# Walden University

SCHOOL OF MANAGEMENT

This is to certify that the doctoral dissertation by

Richard D. Blunt

has been found to be complete and satisfactory in all respects,
and that any and all revisions required by
the review committee have been made.

Review Committee
Dr. Ruth Maurer, Committee Chairperson, Applied Management and Decision Sciences Faculty
Dr. Gary Gemmill, Committee Member, Applied Management and Decision Sciences Faculty
Dr. Marilyn Simon, Committee Member, School of Education Faculty

President and Provost

Paula E. Peinovich, Ph.D.

Walden University
2006

ABSTRACT

A Causal-Comparative Exploration Of The Relationship Between Game-Based Learning And Academic Achievement: Teaching Management With Video Games

by

Richard D. Blunt

M.S., George Mason University, 2000
M.S., Lesley College, 1997
B.S., United States Naval Academy, 1981

Dissertation Submitted in Partial Fulfillment
of the Requirements for the Degree of
Doctor of Philosophy
Applied Management and Decision Sciences

Walden University
August 2006

# ABSTRACT

The field of game-based learning is expected to grow to more than $125,000,000 in 2006. However, Dr. Jan Cannon-Bowers (2006), eminent researcher in the field of the science of learning, recently challenged the efficacy of game-based learning: “We are charging head-long into game-based learning without knowing if it works or not. We need studies.” The problem addressed by this study was the lack of research into the effectiveness of game-based learning. The problem affects academia, parents, organizations involved in training, and of course, students. The purpose was to explore the relationship between the use of video games and learning. Research questions revolved around the effects of video game use on overall class scores, gender-based scores, ethnic-based scores, and age-based scores.

A causal-comparative study was conducted at ABC University to examine the difference in academic achievement between students who did and did not use video games in learning. A video game was added to half the classes teaching 3rd year management students. Identical testing situations were used while data collected included game use, test scores, gender, ethnicity, and age. ANOVA, chi-squared, and *t* tests were used to test game use effectiveness.

Students in classes using the game scored significantly higher means than classes that did not. There were no significant differences between genders, yet both genders scored significantly higher with game play. There were no significant differences between ethnicities, yet all ethnic groups scored significantly higher with game play. Students 40 years and under scored significantly higher with game play, while students 41 and older did not.

Such significant increases in student learning could lead to positive social change as games and simulations become standard teaching tools. If further studies continue to prove the efficacy of game-based learning, America's educational system faces a revolution in learning.

# A Causal-Comparative Exploration Of The Relationship Between Game-Based Learning And Academic Achievement: Teaching Management With Video Games

by

Richard D. Blunt

M.S., George Mason University, 2000
M.S., Lesley College, 1997
B.S., United States Naval Academy, 1981

Dissertation Submitted in Partial Fulfillment
of the Requirements for the Degree of
Doctor of Philosophy
Applied Management and Decision Sciences

Walden University
August 2006

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

# CHAPTER 1:
# INTRODUCTION TO THE STUDY

## Background of the Problem

The public and private sectors are faced with challenges in expanding technology-based solutions that can make their personnel more efficient, effective, knowledgeable, and flexible. Of growing interest in some sectors, such as the Department of Defense, is the potential of using commercial off-the-shelf (COTS) game-based learning for increasing learning and performance. Over the past 25 years, games have evolved from black-and-white blips made by hobbyists into a complex multi-billion dollar industry. Over the past 5 years, interactive digital entertainment — computer and video games, have made significant strides in developing immersive worlds, interactive stories, massively multiplayer on-line communities, while tackling a broader range of themes and human experience. The military recruits and entry-level civilians of today not only understand technology in every day use, they expect it. These young workers are *digital natives* who were raised in a digital environment surrounded by inexpensive, yet highly interactive gaming systems. Today's college generation grew up with video games from infancy. They can process more information not only faster but in a different way than most experienced academicians can.

Some educators see games as a useful and perhaps even necessary learning environment suitable for learners of all ages. However, there are obstacles to this blending. One issue concerns the translation of *fun* elements in games to settings of institutional learning where intellectual content is king. Adolescent students often complain that they cannot see the relationship between school participants and real life.

Adult learners view the manipulation of teaching strategies for entertainment value as transparent and reject hybrid experiences as patronizing. Critics of educational game design say that products have erred too far in the direction of weightiness and away from the attraction of play. Indeed, "designers have been tempted to hold children's play at arm's length, by referring to games for education as 'serious' games and thus completely different from the idle pastimes of the young" (Corbeil, p. 163).

To get the most from our new *best and brightest*, new research into game-based learning must be done. This study may help answer some of the questions now surrounding game-based learning and determine the relationship between the use of video games and learning as measured on standardized tests. It provides answers to both skeptics and supports.

## Statement of the Problem

Because of the pervasive presence of technology while they were growing up, today's college-level students learn differently than the way most college instructors learned while they were growing up without technology (Prensky, 2001, pp. 35-46). Yet, there is not enough research to determine the relationship between video games and learning.

During the recent Training 2006 Conference and Expo, David Milliken, founder of Blueline Solutions, spoke about the growing game-based learning industry:

> Right now the industry is small, but growing quickly. There's about $100 million in the corporate sector and at $25 million in the defense sector that I know about. This is more than twice what it was last year. I believe the game-based learning industry will grow at the rate of Moore's Law for the next several years (2006).

However, Cannon-Bowers (2006), eminent researcher in the field of the science of learning, challenged the efficacy of game-based learning during a panel discussion with Milliken:

> Simulations. We have plenty of empirical studies about simulations over the last 25 years. We know simulations work. We know simulation improve performance. We know simulations improve learning. Yet, I challenge anyone to show me a literature review of empirical studies about game-based learning. There are none. We are charging head-long into game-based learning without knowing if it works or not. We need studies.

In 2006, $125,000,000 is being spent on game-based learning without knowing if it works or not. The problem addressed by this research, then, is to determine the relationship between the use of video games and learning.

## Purpose of the Study

The purpose of this study was to determine the relationship between the use of video games and learning. Determining relationships, cause, or reason, for preexisting differences in groups of individuals (Wallen & Fraenkel, 2001, pp. 330-348) is the strengths of the casual-comparative study. The basic causal comparative approach starts with an effect (test scores) and seeks possible causes (game play).

## Theoretical Framework

This study used a wide body of recent literature that supports the superiority of a constructivist-learning paradigm, alternatively called experiential learning (DeKanter, 2005; Gee, 2004). “People learn best when they are entertained, when they can use creativity to work toward complex goals, when lesson plans incorporate both thinking and emotion, and when the consequences of actions can be observed” (Carlson, 2003, p.

A32). These needs are inherent in constructivist learning. While many video games support this type of learning, traditional lecture-based classroom activities do not support constructivist learning or in the computer-based teaching (CBT) supplements that typically accompany courses and texts (Black, 2001). A typical CBT product is a compact disk (CD) accompanying a textbook and provides some type of multimedia presentation of the text, followed by skill-and-drill, multiple-choice questions to assess whether students have mastered the text content (Black). As such, this type of *interactive* supplement encourages passive memorization of content, rather than learning from an active constructivist approach ("Gaming Draws Interest," 2005, p. 1).

In contrast, video games require players to be part of the learning environment. Their decisions typically affect the course of the game (Prensky, 2000). For example, in a virtual management situation the student has the opportunity to try different responses to a potential question. The student may decide first to hire additional staff, but if that does not produce the desired result, on another play attempt may decide to implement a technological solution instead. This enables the student to experience a situation from multiple perspectives (LoPiccolo, 2005). It further provides feedback to the student, increases real-life, problem-solving skills, and causes the student actually to be part of the learning environment, rather than a passive recipient of someone else's experience (Prensky, 2000).

Gee (2004) reported in his study of video games as a learning tool that this type of learning allows students to be situated within the learning environment and an active contributor to it. As active learners, they embark on a process of discovery through their video game play, allowing students to develop their own understanding and concept of

both content and environment (Gee, 2004). Students are also more likely to remember their experiences and be able to connect them to future situations and are more likely both to engage and invest in the learning goals and outcomes presented by the game (Barab, Barnett, & Squire, 2002; Gee, 2004). Doyle and Brown (2000) emphasized the enjoyment students have from playing video games increases their willingness both to invest in a game-based learning process and to remain motivated and engaged, even when challenged or facing difficult tasks. Furthermore, from a management perspective, games offer one of the few opportunities for students to develop skills and experience in certain areas, such as developing real soft skills outside the actual work environment (Walters & Coalter, 1997).

As in the real world, constructivist learning such as players experience in a video game provides one of the few truly three-dimensional (3-D) learning constructs available to the classroom teacher (DeKanter, 2005). Game-based learning anchors all the related learning components in a larger task or problem, just as managers would experience in real-world situations (DeKanter, 2005). It provides authentic tasks and environment, both challenges and supports the learner's critical thinking processes, and encourages trying out alternative views or methods without substantial risk to the player (DeKanter, 2005). In constructivism, knowledge and learning become "personally constructed by the learner and cannot be delivered in exact form from one mind to another" (Kirkley & Kirkley, 2005, p. 44). The learner not only must negotiate knowledge and meaning with others in the gaming environment, but often must construct entirely new concepts and personal models of how the world works (Kirkley & Kirkley, 2005). As such, according to Gary (2003, p. 3):

> Gaming doesn't just build workplace skills. It also appears to foster attitudes toward work that hiring managers want to see…the more frequent the respondent's game-playing activity, the stronger his attachment to the organization he worked for, the more likely he was to care about his relationships with his coworkers, and the greater his flexibility and motivation to work hard.

*Evaluation and Selection of the Game*

The Principles of Management course (MGMT 303) examines the fundamental management theories and the evolution of management thought and action within the last century. An understanding of traditional management practices and the changing requirements of management in a dynamic, global marketplace is balanced. Students learn how to develop and utilize effective problem solving, team building, leadership, and communications skills to meet the unpredictable nature of the business enterprise of tomorrow.

Choosing a commercially available off-the-shelf game not originally designed to teach principles of management, as a teaching supplement, was a simple, yet time-consuming process. The instructor must play the game to see how well, or not, the game covers the terminal course objectives. Inserting the terminal course objectives from the MGMT 303 learning objectives into the game-based learning taxonomy described in detail later in chapter 2 yields the game type most appropriate to choose for a learning environment.

Virtual U is very specific to the higher education field, although the skills and participants covered (hiring, budget allocation, and similar) are certainly applicable in almost any management situation (Virtual U Program, 2003). The game creates a college campus where students are in charge of the management of the university and by doing so increase understanding of management practices (Virtual U Program, 2003). As the

college president, a player confronts a variety of complex issues covering all components of a higher education institution (Virtual U Program, 2003). The player must address major areas such as operating budgets, hiring faculty, and endowment management as well as lesser areas such as campus parking and availability of athletic scholarships (Virtual U Program, 2003). The game even includes variables for student and faculty moral considerations and prestige of the institution (Virtual U Program, 2003).

Table 1 provides a summary evaluation of Virtual U. Table 1 uses the stoplight scoring system widely used in both government and private sector organizations (Results.com, 2006). The scorecard employs a simple grading system common today in well-run businesses.

Table 1.

*Virtual U Evaluation to Teach MGMT 303*

| | Terminal Course Objectives | Evaluation |
|---|---|---|
| 1. | Given a description of a specific business enterprise, write a management job description that incorporates the basic activities that comprise the management process and the job of a manager. | ◑ |
| 2. | Given a case describing an external environmental situation, write a report analyzing the internal and external environment of the business, including the organization's culture and the challenges of operating in an international, multinational, and global environment. | ● |
| 3. | Given a specific ethical situation, analyze the situation and prepare recommendations for a course of action that will promote ethical behavior. | ● |
| 4. | Given an example of a strategic business plan, evaluate the plan and provide recommendations to improve the plan and include more effective planning and decision-making. | ● |
| 5. | Given an example of a proposed organizational structure, identify the functional elements of the organization, create an organizational design and provide recommendations on organizational change. | ● |
| 6. | Given a specific staffing requirement, design a recruiting and development system that will attract, select, develop, and maintain human resources. | ◑ |
| 7. | Given a case or scenario involving a performance intervention, the student will prepare recommendations, which demonstrate an understanding of the individual-organization relationship and the elements affecting individual behavior, including personality, attitudes, and perceptions. | ◑ |
| 8. | Given a leadership scenario, recommend a course of action that incorporates the concepts of motivation and leadership to influence behavior. | ● |
| 9. | Given a situation that calls for improving interpersonal relations within an organization, create a plan of action that addresses the communication process, as well as the issues and methods of managing the interpersonal relationships of individuals, work groups, and teams. | ○ |
| 10. | Given a situation that requires the need to regulate organizational activities, students will create a management plan that includes the basic elements of control in organizations and that specifies how to manage information, operations, quality and productivity. | ● |

● for success ◑ for mixed results ○ for unsatisfactory

## Nature of the Study

The research was a causal-comparative exploratory study using archival data from a nationally known university in Arlington, VA. It examined the effectiveness of the

addition of a commercially available off-the-shelf game not originally designed to teach principles of management to an upper level undergraduate management principles course. The primary and fundamental problem this study addressed was to determine the relationship between the use of video games and learning. Yet, there is not enough research to determine the relationship between video games and learning. Such research could include insights into the relationships between video games and mean test scores, gender difference in mean scores, ethnicity differences in mean scores and age differences in mean scores.

### *Research Questions*

Research Question 1: What was the difference in academic achievement between students who used video games in learning and those who did not?

Research Question 2: What was the difference in academic achievement between male and female students who used video games in learning and those who did not?

Research Question 3: What was the difference in academic achievement between ethnic groups of students who used video games in learning and those who did not?

Research Question 4: What was the difference in academic achievement between age groups of students who used video games in learning and those who did not?

## Significance of the Study

The scholarly research of game-based learning is still in its infancy. Consequently, there were three compelling reasons to conduct this study. First, it provides quantitative data on the relationship between commercially available video

games and learning in a college course. Opposition to changes in academic curricula is often cost related; some opposition comes from limited availability or similar considerations. Using Virtual U in this study provides and argument to eliminate these oppositions. Additionally, this study documents relationships from both genders and a variety of racial backgrounds and age groups whether they can benefit from the addition of such games to management curriculum. Also, they can benefit midway through their college work, not just as a capstone-type enhancement.

