
3. You must be present for each of your game play sessions or you will be dropped from the study.

POTENTIAL RISKS AND DISCOMFORTS

We expect that any risks, discomforts, or inconveniences will be minor and we believe that they are not likely to happen. If discomforts become a problem, you may discontinue your participation.

POTENTIAL BENEFITS TO SUBJECTS AND/OR TO SOCIETY

It is not likely that you will benefit directly from participation in this study, but the research should help us learn whether or not playing collaborative video games can have a positive effect on team cohesion.

PAYMENT FOR PARTICIPATION

You will not receive any payment or other compensation for participation in this study. There is also no cost to you for participation. However, your name will be entered into a drawing to win an Xbox gaming system.

CONFIDENTIALITY

Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission or as required by law. Confidentiality will be maintained by means of a code number to let Mr. Anderson and Dr. Maughan know who you are.

We will not use your name in any of the information we get from this study or in any of the research reports. When the study is finished, we will destroy the list that shows which code number goes with your name. Information that can identify you individually will not be released to anyone outside the study. Mr. Anderson will, however, use the information collected in his dissertation and other publications. We also may use any information that we get from this study in any way we think is best for publication or education. Any information we use for publication will not identify you individually.

PARTICIPATION AND WITHDRAWAL

You can choose whether or not to be in this study. If you volunteer to be in this study, you may withdraw at any time without consequences of any kind. You may also refuse to answer any questions you do not want to answer. There is no penalty if you withdraw from the study.

IDENTIFICATION OF INVESTIGATORS

If you have any questions or concerns about the research, please feel free to contact
Mr. Greg Anderson
Principal Investigator
Department of Computer Science
2401 University Circle
Ogden, UT 84408-2401
801-626-8098
ganderson@weber.edu

RIGHTS OF RESEARCH SUBJECTS

If you have any questions about your rights as a research subject, you may contact the Indiana State University Institutional Review Board (IRB) by mail at Indiana State University, Office of Sponsored Programs, Terre Haute, IN 47809, by phone at (812) 237-8217, or e-mail the IRB at irb@indstate.edu.

You will be given the opportunity to discuss any questions about your rights as a research subject with a member of the IRB. The IRB is an independent committee composed of members of the University community, as well as lay members of the community not connected with ISU. The IRB has reviewed and approved this study.

I understand the procedures described above. My questions have been answered to my satisfaction, and I agree to participate in this study. I have been given a copy of this form.

Printed Name of Subject

Signature of Subject Date

Indiana State University
Institutional Review Board

IRB Number: _____

Approval: _____

Expiration Date: _____

APPENDIX F: MODIFIED GEQ PRETEST

The Group Environment Questionnaire (Pre Test) Subject # _____

Before taking this survey you should have spent 5 minutes just getting to know a little bit about each team member (i.e. Hobbies, favorite video games, work, school, etc.)

Before taking this survey, for 5 minutes discuss any strategies for how you will play the video game in order to achieve the best performance

Average number of hours you play video games a week: _____

Have you played Halo 3 before: Yes No

In your opinion, what is your Halo 3 skill level: Easy Medium Hard

Please respond by checking a numerical response for each question.

1. I do not enjoy being a part of the social interaction of this team

Strongly

Strongly

Disagree

Agree

1 2 3 4 5 6 7 8 9

2. I am not happy with my level of participation within the video game play and what my responsibilities are during the game

Strongly

Strongly

Disagree

Agree

1 2 3 4 5 6 7 8 9

3. I am not going to miss the members of this team when this video game play ends

Strongly

Strongly

Disagree

Agree

1 2 3 4 5 6 7 8 9

4. I am unhappy with my team's level of desire to do well in this video game

Strongly

Strongly

Disagree

Agree

1 2 3 4 5 6 7 8 9

5. I consider some members on this team my friends

Strongly

Strongly

Disagree

Agree

1 2 3 4 5 6 7 8 9

6. This team does not give me enough opportunities to improve my video game play skills

Strongly

Strongly

Disagree

Agree

1 2 3 4 5 6 7 8 9

7. I enjoy playing video games with other people more than with this team

Strongly

Strongly

Disagree

Agree

1 2 3 4 5 6 7 8 9

8. I do not like the style of how this team plays this video game

Strongly

Strongly

Disagree

Agree

1 2 3 4 5 6 7 8 9

9. For me, this team is could become or is one of the most important social groups to which I belong

Strongly

Strongly

Disagree

Agree

1 2 3 4 5 6 7 8 9

10. Our team is united in trying to reach its goals and performance in playing this game

Strongly

Strongly

Disagree

Agree

1 2 3 4 5 6 7 8 9

11. Members of our team would rather go out on their own and play rather than get together as a team and play

Strongly

Strongly

Disagree

Agree

1 2 3 4 5 6 7 8 9

12. We all take responsibility for any loss or poor performance by our team

Strongly

Strongly

Disagree

Agree

1 2 3 4 5 6 7 8 9

13. Our team members rarely socialize together and would not want to get together to socialize

Strongly

Strongly

Disagree

Agree

1 2 3 4 5 6 7 8 9

14. Our team members have conflicting aspirations for the team's performance

Strongly

Strongly

Disagree

Agree

1 2 3 4 5 6 7 8 9

15. Our team would like to spend time together outside of school time and this experiment

Strongly

Strongly

Disagree

Agree

1 2 3 4 5 6 7 8 9

16. If members of our team have problems while they are playing everyone wants to help them figure out how to improve their game play

Strongly

Strongly

Disagree

Agree

1 2 3 4 5 6 7 8 9

17. Members of our team do not or will not hang out together outside of this experiment time

Strongly

Strongly

Disagree

Agree

1 2 3 4 5 6 7 8 9

18. Members of our team do not communicate freely about each other's video game play abilities during game play

Strongly

Strongly

Disagree

Agree

1 2 3 4 5 6 7 8 9

2. I am not happy with my level of participation within the video game play and what my responsibilities are during the game
- | | | | | | | | | | | |
|----------|---|---|---|---|---|---|---|---|--|----------|
| Strongly | | | | | | | | | | Strongly |
| Disagree | | | | | | | | | | Agree |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | | |

3. I am not going to miss the members of this team when this video game play ends

Strongly

Strongly

Disagree

Agree

1 2 3 4 5 6 7 8 9

4. I am unhappy with my team's level of desire to do well in this video game

Strongly

Strongly

Disagree

Agree

2 2 3 4 5 6 7 8 9

5. I consider some members on this team my friends

Strongly

Strongly

Disagree

Agree

1 2 3 4 5 6 7 8 9

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