*Importance to Learning*

The knowledge students gained from lectures, reading, and other classroom learning afforded them greater understanding of the game's deeper meanings, while the game playing reinforced and provided real-world application for information from the regular classroom (Doyle & Brown, 2000, p. 331). "The use of a business game in a business policy course gives students the opportunity to implement strategic concepts with some degree of realism" (Walters & Coalter, 1997, p. 172). Most games are used later in students' business training, often as a capstone course, and this research seeks to examine the benefit of both games as supplements in general and their effectiveness in early business education (Black, 2001, p. 6). Prensky (2000, pp. 66-67) puts it simply, if not dramatically:

> But the truth, as we all know — and most of us admit — is that our learning and training system *is* broken. Seriously broken. The evidence comes from reading and math scores, boredom, dropout rates, and lack of skills in the workforce. It comes from the fact that standardized tests are "dumbed down," that colleges and businesses must do remediation of basic skills, and that over 45 percent of American adults scored at levels 1 or 2 in the 1992 National Adult Literacy Survey, which means they "lack a sufficient foundation of basic skills to function successfully in our society."

*Social Change*

According to Mayo (2005), the U.S. ranks 80th out of 92 countries in the fraction of its college students who obtain bachelors degrees in the natural sciences and engineering. The U.S. also ranks 80th out of 92 countries in the fraction of its college students who obtain bachelors degrees in engineering. International (TIMSS) test scores show U.S. 4th graders to be 12th in the world in math and 6th in the world in science. U.S. 8th graders are 14th in the world in math; 9th in the world in science while 12th graders are 24th in the world in math; 22nd in the world in science. America educates many more people than other nations, but only a small fraction of those choose to major in science and engineering. If simulation games are effective learning tools for college students, particularly when used to augment traditional instruction, students will learn more effectively. Such games may assist students in applying, practicing, and ultimately developing greater understanding. Obviously, such a dramatic increase in student understanding of learning materials could lead to the recommendation that simulation and games be included as supplementation learning and teaching tools in most areas curriculum. Publishers and educators could consider the creation of such simulations as a needed component of textbook and curriculum development, with more publishers providing game simulations as accompaniments to college course texts. If game-based learning should prove to increase learning, America's education decline might not only be stopped, but also reversed.

## Assumptions, Limitations, Scope and Delimitations

### *Assumptions of the Study*

The researcher brought several assumptions related to both theories of change and theories of learning to this study, which should be noted:

1. All test questions came from the same test bank that accompanied the common textbook to minimize unwanted variation.

2. Identical testing situations and test materials were provided to all students, with a similar time limit, position of testing in the semester, and directions provided to all students to minimize unwanted variation.

3. An approximately normal distribution in scores was anticipated and equal standard deviations assumed.

4. The classes with game play were not given any additional class time in which to play the game; they were given the same amount of class time as the non-game classes to minimize the idea some students were given additional instruction.

### *Limitations of the Study*

First, the findings presented in this study may not be generalized to all settings for teaching this particular management course. Additionally, the sample findings may not be transferable to the overall population from which the sample was taken. Since management classes vary from university to university, the findings may not be transferable to other universities.

Second, some student groupings did not support a large enough sub-sample to analyze.

Third, there were seven different instructors who taught the course. Each instructor brought their own style, good points, and foibles to the mix of students. There was the potential for large variations in student performance that had nothing to do with the use of the video game because of the variations in the instructors.

Despite its several key advantages, causal-comparative research does have some serious limitations that should also be kept in mind (Gay, Mills, & Airasian, 2006, pp. 217-232):

1. Since the independent variable has already occurred, the same kinds of controls cannot be exercised as in an experimental study
2. Lack of randomization, manipulation, and control are also weaknesses
3. Lack of researcher control
4. An apparent cause and effect relationship may not be what it seems
5. Causes and effects may be reversed
6. An external third factor may actually be responsible for both the hypothesized case and the hypothesized effect
7. The results are, at best, tentative in most cases
8. Requires repeated measures to yield definitive results.

*Scope of the Study*

The scope of this study was limited to A causal-comparative study using archival student data from ABC University enrolled in a specific, 3rd year, junior-level

management principles course in Arlington, VA. The study described two sets of data: test results from students taught with the video game and test results from students taught without the video game. Tests were made using a bank of standardized test questions provided with the course text, *Management (8th ed.)* (Griffin, 2004). All students used this text for the management principles course and it serves as the guiding text for professors. The ABC University Academic Department provided archival test data including the following while keeping the student identity confidential: (a) class number, (b) test score, (c) gender, (d) ethnicity, and (e) age. These data were used both in data analysis of test scores and in making demographic generalizations between the sample population, the local campus population, and ABC University students on other campuses. Such data was kept in the ABC University Oracle Student System database and accessible to faculty and staff via the University's Wide Area Network (WAN). However, the sample included a diverse group of students who provided a rich data set for analysis. Additionally, a variety of different professors taught students this course.

*Delimitations of the Study*

1. The period of this study was 2005.
2. The study took test scores from both day-time semester length (15 week) students and nigh-time accelerated (8 week) classes.
3. The examination of archival test scores came from the three ABC University locations within the Washington, D.C. metropolitan area.
4. Gameplay was planned to be approximately 2 hours every other class period.

## Game or Simulation

The difference between a game and a simulation is not an easy distinction. As Aldridge (2006) recently told the audience at the Training 2006 Conference and Expo, "If your company doesn't like the word 'game,' use 'simulation.' If they think a 'simulation' is something boring, use 'game.'" There are several different definitions, stated differences, stated similarities, and variations of definitions in today's literature. The definitions offered by the Defense Modeling & Simulation office glossary of terms offers some guidance (DMSO, 1998):

1. Game: A physical or mental competition in which the participants, called players, seek to achieve some objective within a given set of rules.
2. Model: A physical, mathematical, or otherwise logical representation of a system, entity, phenomenon, or process.
3. Simulation: A method for implementing a model over time.

Therefore, for the purposes of this study, the following definitions will apply:

Game: An electronic-based competition in which the players seek to achieve some objective(s) within a given set of rules.

Simulation: A physical, mathematical, or otherwise logical representation of a real-world system, entity, phenomenon, or process over time.

## Definition of Terms

*Attention-relevance-confidence-satisfaction (ARCS) model* – consists of four conceptual categories related to human motivation as well as a set of specific strategies (Keller, 1987).

*Electronic learning (E-learning)* – learning using an electronic delivery medium, may be synchronous or asynchronous.

*Game generation* – People under the age of 50, and typically much younger, who grew up with games, television, and interactive technology. (Prensky, 2000).

*Game-based learning* – is an approach using games designed for learning, usually for younger learners raised on interactive technology.

*Gaming simulation* – similar to game-based learning, except simulations target skill attainment.

*Virtual U* – the video game used in this study that creates a college campus where students are in charge of the management of the university and by doing so increase understanding of management practices (Virtual U Program, 2005).

## Summary

The research was A causal-comparative exploratory study using archival data to examine the effect of the introduction of a commercially available off-the-shelf game not originally designed to teach principles of management. The game, Virtual U, was not designed for to teach the knowledge and learning of management principles for 3rd year, junior-level students at ABC University in Arlington, VA. This game introduced a supplement to traditional classroom instruction and textbooks. Data from tests of standardizes questions drawn from the course text were measures of student learning *Management* (Griffin, 2004). Based on a growing body of research that supports video game enhancements to college business curricula, four areas of comparison were undertaken. Specifically, student means (a) overall with and without game participation

and with division into comparison sets based on (b) gender, (c) race, and (d) age. Analysis of demographic data compared the sample to the campus and university-wide populations to see if the findings might be transferable to the larger populations.

Chapter 1 has presented the background of the study; statement of the problem; rationale for the study; and overview of the study, which includes the major research questions, objectives, outline, and operational definitions of key terms.

In chapter 2, a literature review presents adult learning theory, traditional instruction, video game-based learning, and an overview of business, economics, and management video games. The chapter also includes a section on the implications of related research for the focus and methodology of this study.

Chapter 3 explicates the research methods used for the dissertation, presenting an overview of the research methodology and rationale, a review of the research questions, the research design, and procedures, and a discussion of how data analysis and interpretation.

Chapter 4 contains the overall data analysis, presentation, interpretation, and explanation of the data. Tables and figures are given in order to make the data analysis clear. Outcomes are clearly interpreted within the context of the research questions.

Chapter 5 brings the entire study together. Topics addressed include a report and interpretation of the findings, implications for social change, recommendations for action and further study. It answers the four research questions within the context of the research and brings the study to a close.

# CHAPTER 2:
# LITERATURE REVIEW

## Adult Learning Theory

Currently, there is no consensus on the pedagogical value of video game-based learning. A host of research issues has emerged to create the next generation of games to support learning in math, science, and engineering. Yet, little to no research has emerged in the area of game-based learning. This literature review explores, compares, contrasts, and synthesizes prevailing learning design theories from such noted learning experts as Gagné, Bloom, Kirkpatrick, and Keller with video game design theories in order to create an evaluation framework for video game-based learning. This project will fill one of the many areas of research needed by creating an evaluation framework of video game-based learning.

As an educational tool, gaming simulation has been around for thousands of years, with the depiction of strategic military problems in games like chess. In modern times, the use of flight simulators to train pilots and astronauts is a highly developed example. Other examples include business gaming such as the Top Management Decision Simulation, developed by the American Management Association in the 1950s (Coppard, 1976). From the late 1950s to the mid-1960s, gaming simulations appeared in political science, international affairs, and the field of urban planning.

An early example of computer-assisted instruction was a system called the Program for Learning in Accordance with Needs (PLAN) (Weisgerber, 1971). Schools used this system throughout the United States in the mid-1970s. In this system, the computer kept records about each student's previous study, progress, and performance.

Teachers received daily reports on completion of lesson objectives; activities started or completed by each student, as well as periodic student progress reports. The information in the computer database was used to help plan individualized learning activities.

Early examples of computer-based instruction (CBI), even those that included some variation resulting from user control, such as limited branching, tended to limit design in such a way that everyone received the same program. A better approach is to incorporate adaptive motivational conditions, which reflect the changes in a student's motivation over time (Keller, 1999).

Today, simulation applications are in almost every field. Coppard (1976) suggested, "Some of the most appropriate games are not found in one's own field, but instead were developed for another purpose and may be easily adapted to similar applications in a different field" (pp. 40-42). (For more on the design process for gaming simulations, see Coppard, 1976, pp. 40-9–40-13. For a detailed technical consideration of the game design process, see Adair & Foster, 1972).

*Pedagogy Versus Andragogy*

Knowles (1970) coined the faux-Greek term *andragogy* (sometimes spelled *androgogy*) to distinguish teaching practices specifically aimed at adult learners from those used to teach young people in primary and secondary education. Knowles's theory of andragogy assumes that adults (a) want to know why they need to learn something (although this would seem to apply to adolescents as well), (b) need to learn experientially, (c) approach learning as problem solving, and (d) learn best when the

subject is of immediate value. Furthermore, adults tend to be self-directed and expect to take responsibility for decisions that affect them.

Electronic-learning (E-learning) courses based on the principles of androgogy ask the questions: What do you want to learn? How and when do you want to learn? (Islam, 2002). The assumptions for adult learners, in many cases reasonably, apply to young people when discussing video game-based learning systems.

Brookfield (1986) said that adult learners (a) are not beginners, but are in a continual state of growth; (b) bring with them a package of experiences and values, each one unique; (c) come to education with intentions; (d) bring expectations about the learning process; (e) have competing interests; and (f) already have their own set patterns of learning. Adult learning is therefore most productive when the following occurs:

1. Learners are engaged in the design of learning.
2. Learners are encouraged to be self-directed.
3. Educators function as facilitators rather than didactic instructors.
4. Taking the individual learners' needs and learning styles into account.
5. A climate conducive to learning is established.
6. The learning process uses the learner's past experiences.
7. Learning activities seem to have some relevance to the learners' circumstances.

As will be seen shortly, Brookfield's ideas are very similar to John Keller's ARCS model of learning as well as Chris Clark's principles of game-based learning.

*Gagné's Nine Events of Learning*

Gagné, Briggs, and Wager defined instruction as "a set of events external to the learner designed to support the internal processes of learning" (Gagné, Briggs, & Wager, 1992, p. 189). Gagné also developed several studies and works that helped to define what is considered "good instruction" or instructional design today. Proceeding from this definition, he formulated nine instructional events that relate to internal learning processes, summarized in Table 2.

Table 2.

*Gagné's Nine Events of Learning*

| Instructional event | Relation to learning process |
|---|---|
| 1. Gain attention | *Reception* of patterns of neural impulses |
| 2. Inform learner of the objective | Activates a process of *executive control* |
| 3. Stimulate recall of previous learning | *Retrieval* of prior learning to working memory |
| 4. Present the material | Emphasize features for *selective perception* |
| 5. Provide learning guidance | *Semantic encoding,* cues for retrieval |
| 6. Elicit performance (practice) | Activate *response organization* |
| 7. Provide feedback about performance | Establish *reinforcement* |
| 8. Assess the performance | Activate *retrieval*, making *reinforcement* possible |
| 9. Enhance retention and transfer | Provide cues and strategies for *retrieval* |

*Note.* Source: *The conditions of learning and theory of instruction* (4th ed.), by R. M. Gagné, 1985, New York: Holt, Rinehart and Winston. Used with permission.

Five different purposes for evaluation of student performance are the following (Gagné et al., 1992):

1. Student placement: Administer tests in order to identify an appropriate starting point for instruction.

2. Diagnosis of difficulties: Tests can indicate areas in which a student needs remedial instruction for earlier skills that not previously mastered, making it difficult to learn material that builds upon those skills. Remedial instruction may require the use of different methods and materials.

3. Checking student progress: Routine tests check student progress less often when students appear to be progressing consistently well. Such progress checking may be more often when students are experiencing difficulties.

4. Reports to parents or supervisors: In addition to the function of supplying reassurance that the learner is progressing well, accumulated assessment results may provide a basis for promotion, certification, or other benefits.

5. Evaluation of the instruction: Evaluate methods with overall scores as well as evaluation of individual items. A common evaluation process (particularly applicable to CBI) is formative evaluation, in which a series of tryouts and revisions result in improved effectiveness.

The various types of individualized instruction can differ substantially from traditional classroom instruction. Adult learners can benefit from materials and procedures that are less highly structured than those used for younger students. Because of the non-linear nature of video games, such games are well suited for adult learners.

*Keller's ARCS Model*

In an article summarizing the research upon which his attention-relevance-confidence-satisfaction (ARCS) model is based and giving examples of actual use of the system, Keller (1987) noted, "No matter how motivated learners are when they begin a course, it is not too difficult to bore them, if not kill their interest totally" (p. 2). The ARCS model consists of four conceptual categories related to human motivation as well as a set of specific strategies (see Keller, 1987, pp. 4-5), which may improve the general

motivational aspects of a course of study. It also makes use of Keller's process called motivational design.

Expectancy-value theory, based on the work of Tolman (1932) and Lewin (1938), provides the foundation of ARCS.

> Expectancy-value theory assumes that people are motivated to engage in an activity if it is perceived to be linked to the satisfaction of personal needs (the value aspect), and if there is a positive expectancy for success (the expectancy aspect). (Keller, 1987, pp. 2-3)

Keller separated value into two categories: (a) interest, which refers to attention-related issues, and (b) relevance, which refers to matters of perceived benefit and usefulness. He added a category for outcomes to cover the application of applied reinforcement and environmental outcomes that contribute to intrinsic motivation. Interest, relevance, expectancy, and outcomes subsequently became attention, relevance, confidence, and satisfaction, respectively, giving rise to the acronym ARCS:

1. Many simple techniques can get attention, but the difficulty lies in sustaining attention. "The goal is to find a balance between boredom and indifference versus hyperactivity and anxiety" (Keller, 1987, p. 3).

2. Perceived relevance with regard to schoolwork or future career goals may or may not be present intrinsically in a given course of study. Keller (1987) held that a perception of relevance could come from the method of instruction, whether or not it is inherent in the content.

3. Whether one succeeds or not, regardless of external factors or innate ability, depends to a great degree on one's feelings of confidence in the possibility of success. This can particularly affect a student's persistence. Keller (1987) pointed out that "fear of failure is often stronger in students than teachers realize" (p. 5). The design of the

confidence strategies offered by ARCS help create the impression that some degree of success is possible given an appropriate effort on the part of the learner. Keller (1987) cautioned, however, that it is important to "avoid creating this impression if it is false," thereby setting up unrealistic expectations (p. 5).

4. According to operant conditioning theory, the definition of task and reward, together with an appropriate reinforcement schedule, should cause people to be more motivated. A problem can arise if the perceived use of these techniques intrudes on the student's rightful sphere of control. This is particularly likely to happen when the activities in question are those from which the student derives intrinsic satisfaction. "A challenge is to provide appropriate contingencies without over controlling, and to encourage the development of intrinsic satisfaction" (Keller, 1987, p. 6).

The ARCS model incorporates a systematic seven-step approach to the design process (Keller, 1997, pp 188-203). Further study revised and refined the model (see Keller, 1999, p. 39). This process can be summarized as define, design, develop, and evaluate. According to Keller (1987), it is appropriate to use the ARCS model "if the problem is one of improving the motivation appeal of instruction for a given audience" (p. 6). A point that may be particularly relevant to video game-based learning is that, for students who have a high degree of initial motivation, overuse of motivational strategies actually can interfere with the instructional objectives.

In the evolution of the ARCS process, a simplified design strategy was developed (Keller, 1997; Suzuki & Keller, 1996). Successfully utilized in studies in several different countries, this process suggests a multicultural validity. A two-dimensional (2-D) matrix

depicts the process with the ARCS categories on the horizontal axis and specific design factors on the vertical axis (see Keller, 1999, p. 39).

A principal application of this system is to identify areas in which motivational strategies are appropriate. As mentioned earlier, overuse of motivational strategies can interfere with a student's intrinsic interest in a subject. The motivational design process requires an audience analysis to decide which motivational tactics are appropriate. Keller (1999) pointed out, "Learner motivation changes over time, however, and sometimes in unpredictable ways" (p. 42). According to Keller (1999),

> When students are motivated to learn, they want to work on highly task-relevant activities. They do not want to be distracted with unnecessary motivational activities. For this reason it would be nice to have computer or multimedia software that can sense a learner's motivation level and respond adaptively. (p. 4)

Song (1998) developed an approach to motivationally adaptive CBI. At predetermined points in the instructional program, a screen asked questions pertaining to the students' motivational attitudes. The responses, in conjunction with actual performance levels, helped to personalize motivational tactics for each student.

Another variation relevant to CBI concerns the motivational problems faced by distance learners. These students must overcome feelings of isolation, feelings associated with a lack of evidence of steady progress, and doubts about their ability to complete the material. Visser (1998) used a variation of the ARCS approach to address these problems. Her approach, which dealt with traditional distance learning materials, could be adapted to CBI and video game-based learning. She sent messages in the form of greeting cards to students according to two parallel schedules. The first schedule depended on specific points in the course, and the messages were the same for all students. The second schedule consisted of personalized messages sent at times deemed appropriate, based on

the student's performance. The study also saw an increase in the completion rate for the course.

*Bloom's Taxonomy*

Benjamin S. Bloom of the University of Chicago headed a group of distinguished academics who, in a series of conferences held from 1949 to 1953, set out to develop a taxonomy, or classification system, for use in working with educational objectives and outcomes. In 1956, the first volume of the work, *Taxonomy of Educational Objectives*, covered the cognitive domain. In 1964, a second volume covered the affective domain (Krathwohl, Bloom, & Masia, 1964). The primary focus of this work was to aid college-level instructors analyzing test items. "The major purpose in constructing a taxonomy of educational objectives is to facilitate communication" (Bloom, 1956, p. 10). This would enable those involved with educational research, curriculum development, and testing to "compare and exchange tests and other evaluative devices intended to determine the effectiveness of these programs" (Bloom, p. 10). In deciding how to proceed with the construction of the taxonomy, Bloom stated,

> We are of the opinion that although the objectives and test materials and techniques may be specified in an almost unlimited number of ways, the student behaviors involved in these objectives can be represented by a relatively small number of classes. (p. 12)

The classification system presented in Bloom's (1956) work has been widely accepted throughout the educational system, though several alternatives and revisions are available. Bloom's taxonomy, as it is commonly known, is considered hierarchical,

ordered in terms of increasing complexity, and consists of the categories and subcategories shown in Table 3.

Table 3.

*Bloom's Taxonomy, Cognitive Domain*

| Domain | Category | Subcategory |
|---|---|---|
| Cognitive domain: Knowledge | | |
| | 1.00 Knowledge | |
| | | 1.10 Knowledge of specifics |
| | | 1.11 Knowledge of terminology |
| | | 1.12 Knowledge of specific facts |
| | | 1.20 Knowledge of ways and means of dealing with specifics |
| | | 1.21 Knowledge of conventions |
| | | 1.22 Knowledge of trends and sequences |
| | | 1.23 Knowledge of classifications and categories |
| | | 1.24 Knowledge of criteria |
| | | 1.25 Knowledge of methodology |
| | | 1.30 Knowledge of the universals and abstractions in a field |
| | | 1.31 Knowledge of principles and generalizations |
| | | 1.32 Knowledge of theories and structures |
| Cognitive domain: Intellectual abilities and skills | | |
| | 2.00 Comprehension | |
| | | 2.10 Translation |
| | | 2.20 Interpretation |
| | | 2.30 Extrapolation |
| | 3.00 Application | |
| | 4.00 Analysis | |
| | | 4.10 Analysis of elements |
| | | 4.20 Analysis of relationships |
| | | 4.30 Analysis of organizational principles |
| | 5.00 Synthesis | |
| | | 5.10 Production of a unique communication |
| | | 5.20 Production of a plan, or proposed set of operations |
| | | 5.30 Derivation of a set of abstract relations |
| | 6.00 Evaluation | |
| | | 6.10 Judgments in terms of internal evidence |
| | | 6.20 Judgments in terms of external criteria |

*Note*. Source: *Taxonomy of Educational Objectives, Handbook 1: Cognitive Domain*, by B. S. Bloom, 1956, New York: David McKay. Used with permission.

Bloom's (1956) *Taxonomy of Educational Objectives, Handbook 1* contains many specific examples of test items illustrating each subcategory of the taxonomy. Testing of the various stages of learning incorporate these general principles:

1. For knowledge, when testing a student's ability to recognize or cite accurate statements, the form of the question and the level of precision required should not differ significantly from the way the learners initially acquired the knowledge.

2. Translation is the ability to convert the learned material into other words. When testing this stage of learning, Bloom (1956) noted, "If the evaluation is to be of a behavior transcending knowledge, the context in which the terms or symbols appear must be to some extent novel context" (p. 97).

3. Interpretation, or testing a student's ability to interpret learned material, can be done either with a question requiring an essay-type response, multiple-choice selections, classifying items relative to the material presented, or questions as to whether the data presented are sufficient to prove the truth or falsity of given statements. Exercises of this last type may ask either for an evaluation based solely on the information presented or may utilize the given data as well as other knowledge the student may possess.

4. Extrapolation testing is through exercises that often used in conjunction with interpretation, "attempt to determine whether or not the student can go beyond the limits of the data or information given and make correct applications and extensions of the data or information" (Bloom, 1956, p. 117).

5. Application, or a student's ability to apply learning, is tested by presenting situations that "must either be situations new to the student or situations containing new elements as compared to the situation in which the abstraction was learned" (Bloom, 1956, p. 125). When testing effect of instruction on application ability, it is necessary to differentiate between solutions based on general problem-solving ability and solutions

that are the result of instruction. One can make this determination by testing individuals who are equal in general ability to those who are the target of the application items, but who have not received the instruction in question. It is important for purposes of evaluation to distinguish between inability to apply and inability to comprehend. Testing the degree of the student's comprehension of the situation before the application items are attempted can distinguish between the two. When accurate knowledge of the problem-solving process employed by the student is required, actual recording of the steps taken by the student (an operation particularly suited to computer-based systems) is preferable to attempts to infer the process from the construction of the test items. Bloom (1956) noted, "Students can come up with ways of arriving at answers, often correct, that no teacher seems to have anticipated" (p. 127).

6. In discussing analysis, Bloom (1956) indicated a variant of the hierarchy of the published taxonomy adopted by Anderson, Krathwohl, and Bloom (2001) in their revised version. Bloom (1956) wrote, "No entirely clear lines can be drawn between analysis and comprehension at one end or between analysis and evaluation at the other" (p. 144). This statement and the subsequent discussion omitted the synthesis classification, which in *Taxonomy of Educational Objectives, Handbook 1* (Bloom, 1956) is placed between analysis and evaluation. Anderson et al. reversed the order of the elements corresponding to synthesis (create) and evaluation (evaluate).

Bloom (1956) further divided analysis into the ability to classify "elements" of the material, specifying the "relationships" among the elements, and recognition of "organizational principles" of arrangement and structure (p. 145). Testing the student's ability to analyze material is most effective when the material analyzed is in the test

situation, as opposed to relying on the student's familiarity with it. Whereas student answers may be free form or guided responses, selecting the best answers in multiple-choice format offers the advantage of structuring items to include common errors.

7. Synthesis — Synthesis is defined as combining elements in order to form a whole (compare to Anderson et al.'s 2001 category of "create"). "This is a process of working with elements, parts, etc., and combining them in such a way as to constitute a pattern or structure not clearly there before" (Bloom, 1956, p. 162). Bloom distinguished the subcategories of synthesis as "primarily on the basis of product" (p. 163). These products may be a "unique communication" of some form, the purpose of which is "to inform, to describe, to persuade, to impress, or to entertain" (Bloom, p. 163). The second subcategory consists of a plan or proposed set of operations. Distinguishing items in this subcategory from the previous subcategory are incomplete until translated into action. The product of synthesis in the final subcategory is a set of abstract relations. Here the distinguishing factor is that the relations "are not explicit from the start; they must be discovered or deduced" (Bloom, p. 164).

Testing for synthesis is made more difficult by the necessity of providing conditions favorable to creative output—primarily freedom. "The student should be made to feel that the product of his efforts need not conform to the views of the instructor, or the community, or some other authority, if such freedom is otherwise consistent with the nature of the task" (Bloom, 1956, p. 173). Evaluation of synthesis poses formidable problems because of the lack of objective criteria. The idiosyncratic nature of creative output can make judgment, even by experts, appear arbitrary. Bloom (1956) addressed

this issue to a degree by indicating that a synthesis can be faulty because it fails to fit the requirements of the problem. Table 4 summarizes Bloom's taxonomy of learning.

Table 4.

*Bloom's Taxonomy of Stages of Learning*

| Stage of learning | Taxonomy with verbs |
|---|---|
| Evaluation | appraise, argue, assess, attach, choose compare, defend estimate, judge, predict, rate, core, select, support, value, evaluate |
| Synthesis | arrange, assemble, collect, compose, construct, create, design, develop, formulate, manage, organize, plan, prepare, propose, set up, write |
| Analysis | analyze, appraise, calculate, categorize, compare, contrast, criticize, differentiate, distinguish, examine, experiment, question, test |
| Application | apply, choose, demonstrate, dramatize, employ, illustrate, interpret, operate, practice, schedule, sketch, solve, use, write |
| Comprehension | classify, describe, discuss, explain, express, identify, indicate, locate, recognize, report, restate, review, select, translate |
| Knowledge | arrange, define, duplicate, label, list, memorize, name, order, recognize, relate, recall, repeat, reproduce state |

*Note.* Source*: A Taxonomy for Learning, Teaching, and Assessing,* by L. W. Anderson, D. R. Krathwohl, & B. S. Bloom, 2001, New York: Longman. Used with permission.

Bloom's original taxonomy has been revised utilizing advances in education theory since its original publication (Anderson et al., 2001). The revised version changed the focus to a broader audience, especially elementary and secondary teachers. One fundamental change was to replace the noun forms of the classifications used in Bloom's (1956) work with verb forms. "Verbs of the kind used by teachers in statements of objectives and during instruction seemed more helpful in framing and categorizing objectives, instructional activities, and assessment tasks" (Anderson et al., p. 307). These verb forms (as illustrated in Table 4) distinguish the cognitive processes and used to form a separate dimension for analysis. The reorganized and renamed noun forms comprising the original knowledge category and subcategories became another dimension, called the

knowledge dimension. Table 5 shows a simplified version of this new, multidimensional framework.

Table 5.

*The Knowledge Domain*

| | The cognitive process dimension | | | | | |
|---|---|---|---|---|---|---|
| The knowledge dimension | Remember | Understand | Apply | Analyze | Evaluate | Create |
| Knowledge | *Simple* → | | | | | *Complex* |
| Conceptual knowledge | ↓ | | | | | |
| Procedural knowledge | ↓ | | | | | |
| Metacognitive knowledge | *Complex* | | | | | |

*Note.* Source: *A Taxonomy for Learning, Teaching, and Assessing*, by L. W. Anderson, D. R. Krathwohl, & B. S. Bloom, 2001, New York: Longman. Used with permission.

The simplest activities (e.g., remembering facts) are in the upper left of Table 4, and complexity increases moving down and to the right. The research has further divided the categories of the knowledge dimension and the cognitive process dimension into subcategories for classification purposes (Anderson et al., 2001; Krathwohl, 2002). As noted above, the order of evaluate and create are reversed from their corresponding categories in Bloom's (1956) original taxonomy (synthesis and evaluation). This ordering, although not without some difference of opinion, arose in part from an analysis of empirical evidence and a decision to order the categories from simplest to most complex (see Table 4). "Simply stated, induction, which is involved in Creating, is a more complex process than deduction" (Anderson et al., p. 294).

Anderson et al. (2001) defined the new category of metacognitive knowledge as "knowledge of cognition in general as well as awareness and knowledge of one's own

cognition" (p. 29). This category in the revised taxonomy is of increasing significance, as research has shown how being made aware of their metacognitive activity can help students adapt the ways they think and approach learning activities (Krathwohl, 2002).

Table 5, derived from the 2-D representation of the knowledge (noun) and cognitive process (verb) components, provides a concise representation for classifying objectives, activities, and assessments. By plotting course objectives on the table grid, for example, one can represent complex kinds of knowledge and cognitive processes. Blank spaces on the grid suggest what might have been included but were not. This helps to identify opportunities to enhance the course objectives (Krathwohl, 2002).

*The ADDIE Model of Design*

The analysis (or assessment), design, development, implementation, and evaluation (ADDIE) model of instructional system development (ISD) seems to have evolved informally rather than being the product of a single author. Molenda (2003) traced the origins of the ADDIE acronym, which appears to be an afterthought of various related descriptions of ISD concepts. One of the earliest antecedents to ADDIE appears to be a report by Branson (1978) of a model developed in conjunction with the U.S. military called the Interservice Procedures for Instructional Systems Development (IPISD). Branson provided a graphic labeled "Analyze, Design, Develop, Implement, and Control." Some sources cite Thiagarajan (1976) as the originator of the ADDIE label, but he refers only to A-D-E in his work. ADDIE begins to appear in the late 1980s in a variety of sources with no clear attribution. According to Molenda,

> It is only in the recent literature that the term is beginning to take on a more fully elaborated meaning. However, these authors are essentially creating their own

> interpretations as there does not appear to be an original, authoritative version of "the ADDIE Model." (p. 4)

See Figure 1 for a representation of the ADDIE model.

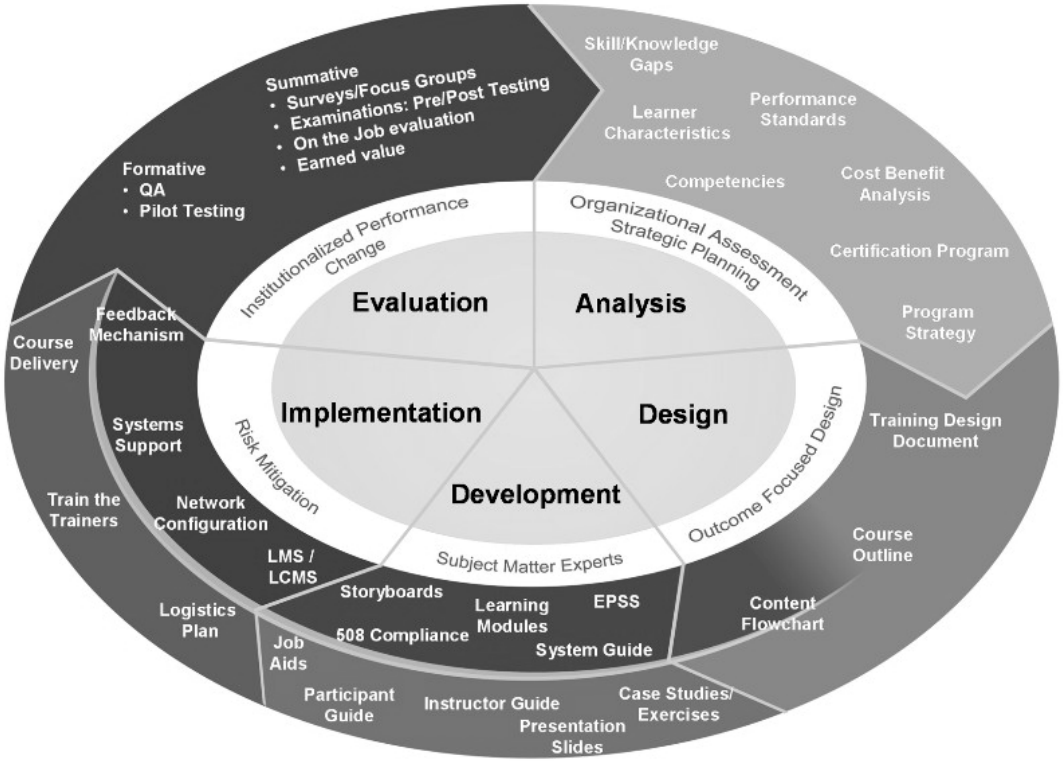



*Figure 1.* ADDIE model of instructional design. Adapted from "ADDIE Model of Instructional Design," 2003, by the Learning Systems Services Team, Booz Allen Hamilton, McLean, VA: Booz Allen Hamilton. Used with permission.

### *Kirkpatrick Evaluation Levels*

The professional training community has used Kirkpatrick's (1976) system of evaluation for over 40 years. This system consists of four steps or levels of increasing complexity. Kirkpatrick's four levels are:

1. Level 1 is reaction. This level, which is the easiest to test for, represents the feelings of the learners about the training received. A variety of testing examples show a familiar series of questions where the student rates various aspects of the training on some kind of quantitative scale. Most questions are in an objective form, as well as space

for additional comments not addressed by the other questions. Kirkpatrick (1976) emphasized that this level of evaluation "does not include a measurement of any learning that takes place" (p. 18-2).

2. Level 2 is learning. Kirkpatrick (1976) defined learning in this context as "the principles, facts, and skills which were understood and absorbed by the conferees" (p. 18-11). In other words, the learning he described corresponds to Bloom's (1956) knowledge category and subcategories. Kirkpatrick recommended that this level of evaluation include before-and-after testing as well as a control group when possible in order to assess the actual impact of the training. The use of objective questions provides quantifiable data, which then can be subject to a statistical analysis.

3. Level 3 is behavior, also called transfer. At this evaluation level, the focus is on behavioral changes that result from the learning that presumably has taken place. Kirkpatrick (1976) described this as a way to quantify the common knowledge that there is often "a big difference between knowing principles and techniques and using them" (p. 18-16). Here again, the use of before-and-after testing, a control group, and statistical analysis are recommended. In addition, Kirkpatrick suggested appraisal by someone separate from the individual under evaluation to aid in the objectivity of the results. He also recommended a post-training appraisal 3 months or more after training in order to assess the lasting effect of behavioral changes resulting from the training.

4. Level 4 is results, the vaguest of Kirkpatrick's (1976) levels. The desired results can vary greatly from one type of training program to another, and therefore the testing to determine the degree to which those results have been met vary as well. For this

reason, in the context of job-related training, Kirkpatrick suggested that evaluations focus on the first three levels:

> From an evaluation standpoint, it would be best to evaluate training programs directly in terms of results desired. There are, however, so many complicating factors that it is extremely difficult, if not impossible, to evaluate certain kinds of programs in terms of results. Therefore, it is recommended that training directors evaluate in terms of reaction, learning, and behavior. (p. 18-21)

Kirkpatrick's (1976) evaluation levels have been widely accepted in industrial and organizational environments. "The power of Kirkpatrick's model is its simplicity and its ability to help people think about training evaluation criteria" (Alliger & Janak, 1989, p. 331).

Three assumptions associated with Kirkpatrick's system are "implicit in the minds of researchers and trainers, although to all appearances unintended by Kirkpatrick himself when the model was proposed" (Alliger & Janak, 1989, p. 332):

1. Levels are hierarchical, with each providing more information than the last.
2. There is a causal relationship between each successive level.
3. There is a positive correlation between levels.

Alliger and Janak challenged the validity of these assumptions with a detailed analysis of the available literature.

Evaluation of training using the Kirkpatrick (1976) system can suffer if evaluators do not take care to define needs and resources or to determine the intended use of the results. Problems can occur if the system comes to shape the questions and results. Emphasis on return on investment (ROI) in a business context tends to skew evaluation. Measurements based mainly on financial indicators focus on past performance, which encourage a short-term strategic view (Abernathy, 1999).

It can be useful to divide results into categories of “hard data” and “soft data” (Phillips, 1996, p. 20). Hard data, the kind traditionally used to evaluate performance, include output (e.g., units produced and tasks completed), quality (e.g., waste, defects), time (e.g., project completion time, overtime), and cost (e.g. overhead, variable costs). Soft data are more subjective and harder to assign a monetary value. Soft data include work habits (e.g., punctuality, safety), work climate (e.g., grievances, job satisfaction), attitudes (e.g., loyalty, perception of responsibilities), new skills (e.g., decisions made, conflicts avoided), development (e.g., promotions, performance ratings), and initiative (e.g., implementation of new ideas, employee suggestions).

Abernathy (1999) asked , “How do we value training that has tangible results versus that which has intangible results?” “Should we try to measure it?” (p. 22). Abernathy quoted Fred Nickols, executive director of strategic planning and management services at the Educational Testing Service as saying, “The best measure of anything, including training, is sometimes gauged by its absence. Only when it is absent does its value dawn on those who take it for granted” (p. 22).

Kaplan and Norton (1992) offered a scorecard method that seeks to balance business management by measuring performance across four perspectives: (a) finance, (b) customers, (c) internal business processes, and (d) learning and growth. “The learning and growth perspective directs attention to the basis of all future success” (Abernathy, 1999, p. 21).

Bloom, Gagné, Keller, and Kirkpatrick formed the models of instructional design from which decades of teaching, education, and training followed. The instructional

design models are only part of the learning equation. Understanding the process of learning is another part.

## Traditional Instruction

Behaviorism, the theory that forms the basis of much of the current educational practice, sees people's thinking and learning as a response to stimuli from the environment (Skinner, 1985). Man is a machine, "dependent on external stimuli to function" (Reynolds, Sinatra, & Jettson, 1996, p. 95); knowledge generates from experiences provided through the five senses; and the brain then creates ideas and thought from these experiences. Positive and negative reinforcement determines future behavior and decisions. "Everyday perception is the product of a vast number of experiences" combined over time through "reinforcing consequences" (Skinner, p. 292).

According to Gardner (1991), many educational settings, view students as cups to be filled. The student receives rewards for memorizing and recounting information, and instruction involves the teacher lecturing about facts and ideas generated by a third party (Gardner, 1991). Gardner contended that students' success in the traditional schooling environment is not an indicator of their overall ability to learn, as this passive approach to learning experience rarely engages students fully. "Concepts are frequently abstracted from those situations in which they are relevant and of value, reified as facts, and treated as self-contained entities" (Barab, Hay, Barnett, & Squire, 2001, p. 52). Not surprisingly, when these abstracted definitions are presented to students, usually in text form without an experiential context from the students' past experience, engagement in learning is low (Barab et al., 2001). Efficient transmission of data from teacher or book to pupil, rather

than meaningful participation in a learning opportunity, becomes the focus and rewarded classroom activity (Lave & Wenger, 1991). Unfortunately, this can also lead to circular definitions, where meanings of individual events or concepts become self-referenced and therefore fairly meaningless to the student (Barab et al., 2001). “If the meaning of the concept only refers to itself, then i

t forms a closed circle, disembodied from the environmental particulars through which the concept gains meaning" (Barab et al., 2001, p. 52). Prensky (2000) concluded that formal training and education are usually less meaningful, not to mention remarkably unengaging, because of their focus on content and telling, rather than creating dialogue with the student.

*Constructivist Learning*

Video games, on the other hand, reflect more of a constructivist approach to learning. Constructivist theory holds that learning is most optimized when the learners perform experiments or tests the environment and then "actively construct ideas and relationships in their own minds" based on these actions, rather than passively accepting the ideas and relationships of others (Prensky, 2000, p. 162). In practice, this requires moving away from lecture or teacher-centered learning to "developing participatory learning environments that are technology rich and allow students to ground their understandings within their own concrete experiences" (Barab et al., 2002, p. 77). For example, rather than simply telling students about the solar system, they must create a virtual solar system on a computer platform and then can change various aspects of their solar systems to experience the results. Emerging technologies can support constructivist learning methods. Consider the difference between an interactive game and a "talking head" computer teaching CD. Video games are "the first medium to combine visual dynamism with an active, participatory role for the learner," allowing them to take meaningful actions and experience the results of these actions rather than simply view or listen (Prensky, p. 55). This allows learners to be immersed "within contexts that

challenge, ground, and, ultimately, extend their understandings," while teachers shift from the provider of all right answers to guiding students as they experience their own learning process (Barab et al., 2002, p. 77).

The constructivist concept also allows the learner to control the speed of the learning experience, at least to some extent. This reveals another draw for younger learners to video games as opposed to traditional schooling instruction. The minds of people who grew up with video games, the "Game Generation" as some call them, "have been programmed to adapt to greater speed and thrive on it," being exposed early and often to twitch-speed video games and MTV (Prensky, 2000, p. 58). Twitch speed is where a high number of images or inputs is presented in a short period of time.

> Yet when they go to school or go to work, educators and trainers typically give them all the "nontwitch" features of the past: "tell-test" education, boring corporate classrooms, poor speakers lecturing at them, talking-head corporate videos, and, lately, endless "click and fall asleep" courses on the Internet. (Prensky, p. 58)

The speed change causes many students to disengage from traditional learning formats and therefore not have meaningful learning experiences in such environments.

Prensky (2000) supported such constructivist theory, although acknowledging additional relevant theories, contending evaluating instruction along two dimensions, (a) engagement, and (b) learning. Considering each dimension as a continuum, with engagement and learning ideally moving higher together along a 45-degree line, if graphed. As shown in Figure 2, Prensky found well-crafted video game-based learning to be effective because it requires high aspects of both components. He found CBT less effective because, although it is high learning, it provides low engagement. Some entertainment-oriented games, in contrast, are high engagement, but provide low learning opportunity, according to Prensky.

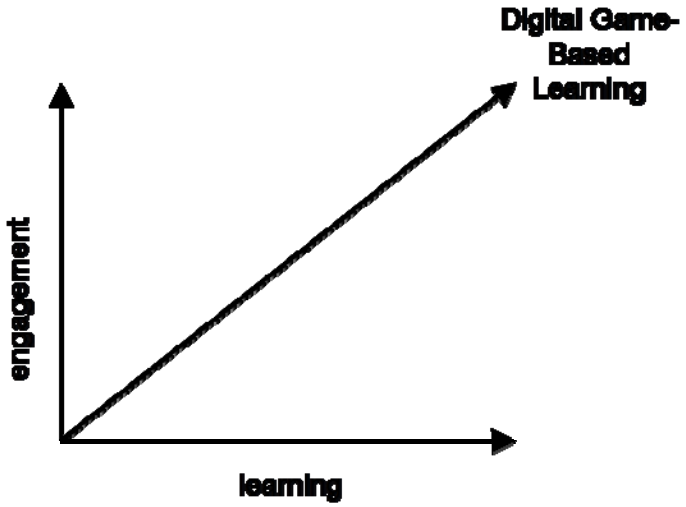



*Figure 2.* Prensky's game-based learning. From *Digital Game-Based Learning*, by M. Prensky, 2000, New York: McGraw-Hill. Used with permission.

"Good digital game-based learning does not favor either engagement or learning, but strives to keep them both at a high level" (Prensky, 2000, p. 150). If learning is not emphasized, game-based learning slides toward being only a game, while not enough engagement moves the activity towards CBT. "It is much better to think about keeping both dimensions high than to think about trading them off" (Prensky, p. 150). Gee (2004) also described gaming design as based on constructivist principles. As he put it, "you cannot play a game if you cannot learn it" (Gee, p. 6). Therefore, game designers must make games that customers can teach themselves to play. This requires the learner to be actively participating in the learning experience, rather than passively observing. Interestingly enough, the harder, more challenging games sell more than easy, watered-down ones, according to Gee.

*Activity Theory*

Activity theory is another learning construct that is useful in examining the effectiveness of learning in the video game format. It melds well with constructivist theory. Activity theory contends that establishing rich environments for learning, where the learner can act in a participatory fashion, supports the creation of activity systems (Barab et al., 2002). Learners then use these systems to extend their understandings of the environment (Barab et al.). Of particular importance in activity theory is the relationship between individual and social understanding of the environment and its systems. The components of activity systems include tools, subject, rules, classroom microculture, object, and division of labor. These combine to create an outcome.

> The components of activity systems are not static components existing in isolation from each other but are dynamic and continuously interact with the other components through which they define the activity system as a whole . . . examination of any phenomenon (e.g., learning in the classroom) must consider the dynamics among all these components. (Barab et al., 2002, p. 79)

In a video game learning environment, activity theory's emphasis on how individuals transform objects in the environment and the activity systems that allow this transformation become obvious. The entire activity system—the player, computer, game, game design, and the like—all must be considered as one holistic unit, with each component influencing the others (Barab et al., 2002). "This perspective expands the unit of analysis from the mind of the individual (as in traditional cognitive research) or from the human–computer interaction (as in traditional human–computer interaction research), to the entire activity system" (Barab et al., pp. 79-80). This theory, as well as video-game learning constructs in general, emphasize a shift away from seeing a learner as an individual, isolated thinker to an emphasis on a situated learning (Barab et al.).

*Social Aspects of Learning*

Theorists increasingly consider learning a social rather than individual occurrence. That is, the social environment shapes and directs learning of the learners and by their present and past social constructs (Gee, 2004). Those who study learning theory and practice have reported a shift "from cognitive theories that emphasize individual thinkers and their isolated minds to theories that more fully acknowledge the role of the physical and social context in determining what is known" (Barab et al., 2002, p. 494). Reading, for example, is both a mental act and a social one. The reader must have life context or understanding in which to situation the reading, and this context is socially derived (Gee). Thinking and learning are "attuned to and normed by the social groups to which we belong or seek to belong" (Gee, p. 180). Various research studies propose, "radically new theories of what it means to know and learn, and . . . emphasize the reciprocal character of the interaction in which identities, as well as cognition and meaning, are considered to be socially and culturally constructed" (Barab et al., p. 494).

In this sense, the social relationship and the identity one develops from such relationship with society directly influence the learning experience. "Developing an identity as a member of a community and becoming knowledgeably skillful are part of the same process, with the former motivating, shaping, and giving meaning to the latter" (C. Lave & March, 1993, p. 65). Barab et al. (2002, p. 532) recognized that moving from what they called an acquisition metaphor, where learners are "filled" with facts to a participation metaphor, where learners experience and influence the learning opportunity, requires a social or interactive orientation. According to Squire and Steinkuehler (2005), such a community view is already a given in most video-gaming constructs. "Groups of

people from around the world solve problems with an array of information, digital tools, resources, screen shots, and arguments. . . . Commercial developers, doctoral students, and 16-year-olds in Nebraska play, think, and learn together" (Squire & Steinkuehler, p. 39).

Dickey (2005) cited the doctoral work of Bruckman (1997) regarding a game virtual world called Moose Crossing. Bruckman concluded that "virtual environments support the emergence of peer role models predicated on characteristics different from those occurring in traditional classroom settings" and "afford emotional support between participants, along with the presence of an appreciative audience" (Dickey, p. 68). Indeed, some Internet-based games such as Everquest have hundreds of thousands of subscribers; the game Lineage boasts over 2 million players in South Korea alone (Gee, 2004, p. 170). Gee gave an example of such social support in the story of Adrian, a young Everquest player. When Adrian's player died, a group of players with whom he was associated worked and even "cheated" the game to resurrect him, one calling him long-distance from across the country. Internet sites devoted to describing and connecting game players provide further support and community, according to Dickey.

Gee (2004) contended that participants in such relationships share a semiotic domain. Situated cognition theory ties thinking to the physical body and how it experiences the "material, social, and cultural world" (Gee, p. 8). Individuals experience worlds within these worlds, which Gee called semiotic domains. When individuals operate in a new semiotic domain, they must learn the construct of this domain or will be unable to learn within it. Gee contended the infamous "fourth-grade slump," where reading scores plummet in the fourth grade, is caused by the move from decoding to

comprehension (p. 17). Students, who often have no context in which to understand what they are reading, move from learning to read to reading to learn, and their academic performance falls. “Content, the internal part of a semiotic domain, gets made in history by real people and their social interactions” (Gee, p. 29). The domain then influences their decisions, which further define and build the domain in a circular process. If students are not part of the domain that contains the learning, they have no context for the learning experience.

In video games, the player often must play the game to be able to understand the manual. Without experience or context for the semiotic domain of the game, the information in the manual is of little value. All true meaning is within one or more domains (Gee, 2004). Once a player has spent some time in the game, he or she develops a basic understanding of the parameters of the game, “pockets” where future information and concept can be stored. Through indoctrination to the game, Gee contended the players join an affinity group. Affinity groups are collections of individuals similarly connected to a specific semiotic domain. They share a common endeavor, and knowledge spreads among group members (Gee). The cohort of players with which the previously mentioned Adrian participated in Everquest is an example of a narrow affinity group. All players and designers of a particular game are part of a wider affinity group, defined by their participation in the semiotic domain that constitutes the virtual game world. This virtual world also can affect the real one; for example, virtual items related to Everquest have sold on eBay for $2,000 (Gee, p. 171).

Looking at learning in general, rather than focusing on video game-based situations, Lave and Wenger (1991) presented a theory of community participation in

learning, where the individual develops an identity within a community and then participates in relations with others in the community that further build and define it. They called such communities of practice a reciprocal practice, emphasizing the importance of connecting individuals to communities and of these same communities then legitimizing individual actions. “Within the context of these communities, learning is conceived as a trajectory in which learners move from legitimate peripheral participant to core participant of the community of practice” (Barab et al., 2002, p. 495). Community members are motivated to participate in learning activities that are meaningful to the community as a whole and assist in positioning the learner more centrally within the community (Barab & Duffy, 2000). Members of a community of practice are socially interdependent and “share mutually-defined practices, beliefs, and understandings over an extended time frame in the pursuit of a shared enterprise” (Barab et al., p. 495).

All communities of practice have four components consistently present (Barab & Duffy, 2000):

1. The first, community history, provides a cultural or historical context within which the community members identify themselves.

2. Community members also share goals, beliefs, and stories that define appropriate practice within the community.

3. Members recognize that the community is larger than themselves or any one group of members and is constantly changing and evolving as new members enter and former members leave (Barab & Duffy).

4. Whether real or virtual, new members typically move from outside the community to a more central positioning as they participate in community activities (C. Lave & March, 1993).

Barab et al. (2002), in their study of teachers participating in a learning-community teacher-education program, found “members were not simply learning about teaching practice (content) as they were situated within a community (context), but instead were learning about teaching practice through participation as a community member” (p. 533). In traditional learning environments, context is often either something arranged by the instructor to support the content presented or an individual attribute the student brings to the learning experience. In contrast, Barab et al. contended that context is an inherent part of any learning experience, which is neither preplanned nor brought to the learning situation but arises out of the experiences of all participating in the situation. Gee (2004) similarly described learning as a social process, from which goals emerge, meaning is negotiated, and success is relative within the context of the community.

The instructional models developed by Gagné, Keller, Bloom, and Kirkpatrick and the understanding of the learning process gained within the last decade were not developed with today’s young students in mind. Students of today not only understand technology in every day use, they also expect it. These young students grew up in a digital environment surrounded by inexpensive yet highly interactive gaming systems. The use of such technology for learning purposes is becoming more common.

# Video Games

Nearly a half century ago, video games came to life when Willy Higinbotham created the “Tennis for Two” game in 1958 (Demaria & Wilson, 2004, p. 10). Later, on large television screens, people discovered that technology could be fun. The video game industry has changed drastically since then, morphing into one of the biggest and most popular entertainment forms in the world. Video games have thrived, overcoming early criticism as being nothing more than a fad, emerging as the preeminent popular art form of the 21st century.

As a form of entertainment, video games engage us emotionally, and can hold even the most distracted teen’s attention. Video gaming is the most popular form of entertainment today, and this popularity has spawned many books on the subject. In his book, *Trigger Happy: Videogames and the Entertainment Revolution*, Poole (2000) stated, “According to the European Leisure Software Association, the British videogame software market already grosses 60 percent more than total movie box office receipts and 80 percent more than movie rentals” (p. 6).

Video games are more than just fun; they are art and science mixed together. Many people have tried to dismiss video games as a passing fancy or for “techno geeks” without a social life. However, many who take video gaming seriously. By reading about, discussing, and even playing games, it is possible to gain a better understanding of video game design theories in order to create an evaluation framework for video game-based learning.

## *Video Game Design*

Video game design has changed tremendously over the years. It has gone from a single programmer designing a game to a team of individuals with multi-million-dollar budgets working for several years to produce a single game.

It seems as if every devoted gamer wants to be a game designer. Many think they can do it easily, because they know how to program or have a great idea for a game. But how do you go from having a great idea to producing a great game?

### *Rules*

The rules of a game depend on the game genre. These rules define what actions or moves a player can and cannot make; where they can and cannot go, and how they will win the game. Players do not get most of the games rules, or in the games instructions. They are inherent to the game and govern the playing process. For instance, in a puzzle game such as Tetris, the player can only move pieces where they will fit. If the shapes are not an exact match, the piece cannot move. The rules of a game also define the obstacles or challenges the player will face throughout the game (Bartle, 2003; Rollings & Adams, 2003).

### *Goals / Objectives*

The goals and objective of a game establish the game's rules of play and the criteria for winning. Goals and Objectives define the victory condition, how the game will decide the winner.

*Outcomes*

The outcome of a game will be win, lose, or draw depending on the nature of the game, no outcome. A game should have one or more loss conditions, as well as the victory condition. Some games, however, have no outcome – individuals play purely for fun, or in competition with others, to get the highest score.

*Challenge / Competition / Opposition / Conflict*

Games can be competitive in different ways. Some games have clearly defined competition, one player wins, and the other loses. In other games, contestants compete to achieve the highest score. The competition can be with another player, non-player, or the players themselves.

*Interaction / Interactivity*

Interactivity is how the player interacts or acts within the game world. The way the player jumps, shoots, or dunks; how they interact with their competition or enemies; what motions, and actions they can make. Another term for the way a player operates in the game world is the game's *interaction model*.

There are two prevalent interaction models, avatar and omnipresent. In the avatar interaction model, the player plays on one screen or level until he/she completes the objective, or loses. In the omnipresent model, the player can enter and exit different screens or levels at will. Perspective is also a facet of interactivity. It defines how the

player views the game world. Perspective can be third person, though the eyes of another, first person, through the player's eyes, or side scrolling (Rollings & Adams, 2003).

*Story*

A great game must be fun to play and give the player a reason to play. The story is the reason to play the game. The story can be as simple as instructions for the player (e.g., save the princess or it can be long and rival a novel or Hollywood movie.)

The story is inherent to the game; it describes why the players are there, what the goal is, and what obstacles they will face along the way. Computer games create fantasy, and allow the players to immerse themselves in the game. Some stories are abstract and the player learns more about the story as the game unfolds. The game play is actively involved in the story. Other stories have nothing to do with the game play, but simply make the game more interesting (Rollings & Adams, 2003). Figure 3 captures all the elements cited above necessary for good game design.

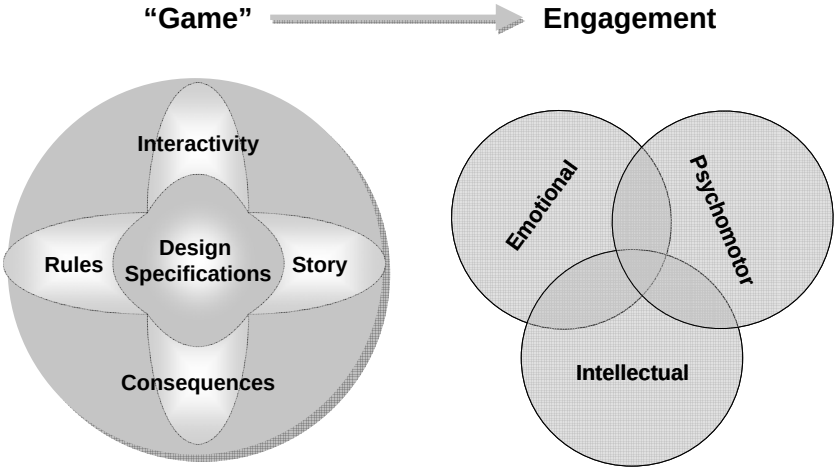



*Figure 3*. Gaming model. Based on the work of Chris Clark's *Principles of Game-Based Learning Video Game Capabilities* presentation at the Learning Strategies Consortium Conference. Used with permission.

*2-D*

Games can be two-dimensional (2-D) or three-dimensional (3-D). A dimension is essentially a degree of freedom or movement the game allows player to make. In 2-D games, the player can only move right to left and up and down. The older arcade games with flat shapes moving in a plane were all two-dimensional. *Asteroids* was the first game with two-dimensional player motion. While some games continue to be 2-D, the trend is the offer them in 3-D (Morrison, 2002).

*3-D*

3-D games have the same movement as 2-D games but offer forward and backward movement as well. Omerick (2004) teaches that "the form of a three-dimensional object can be either revealed or hidden depending on how the light hits the object and at what angle with respect to the camera" (p158). Newer console and computer games where the player moves about in a virtual reality are three-dimensional. Popular examples of this are the Maxis games SimCity and The Sims.

*Immersive Worlds*

Immersive worlds are worlds that are so engaging and realistic that the player becomes "immersed" in the world, forgetting that the world is a fantasy. They are virtual worlds, and are also known as persistent worlds. This type of game can be single or multi-player and the player can control the environment. In multiplayer mode, the players interact with one another as well as the environment. Bartle (2003) stated "because the

environment continues to exist and develop internally (at least to some degree) even when there are no people interacting with it; this means it is persistent" (p1).

### *Massively Multiplayer Online Games*

Massively multiplayer online games (MMOGs) are games that allow at least 128 players to interact with each other in the game world. These persistent or virtual world games usually charge a fee to join. MMOGs have grown in popularity over the years, though the industry is currently in a wait and see state. However, Mulligan and Patrovsky (2003) believe that "most current game manufacturers, however, are planning to enter the MMOG market, with the exception of Nintendo" (p. 7).

MMOGs actually date back to the late 1960s, but experienced a large growth during the 1990s. The players know the realm of possibility by the way MMOG's define their set of rules. There are three types of MMOGS, classic games such as chess or scrabble, hybrid games for use at home or with an internet connection, and persistent or immersive worlds (Mulligan & Patrovsky, 2003).

## *Video Game-Based Learning*

Video games have been part of our culture for many years, although their potential for contribution to the body of understanding of learning theory is a subject more recently addressed. This dissertation will examine several components of theory and practice related to learning in a video game-based environment. An overview will consider relevant learning theory, including those typically used in American school systems, those typically found in video games, and how they differ. Learning as a social

construct and the generational differences in learning practice is of important note, as are the roles of perspective and identity. A final analysis of what makes video game-based learning so engaging and effective will be undertaken. For the purposes of this review, the term *video game* refers to all digital games, whether played on a computer platform or on a special gaming product such as the XBox, PlayStation, GameCube, Tablet PC, Personal Digital Assistant (PDA), or cell phones.

Video games first emerged on a widespread basis in arcades alongside pinball and other similar games in the 1970s (Kent, 2001). The games of this initial era were 2-D and often closely mimicked board games, where the players move pieces around a predetermined course (Kent). Early research focused on the engagement video games presented. Why would a person spend hours and hours playing Pacman? The ability to replicate level of engagement in other learning experiences is also a question. Games since have become significantly more complex and engaging, now providing detailed, changeable storylines with adaptable, create-your-own characters that are often played by thousands simultaneously worldwide over the Internet (Gee, 2004). Consumers in the United States alone spend billions of dollars each year on the purchase of computer and video games (Dickey, 2005). These consumers are not restricted to young people. According to the Entertainment Software Association, “in 2003 41% of the market for computer games and 22% of the market for video games was represented by middle-aged gamers” (Dickey, p. 67).

*Game Categorizations*

Researchers can categorize video games according to how they treat various aspects of style and content. For example, some games are intrinsic in nature, with the content tightly linked to the game style (Prensky, 2000, p. 164). The Sims is a computer simulation game that lets players create and control the lives of virtual people (Maxis, 2005). The content determines much of the game structure and style, as the content choices in a typical Sims game will determine the city, railroad, or whatever the player is creating. An extrinsic game, in contrast, creates a game template that may include any type of content. Trivia games, where the questions vary greatly within a predetermined game structure, are an example of extrinsic games (Prensky). Some games are hard wired and cannot be adapted or changed from play to play, others run on "engines" that allow some flexibility but provide boundaries within the game environment, and still others utilize "shells" that allow various types of information to be called into the program as needed (Prensky, p. 166).

Game timing is also a fundamental component of design and a way of categorizing different game styles. Some games operate in real time, where if the player does not act, he or she usually loses. Other games will wait until the next player takes a turn, even if it takes days (Prensky, 2000). Time-limited games often intimidate beginning gamers; particularly those with a goal must within a fixed time limit (Gee, 2004). Games that are more recent, therefore, often provide a variety of game options related to timing (Gee). Session-based games require the player to complete a particular session before quitting the game or start over. Others are persistent state, where the player can quit the game and pick back up at the same point at another time (Prensky). Many

games combine aspects of the two, allowing a player to “save” after attaining certain levels of success, which is particularly important to very complex games (Gee).

Another game category is depends on the number of players possible. Some games only provide for a single player; others allow multiple players on the same computer or gaming apparatus. Some games allow many players to play over computer networks or the Internet (Gee, 2004). As games become increasingly complex, so do the number of players who can take part and the variety of roles and activities they are able to pursue (Gee). Some games are reflective, where the player provides answers to questions. Others are action games, where the player participates in the actions of the game, often as a character within a story (Prensky, 2000).

A final category of games reflects their graphic components. Video-based games use real-life pictures or realistic representations of the characters and environment in the game. Animation-based games, in contrast, are not realistic and typically present cartoon characters and environments (Prensky, 2000).

### *Narrative Game Features*

Whereas many simpler games lend themselves to easy description, components of more complex games require explaining. Gee (2004) contended, “When people learn to play video games, they are learning a new literacy” (p. 13). This new literacy has both its own symbols and structure. Most games feature some sort of narrative, or story, as their backbone. Simpler games feature a fixed narrative, although the player usually can choose what order to play each section of the narrative (Dickey, 2005). Games that are more complex feature branching stories. In this game design, the player chooses specific

actions, which significantly affect the progression of the storyline and the ultimate outcome of the game (Dickey). Narratives also may be plot based, where a large number of characters are involved in actions that forward a particular goal or endeavor as well as the plot, or character-based. One detailed or central character may represent the actions and decisions o the player (Dickey). The narrative is often communicated or supplemented within the game by backstory, which is simply background information that sets up the plot, or cut scenes, where the storyline is furthered by brief narrative events at certain levels of the game (Dickey). Both can be simple or complex and can take any number of forms, from descriptions in the game manual, to video scenes, to clues or communications delivered to the character (Dickey). Cut scenes, used primarily as information dumps where the player receives key information, usually are a reward for advancing to a certain point in the game (Dickey).

*Identity*

An important component of constructivist and game theories is the concept of identity. Many games allow the player to assume a created identity of some sort (Gee 2004). The combination of this virtual identity and the player's real-world identity forms a “projected identity,” which allows the player to rise above the limitations of both (Gee). The virtual and projected identities allow players to learn about themselves and the domain in which these identities are situated. “Projective identities are the heart and soul of active and critical learning,” allowing learners to be “engaged in real learning, learning as a refashioning of self” (Gee, p. 120).

From a learning perspective, if learners bring damaged identities as learners to a learning opportunity, only after a repair of these identities may any meaningful active learning take place. (Gee, 2004). For example, a child's belief they will fail at a particular activity, damages their identity as a learner in that area. In addition, if another child internalizes the message that success in a certain learning situations is not appropriate for their gender or meaningful in their culture, they bring a damaged learner identity to the educational opportunity. In a school or formal educational setting,

> If children cannot or will not make bridges between one or more of their real-world identities and the virtual identity at stake in the classroom—or if teachers or others destroy or don't help build such bridges—then, once again, learning is imperiled. (Gee, p. 61)

In such a repair situation, the learner must be enticed to attempt the learning activity, as many will have reached a point where they no longer even begin an attempt, then put in continued effort and achieve some type of success meaningful to them based on this effort (Gee, 2004). Gee contended that video games provide just such "a learning space in which the learner can take risks where real-world consequences are lowered," which can allow such damaged learner identities to be repaired (p. 62).

*Perspective*

The player's perspective is another important component of game design. Early games of the Space Invaders and Pacman genre featured a "God" perspective, where the player viewed the whole playing area the way one might look down on a board game (Dickey, 2005, p. 72). More recent games, particularly shooter games, usually present the player a first-person perspective (Dickey). Most players and game designers find first-person perspective provides a more engaging experience for the player (Dickey). In some

games the player's character is not visible, but the player actually "looks through the eyes" of the character. Others show part or all of the player's character. None shows the entire playing area at once. Enemies and rewards hide behind various features in the game, and features change as the character progresses from scene to scene (Gee, 2004). "No longer is the focus on a God's eye view and mastery of a specific set of exercises, but rather information, events, actions, and activities are obscured from view and encountered as the learner moves through the learning materials and environment" (Dickey, p. 72).

Dickey (2005) observed that the shift in recent years to a first-person perspective mirrors a shift from behaviorist to constructivist perspectives in learning. In a real world, interactive learning experience, the learners operate from a first-person perspective, causing the learners to become more active and, at least from their own viewpoint, central to the experience. The learner's decisions, just like the player's decisions in a video game, significantly influence the course and outcome of the learning situation. "The parallel between game design and learner positioning within differing theoretical perspectives of learning reveals that the values perpetuated in the design of contemporary of constructivist learning environments than for design from a behaviorist perspective" (Dickey, p. 72).

*The Game Generation—How Gamers Think*

Research exists analyzing the thought processes of those who play games regularly and whether they differ from nongame players. Much of this research has gathered generational data, as younger people have a much higher rate of participation in

and spend more time playing games, although middle-aged persons make the most purchases (Dickey, 2005). Figure 4 shows video game player demographics in 2005.

There is a measurable difference in thought and learning among those people for whom television and video games are a regular activity ("Gaming Draws Interest," 2005; Beck & Wade, 2005).

> To understand today's Game Generation learners, it is key for us to distinguish and separate those mind changes that come from television from the mind changes of the next generations, influenced as well by *interactive* technologies such as video and computer games and the Internet. (Prensky, 2000, p. 55)

Most importantly, gamers or the game generation are used to being active participants in learning experience and have low engagement when placed in the role of passive observers (Prensky). "They've grown up with games . . . it's a part of their lives," and the typical student is often just as "interested in taking apart the game and learning what components go into the games" as playing them (Toto, 2005, p. B01).

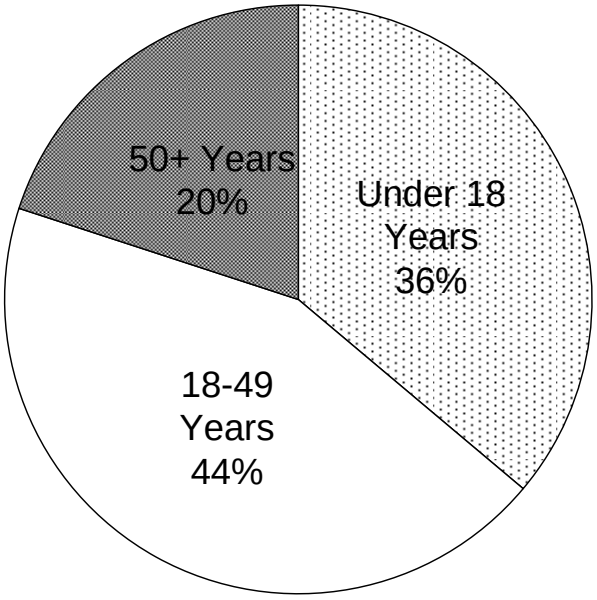



*Figure 4.* Game player demographics in 2005. Source: "ESA's 2005 Essential Facts About the Computer and Video Game Industry," by Entertainment Software Association, 2005, Washington, D.C.

Prensky (2000) described 10 cognitive style changes he observed between the Games Generation and those without game experience. The first, speed, although already mentioned needs more explaining. Most gamers respond to input occurring at "twitch speed," which is a high number of images or inputs presented in a short time period. This differs significantly from conventional speed of presentation, which gamers may find boring compared to the input speed they are used to (Prensky). They are used to learning in a connected environment, where wholes are broken into parts emphasizing the interrelation of components, and are often frustrated by standalone content with no apparent relation to other concepts and ideas. This lack of patience in both speed and presentation of content is because of their experiences with and therefore expectations of immediate payoffs (Prensky).

Table 6.

*Prensky's Cognitive Style Changes*

| No. | New style | Older style |
|---|---|---|
| 1 | Twitch speed | Conventional speed |
| 2 | Parallel processing | Linear processing |
| 3 | Graphics first | Text first |
| 4 | Random access | Step-by-step |
| 5 | Connected | Standalone |
| 6 | Active | Passive |
| 7 | Play | Work |
| 8 | Payoff | Patience |
| 9 | Fantasy | Reality |
| 10 | Technology-as-friend | Technology-as-foe |

*Note.* Source: *Digital Game-Based Learning*, by M. Prensky, 2000, New York: McGraw-Hill. Used with permission.

The Games Generation customarily sees graphics before text and will focus on visual images before words. Being able to read such images is a form of literacy in its

own right, which presents important implications for traditional learning and instructional design (Gee, 2004).

Gamers tend to process information in a parallel rather than linear fashion. Rather than mastering one step of a process and then building on it to move to the next, they experience various portions of a learning experience randomly or simultaneously, developing a context that eventually leads to mastery (Prensky, 2000). For gamers, this random access to inputs versus systematic access represents the norm among gamers, who sometimes feel constrained or bored by systematic structure (Dickey, 2005).

Finally, gamers see technology as their friend and are unafraid to experiment with it. From games to cell phones, gamers see everything as working in a similar manner, which increases comfort levels among gamers as they typically have experience with at least one technology platform ("Gaming Draws Interest," 2005). As active learners, gamers value highly exploration and fantasy, much to the frequent dismay of the passive, reality-based learners of previous generations. Similar conflict can occur due the gamers' value of play versus work and lack of attention to detail or first-time quality of product. There is a tendency among gamers to expect the opportunity to redo if necessary (Beck & Wade, 2005).

> It's a generation brought up on video games, and the experience has defined the way its members see the business world, how they think about work and risk and success, and what they expect of themselves. These attitudes can be confusing to boomers—in fact, to anyone who doesn't intuitively understand game culture. (Beck & Wade, 2005, p. 48)

In a business context, gamers consider risk real and natural, yet they attach less import to it. From a learning standpoint, the importance of decisions is significantly different between persons who had learning experiences based in the real world and those whose learning experiences are typically in virtual realms (Gee, 2004). "As intense and

interactive as they are, games automatically teach two things about perspective: first, that a little distance is not just useful but normal; and second, that your point of view is a choice—and choosing correctly matters" (Beck & Wade, p. 51).

### *Learning in Video Games*

Prensky (2000) contended that not only can educational content and game style be successfully combined, but it also "*is* possible to combine computer and video games with a wide variety of educational content, achieving as good or better results as through traditional learning methods in the process" (p. 145). Ideally, the learning feels like a game throughout but puts the learners in a learning situation, often without their conscious awareness of such, with content and context that guide the learners through experience of a given subject matter or area (Prensky, 2000). Although some critics have discounted the content aspect of video game-based learning, Gee (2004) contended that video games do teach content:

> They situate meaning in a multimodal space through embodied experiences to solve problems and reflect on the intricacies of the design of imagined worlds and the design of both real and imagined social relationships and identities in the modern world. (p. 48)

Video game-based learning works for three primary reasons, according to Prensky's (2000) research:

1. Games are engaging, which motivates people to learn. Although this engagement must be balanced with learning, often traditional teaching methods are not engaging, particularly for younger generations (Prensky, 2000).

2. Games are also interactive. They provide movement within the learning experience based on player action and decisions, where the player's choices have

consequences regarding the progression and outcome of the game. The player learns through personal experience within the game domain and discovers content in a contextual situation (Prensky, 2000).

3. Each game provides a unique combination of learning and engagement, which when properly balanced draws the player through the learning experience in a fruitful and productive way (Prensky, 2000). Gee (2004) concurred that the unique combination of player involvement and subtle content and practice exposure provide a highly motivational learning environment for those who have learned to function within such a paradigm. Barab and Duffy (2000) further supported the learner-centered model provided by the video game-based learning context as optimum for problem solving and inquiry activities.

Of course, different types of content and intended audiences require different structures to be effective (Prensky, 2000). For example, if a game seeks to teach a theory, such as how people learn, its design features open-ended simulations where the player could experience the varied results of his or her own learning choices. Such an open-ended simulation would be less effective, not to mention very hard to design, for a game that seeks to teach a foreign language. Similarly, a game intended to increase typing speed might emphasize timed drills, an important motivator since time is a key learning objective. A game designed to increase creativity, such as where one creates an artwork or structure, likely would be less effective under similar time constraints (Prensky).

Prensky (2000) reported on a 3-year study by the U.S. Navy regarding the effectiveness of games as a teaching tool, particularly for those personnel planning to serve on submarines. Given that the games have built-in opportunities for success that are

achievable by the target population, playing leads to a sense of purpose or the perception of control of one's destiny. The complexity and mystery components typical of games (not knowing what will come next) lead to fascination and further engagement. Success at the game tasks combined with social reinforcement from other players, online game sites, and the like reinforce the player's sense of confidence. Researchers have described this cycle as initiate–persist–succeed, which "leads players of training games to remain involved as they initiate game play, adopt a role, control game play, practice skills, solve problems, persist to the end, and strive to win (which translates as 'learn')" (Prensky, 2000, pp. 147-148).

Gee (2004) similarly concluded that video games reinforce a system of learning that involves four repeated steps. First, the player probes the virtual world and, based on reflection while probing, (second) forms a hypothesis about something. The player then reprobes (third) to test out this hypothesis and modifies (fourth) the hypothesis based on the results of reprobing (Gee). Many consider this process to be the basis of active learning in general, not only in video games. The process additionally leads to greater commitment and engagement of the learner in the game. "No appreciative system is formed without probing, hypothesizing, reprobing, and rethinking through embodied action in a domain in connection with the affinity group associated with the domain" (Gee, p. 100).

Each new learning experience or revelation builds on those previously experienced and causes new probing or questions (Schaller & Allison-Bunnell, 2003, p. 13). In very young children, this can be as simple as binary opposites, but older people develop complex mental organization and can typically experience real, significant

learning and growth if given safe opportunities to explore the extremes of their reality and their place within it (Schaller & Allison-Bunnell). Video games can provide such learning opportunities.

> A cycle of automatization, adaptation, new learning, and new automatization is required for those who want to survive as active thinkers and actors in a fast changing world that requires mastery of ever newer semiotic domains. . . . Video games are quite adept at creating and sustaining this cycle. (Gee, 2004, p. 70)

Players stretch to the edge of their ability on a regular basis and gain rewards when achieving results in such an extended position. “A good video game adapts to the level of the player, rewards different players differently (but rewards them all), and often stays at the edge of the player’s regime of competence” (Gee, 2004, p. 121). This constantly challenges the players and keeps them in a learning situation, rather than interspersing areas of challenge beyond the players’ current ability with situations far below their earned level of competence. Gee found that learners are most motivated when operating on the edge of their resources, where learning is challenging but accomplishable, and will spend a lot of time practicing to achieve competence if such practice is not boring. A combination of motivation and continued practice is fundamental to almost all conclusions regarding learning effectiveness (Dickey, 2005; Din & Caleo, 2000; Prensky, 2000).

A final learning concept that is particularly effective in video game-based learning is the practice of beginning players in a simplified version of the game for learning purposes. “In a good video game, the player learns to play the game by playing in a ‘subdomain’ of the real game” (Gee, 2004, p. 121). For example, a player may begin in a game subdomain where enemies are less skilled, the game moves more slowly, or choices are limited. After mastering the subdomain, the player moves into the full game,

which is usually geared to adjust to player competence, with the game becoming progressively more difficult as the player increases in ability, stretching player competence and social skill (Dickey, 2005). Additionally, while the player is not thrown into the full game at the start, "learning is not started in a separate place (e.g., a classroom or textbook) outside the domain in which the learning is going to operate" (Gee, p. 122). This allows the learning experience to take place in context of its appropriate semiotic domain, as previously described. Traditional school settings rarely apply this concept and provide another factor in the popularity and effectiveness of games as opposed to traditional learning methods (Gee).

## *Business Games*

### *Types of Business Games*

Business simulation games follow two basic models. The first, and historically most widely used, is a role-play game (Walters & Coalter, 1997). In this model, students assume various roles or jobs within a company and are given a specific time and task that would be typical of such a company's functioning (Walters & Coalter, 1997). The instructor then supplies changes in the business situation, and students must respond in such a way that most greatly will benefit their company (Walters & Coalter, 1997). These games typically feature branching situations, where the players' actions affect the progression and outcome of the game (Dickey, 2005). With increases in technology, computer-based versions of such games and new business simulations constructed specifically for a computer-learning environment are enjoying an increased popularity (Alvisi, Narduzzo, & Zamarian, 2003, p. 612). No longer are such gaming platforms the

domain of teenage boys interested in shooting as many enemies as possible (Alvisi, Narduzzo, & Zamarian, 2003). Computer-based business simulation games provide all the benefits of traditional simulation games when used appropriately but allow for a greater number of variables and complexity within the game model (Brawer, 1997). Both game constructs can provide an orderly environment for learning and can ensure that environment generates a fun and rewarding experience (Orbanes, 2002). Given the huge number of business simulation games available, this literature review considers a few representative games from both noncomputer-based and computer-based product sectors.

*General Simulation Games.*

As stated above, most noncomputer-based simulation games operate on a role-play model (Walters & Coalter, 1997). These role plays may feature one individual, operating as an independent entrepreneur and competing against entrepreneur classmates in a given business construct, or may involve a team or larger number of players, who work for the same company in different capacities (Dickey, 2005). “The use of a business game in a business policy course gives students the opportunity to implement strategic concepts with some degree of realism,” an important learning opportunity not typically available in other areas of the business instruction curriculum (Walters & Coalter, p. 172). Games also have the potential to “provide students with opportunities to practice and develop evaluation skills” (Brawer, 1997, p. 4) and to “develop workplace competencies, fostering an awareness of the global business climate, and providing relevant business technology skills” (Black, 2001, p. 3). Unsuccessful game experiences

usually points to lack of instructor involvement or competency or to oversimplification or over complexity of the simulation model (Black).

A game based on individual role-play, the Extended Buying Center Game (EBCG), “integrates marketing course concepts, theories, and practices; develops skills valued by industry; and is adaptive to course design” (Anselmi & Frankel, 2004, p. 169). In this simulation game, students take on the role of buyer or vendor, providing opportunity for development of negotiating and decision-making skills. Students typically play in one role one semester then switch to another role in the next, giving them valuable insight into a larger viewpoint of company buying functions (Anselmi & Frankel, 2004). Although primarily designed to enhance marketing instruction, the EBCG also can be used as an experiential teaching tool for operations, purchasing, and management (Anselmi & Frankel, 2004). Students learn in EBCG through involvement and discovery, “applying marketing knowledge in a game that they self-report as unique and challenging, creative, fun, inventive, enjoyable, relevant, and important to continue” (Anselmi & Frankel, 2004, p. 170). Operating on a similar individual role-play model, the Ethics Bingo Game’s design augments often-dry textbook exercises, also important since “classroom coverage usually does not emphasize the responsibilities accountants have in ethical dilemmas” (Haywood, McMullen, & Wygal, 2004, p. 85). This game assists accounting students in experiencing and dealing with the complex business dilemmas common in the real world that may affect the lives of literally millions of stakeholders (Haywood et al., 2004).

Two team-model simulation games shown to be successful learning opportunities are Corporation and Calvados. In 1994, Smith and Golden developed Corporation: A

Global Business Simulation that simulates the continuing operations of a multidivisional, multinational corporation (Walters & Coalter, 1997). The corporation's main customers are industrial users, and it produces hardware and software products and services specific to different areas of the industrial sector (Walters & Coalter). Players placed on different teams within the company are responsible for making all the various decisions that would affect the future of such a company in real life (Walters & Coalter). In contrast, Calvados is a noncomputer role-play game, which uses "the production of French apple brandy and considers relevant costs, opportunity costs, and in particular, the determination of the optimal internal transfer price" (Hoffjan, 2005, p. 63). Instead of all working for the same company, student teams in this simulation are all involved in the same product. For example, one team of students is the apple farmers who supply product to the Calvados company but are not directly employed by the firm (Hoffjan, 2005). This provides students with an opportunity to see the effects of their decision and actions not only within a company, but also on the business environment as a whole (Hoffjan, 2005).

### *Computer-Based Games*

Computer-based business simulation games also offer "sufficient insight into the actual operations of a business so that participants can later transfer the simulation model strategies into real-life situations" (Brawer, 1997, p. 3). They do so with a complexity that is rarely possible in noncomputer-based games. First, computer-based games offer learning opportunities across a vast array of business topics. For example, a game called Royal Flush helps students learn to consider and deal with cross-cultural issues that influence business decisions (Robinson, Lewars, Perryman, Crichlow, Smith, & Vignoe,

2000). Stock-Track, a well-known investment game, allows investment management students to practice “trading in bonds, options, futures, mutual funds, and spot contracts” (McClatchey & Kuhlemeyer, 2000, p. 208). Industry Giant II, a business building simulation game previously mentioned, forces students to consider both macro and micro impacts on the growth and expansion of a number of different industries (JoWooD, 2005).

The Business Strategy Game is a widely used business simulation featuring international athletic shoe companies (Doyle & Brown, 2000). Students work in small groups to control an independent shoe company that is in competition with other student-run shoe companies. The presence of other, hostile companies forces students to take risks, to develop aggressive and effective strategy, and to anticipate their competitors’ strategies (Doyle & Brown, 2000). As competitors in a fiercely competitive industry, students must “make numerous decisions regarding product pricing, production, marketing and all aspects of company operations in numerous decision periods” (Doyle & Brown, 2000, p. 332). This gives the students experience in “developing strategies, decision making, team building and core marketing skills” (Doyle & Brown, 2000, p. 330).

### *Effectiveness and Use of Business Games*

Business games, particularly those that are computer based, are effective because they provide an enhancement and forum for practice of learned material, offer increasingly complex situations that stretch players’ learning experience, and provide an opportunity for development of skills needed in the business world. The classroom does

not offer opportunities for similar development of these skills. As Orbanes (2002) contended,

> In many ways, workplaces are like games: both can be structured to avoid controversy and even to sweep us up in exciting rhythms of activity, both can engage us in challenging tasks while supporting rich experiences off the board, and ultimately, a great game and a great workplace can produce the same sentiments. (p. 8)

If school or work challenges learners in non-threatening ways, they will invest time and talent in a high-quality outcome and will look forward to repeating the process (Orbanes, 2002). Beck and Wade (2005) described games as particularly effective teaching tools, in part because they "automatically teach two things about perspective: first, that a little distance is not just useful but normal; and second, that your point of view is a choice – and choosing correctly matters" (p. 51).

*Business Games as Enhancement*

A number of researchers have concluded that simulations most appropriately augment, rather than to replace, traditional business instruction (Brawer, 1997; Haywood et al., 2004; McClatchey & Kuhlemeyer, 2000). Doyle and Brown (2000) concluded from a review of available literature that games are best and therefore most typically used in tandem with lectures rather than to replace them; the information from lectures deepens a student's understanding of the game, which in turn reinforces the content of the lecture. For example, an elementary school used a simulation game called Dino Park Tycoon, combined with age-appropriate business lectures and in-class demonstrations (Ganzert & Helms, 1998). The school principal later stated the game "gave students real reasons for writing, calculating, estimating, and organizing their thoughts," which led to noticeable benefits in many areas of classroom work (Ganzert & Helms, 1998, p. 54). A game such

as Industry Giant II, for example, could both teach and provide business concepts and provide experiential learning in history, politics, and economics. JA Titan, a free business simulation game available online, allows high school students to become chief executive officers (CEOs) of their own manufacturing firm in the year 2030 (“Junior Achievement Program,” 2004). The game can be adapted by teachers to “create a series of economic scenarios such as a full business cycle; recession only; product introduction phase; or, most challenging of all, product obsolescence,” which forces students to consider a variety of factors and their effect on businesses and society (“Junior Achievement Program,” 2004, p. 26). Instructors use it to support other instruction in business principles and across the curriculum (“Junior Achievement Program,” 2004).

*Real-World Exposure and Application*

Students appreciate and value simulation games because they perceive the games improve their understanding of business and help to develop the skills necessary for success (Anselmi & Frankel, 2004). Business situations are often hugely complex, and games allow students to experience and work through such situations in a safe environment, learning to “sift through complex information and use critical-thinking skills to see the situation from the viewpoint of all interested parties” (Haywood et al., 2004, p. 88). In Industry Giant II, for example, players can gamble in a variety of risky business propositions, try and retry various strategies, and never lose more than their virtual shirt (JoWooD, 2005). The budding entrepreneur in this and similar games can practice various strategies and experience their impact on business as a whole. This integrated view of business provided by simulation games causes participants to view

decisions as relating to the entire company rather than just to one's own department, and increases coordination across the firm (Hoffjan, 2005). Barrese, Scordis, and Schelhorn (2003) further encouraged instructors to use games to "develop the merits of alternative business strategies" and to consider their impact company-wide (p. 48).

Games further incorporate the happenings of luck and chance, a real but often neglected component of business instruction (Orbanes, 2002). For example, considerations such as weather can be vital to some companies but beyond their control (Ganzert & Helms, 1998). Games allow learners to develop "a feel for the interaction of management decisions and market stress" not available in typical classroom learning activities (Barrese, Scordis, & Schelhorn, 2003, p. 43). Just like in a typical work environment, players of computer-based or leveled simulation games find that as they master one level of expertise, they must then to move to more difficult scenarios (Gee, 2004). Gee found that a successful game "adapts to the level of the player, rewards different players differently (but rewards them all), and often stays at the edge of the player's regime of competence" (p. 121). Players may end up bankrupt (in which case they can start over) or may achieve remarkable success, but all usually enhance their business acumen and learn to consider the broad indicators and impact of business life (Ganzert & Helms, 1998).

### *Business Games To Develop Soft Skills*

Finally, simulation games develop teamwork skills, offer a risk-free environment for learning, lower fear of failure, and provide quick and relevant feedback to participants (Doyle & Brown, 2000). Since business games typically require cooperation with other

students, participants must be open to the exchange of opinions within the group and be ready to compromise or make trade-offs when faced with opposing goals (Hoffjan, 2005). In existing companies, Orbanes (2002) reported that business simulation games can build relationships and increase social capital across an organization, increasing "camaraderie, mutual understanding, and cooperation" (p. 8). For example, the managerial game Income/Outcome has been shown to increase participant appreciation of the importance of different departments working together to achieve success (Orbanes, 2002). Similarly, transfer pricing is for many firms an ongoing source of internal tension; however, as participants work through a game of Calvados, they begin to recognize that the success of the entire company depends upon the successful resolution of conflicts between the different business units and entities (Hoffjan, 2005). The Extended Buying Center Game mentioned previously "covers a broad spectrum of topics with the intent of exposing students to a number of basic activities or skill sets – such as problem solving, verbal and written communications, and interpersonal skills – that they are likely to use in an introductory employment setting" (Anselmi & Frankel, 2004, p. 174).

Further, games help managers consider complex issues and avoid "assigning the best project manager in the Houston office to a client in Winnipeg at the same time that the manager is planning her Texas wedding" (Orbanes, 2002, p. 6). Development of such negotiation, communication, and other soft skills is nearly impossible in a traditional classroom, but all are skills highly prized by and needed in business. In short, "business training makes one a better game player, and game playing also trains one for better business judgment" (Orbanes, 2002, p. 8).

*Economics Games*

A wide variety of video games has economic components, most developed along simulation principles. Some simulate specific industries, usually from a micro-economic standpoint, while others deal with macro-economic, often global economic concerns of the real world or some fictitious country. Two of each type is representative of their respective categories.

The earliest of this type of game were the Sim games, such as SimCity, and the "tycoon" games, such as

1. Airport Tycoon 3.
2. Health and Fitness Club Tycoon.
3. Lemonade Tycoon 2.
4. Mall of America Tycoon.
5. Prison Tycoon.
6. Railroad Tycoon 3.
7. Roller Coaster Tycoon 3.
8. School Tycoon.
9. Seaworld Adventure Park Tycoon 2.
10. Starship Tycoon.
11. Tabloid Tycoon.
12. Tycoon City: New York.
13. Zoo Tycoon 2 (Poole, 2000).

Of these, the tycoon games usually simulate a specific industry and require the player to develop companies and eventual empires within the sector (Poole, 2000). The

latest example of a game of this type is Tabloid Tycoon, where players run a “scandalous newspaper,” requiring them to consider business issues such as risk versus growth (Gamespy, 2005). Risks inherent to this specific game include whether to run a questionable story, sabotage competitors, or resort to blackmail (Gamespy, 2005). Players of all tycoon games additionally must practice typical business functions, such as controlling budgets and managing staff (Gamespy, 2005). The game advertises it requires hard choices, but players should aspire to growth at any cost (Gamespy, 2005). “You won’t make it big [in Tabloid Tycoon] without taking big chances” (Valusoft, 2005, para. 7).

Zapitalism is another excellent example of a game simulating a specific business (Lavamind, 2005). It is the second in a series of three games, and the company that produces the game recommends players with little or no business knowledge begin with a game called Gazillionare and then move on to Zapitalism (Lavamind, 2005). The game includes easy-to-follow tutorials that quickly get the new player up and running on the game, facilitated by intuitive design (Lavamind, 2005). The game also adjusts in difficulty, providing a continued challenge to players and allowing students to learn at their own pace, an important consideration in any active learning opportunity (Lavamind, 2005). In the Zapitalism game construct, players build a retail empire in the imaginary islands of Mermandan (Lavamind, 2005). Students learn and practice economic concepts such as profit margins, supply and demand, inventory management, and financial and debt planning, among other things (Lavamind, 2005). True to its real-world paradigm, even bad weather can be a factor in game success (Lavamind, 2005).

This sort of game allows students to experience various micro-economic impacts in a realistic environment. Changes in price or going over budget have real-world economic ramifications. Decisions must be made regarding whether to expand the business and if so, when. One player may expand aggressively using high-interest loans, another more slowly with more conservative funding options. The results of each will be different, and players are free to try one option when playing the game one time and another option the next time through (Gamespy, 2005). Various fixed environmental aspects, such as the overall state of the economy, interest rates, and the like, require analysis and consideration when making decisions (Gamespy, 2005). This category of economic video game provides excellent experiential learning for students studying either general business or some micro-form of economics.

In contrast, some games deal with economic conditions in a macro-economic context, such as an international organization or the government sector. The Sim games mentioned above typically involve building an entire country or city, such as ancient Rome (Poole, 2000). Again, participants in these games must make strategic resource distribution decisions. Players who decide to invest in buildings instead of fire protection may have their whole world burn down.

Created for an international agency, Force Food is a simulation game developed by Deepend (Rome, Italy) and Playerthree (London, UK) for World Hunger (2005), intended to educate players about world hunger and increase awareness of UN programs that address this worldwide problem. The game requires players to take into consideration economic variables in additional to cultural, political, and logistic concerns (World Hunger, 2005). In this simulation, the player is one of a team of six sent to deal

with a major famine crisis in the Indian Ocean, on the imaginary island of Sheylan (World Hunger, 2005). Other team members are all experts in some needed area, including a nutritionist, a logistics officer, a pilot, an appeals officer, and a director of purchasing and planning (World Hunger, 2005). The major economic issue of the game revolves around “food insecurity,” a scarcity factor related to the supply issue of food products in a given community (World Hunger, 2005). Specific considerations of how to distribute limited resource supply in light of increased demand are foundational to the game (World Hunger, 2005).

A similar game aimed at younger players, The Peter Packet Challenge, requires players to decide what type of resource or resource mix to supply to a given community (Peter Packet, 2005). The goal is saving lives through economic development in third-world countries, and players face tough decisions whether to provide water supply improvements, health care and medicine, improved education, or similar programs (Peter Packet, 2005). Real-life locations range from Zimbabwe to Haiti, and the realistic conditions of the game promise to be eye opening to players (Peter Packet, 2005).

Games in this category tackle economics in the scope of wider global issues. They are designed not only to teach various economic, business, and logistical concepts, but also to educate players on the difficulty of many decisions faced by this sector. For example, how does a player chose between clean water for one community and providing food for anther, if limited resources will allow only one project? This requires students to consider the macro issues regularly faced by governments and other international organizations responsible for such economic decisions (World Hunger, 2005).

Chavez (2004) studied the use of *Aplia*, a multimedia Web site designed for teaching economics. *Aplia* uses an asynchronous and interactive set of web-based tools to supplement classroom education. Although not a game, *Aplia* adds the dimension of self-paced interactivity to the student's learning assignments. During his study, Chavez (2004) found the additional use of *Aplia's* interactive assignments significantly improved learning.

*Management Games*

Video games are particularly suitable as a supplement to business curricula because they allow for a complexity similar to the real business world yet almost impossible in noncomputer-based games or exercises (Brawer, 1997). Students playing these games have the option of trying various strategies, experiencing the results, and then repeating the game from a different strategic plan. For example, in the Business Strategy Game, students work in groups to manage an athletic shoe company (Doyle & Brown, 2000). Other students, running similar companies, compete against each other to be the most successful shoe venture (Doyle & Brown, 2000). In addition to providing students opportunities for practical decision-making and team-building experience, students also must make operational management decisions such as marketing, pricing, and production (Doyle & Brown, 2000).

This type of game type of game typically refers to a simulation because it creates a virtual environment that closely mirrors the real world. A number of different kinds of game and interactive media products are available related to management concepts, but by far the most effective and popular management video games are simulation games

(Poole, 2000). These were one of the earliest types of games, usually broadly encompassing building an "empire" of some sort, such as found in the Railroad Tycoon and other games in the tycoon model (Poole). A significant number of such games are now available, and many allow players to develop multiple businesses across historic periods of time. For example, a game such as Industry Giant provides experience in applying management principles across a number of business ventures, beginning at the start of the 20th century and progressing over a number of decades (JoWooD, 2005). Players must make many macro decisions typical to upper level business managers, in addition to making investment decisions regarding entry into additional business ventures (JoWooD). Other recent tycoon type games have become more industry specific. For example, Tabloid Tycoon centers on management of a tabloid newspaper and requires players to make decisions regarding hiring, expansion, risk, and growth (Gamespy, 2005). As managers, players notably must decide exactly how morally upright they will be in story choice and competition with other papers, allowing players to try out a number of managerial ethics models without ending up in more than virtual jail (Gamespy).

Other games operate on a much more micro-oriented simulation concept. For example, the U.S. military developed a game, America's Army, which both provides both military training and as a recruitment tool (Zeller & Lyhus, 2005). It is currently the third most popular online game worldwide, which the Army heralds as providing a more effective recruitment vehicle than all other methods combined (Zeller & Lyhus). America's Army further provides virtual training in battle leadership and other management issues specific to the military (Zeller & Lyhus). For example, the Army has

realized through its various responses to terrorist threats and overseas operations in recent years that any soldier may assume some sort of leadership role in a real-life battle situation. The Army therefore identified leadership training as a vital skill for all soldiers, even those with lowest rank (Zeller & Lyhus). The America's Army video game is one of the ways the military provides leadership training to lower ranking soldiers, helping to prepare them for the unexpected task of managing civilians and other military personnel in an emergency (Zeller & Lyhus).

### *Virtual U*

Technology today allows us to record, analyze, and evaluate the physical world to an unprecedented degree. Enterprises in the new millennium are increasingly relying on technology to ensure that they meet their mission requirements. It is important to note here that, "Educational organizations have been referred to as complex and arcane enterprises" (Massy, 1999). For educational institutions, this reliance on technology requires new mission statements, revised catalogs and other materials, different learning environments and methods of instruction, and, perhaps most significantly, new standards for measuring success. To achieve these objectives, several initiatives in the form of web based systems, models, scenarios, simulations, and games are being developed and tested. Among these approaches, simulations and games are the most effective ones (Massy). One such higher education simulation is "Virtual U" also known as Virtual University (Virtual U Project, 2003).

William F. Massy conceived and designed Virtual U. Dr. Massy was a professor, university administrator, and is currently the president of the Jackson Hole Higher

Education Group (PR Newswire, 2000). Funding came from Alfred P. Sloan Foundation in New York while the Institute for Research on Higher Education at the University of Pennsylvania (Waters & Toft, 2001) provided the data. In designing the game, Massy and Ausubel (Program Director, The Alfred P. Sloan Foundation) included detailed data from 1,200 U.S. academic institutions, as well as information culled from government sources (Schevitz, 2000). Released in 2000, Enlight Software of Hong Kong produced the first version that sold commercially for $129 (Blumenstyke, 2000). Today, the game is a free download from the Virtual U Website at www.virtual-u.org.

Developed along the lines of the popular “SimCity” game, see Figure 5, the primary objective of the Virtual U game is to develop the skills of the players for running a higher education institution such as a college or university. According to Moore and Williams (2002) “Virtual U will let you test your skill, judgment, and decisions,” while directing an educational institution. This game based environment design specifically enables any person to tackle the various scenarios and problems that usually encounter a higher educational institution. “The game is driven by a powerful simulation engine that uses a combination of micro-analytic and system dynamics methods and draws on an extensive compilation of data on the U.S. higher education system” (Massey, 1999).

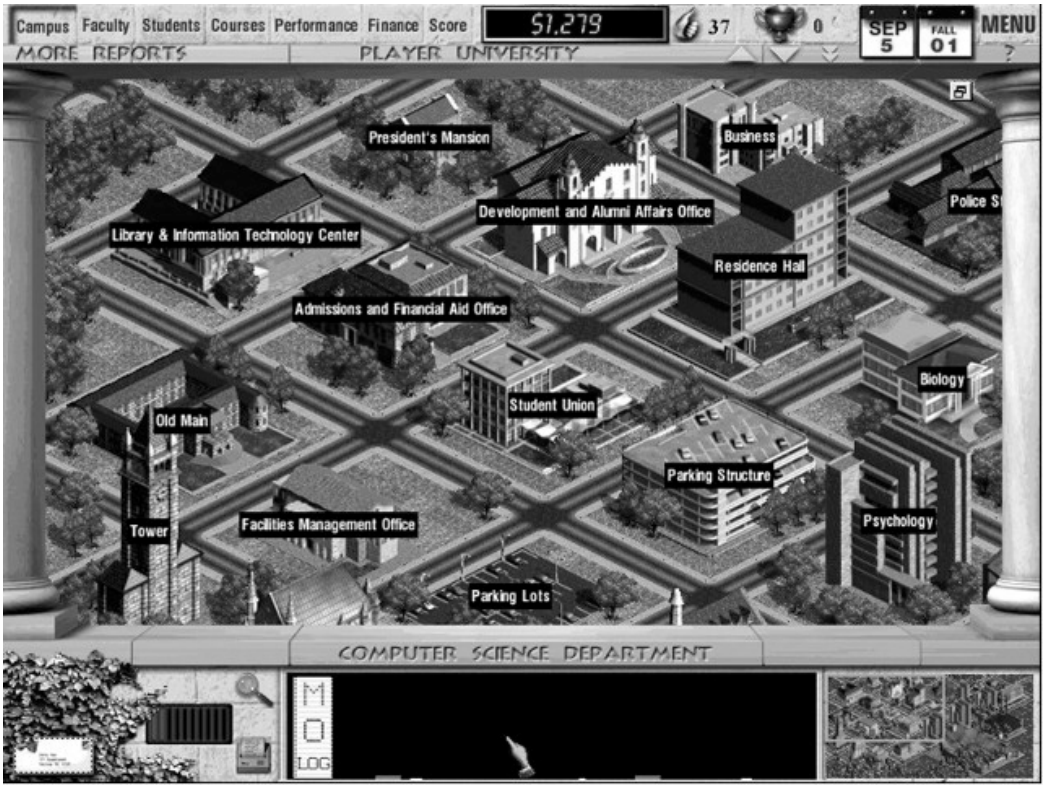



*Figure 5.* Virtual U main screen. Used with permission.

The Virtual U game employs several possible working strategies and allows the player to success as per their exploratory or learning style (Rainwater et al., 2003). In general the player is appointed as the University president and allowed to administer the University as a whole. In this role, the player is concerned about institution level policies, budget etcetera. Then there are scenario-based strategies such improving teaching or research performance in a particular faculty, where the player assumes the role of a faculty head (Rainwater, Salkind, Sawyer, & Massy, 2003). As the college president, a player confronts a variety of complex issues covering all components of a higher education institution (Virtual U Program, 2003). They must address major areas such as operating budgets (Figure 6), hiring faculty, and endowment management as well as lesser areas such as campus parking and availability of athletic scholarships (Virtual U

Program, 2003). The game even includes variables for student and faculty moral considerations and prestige of the institution (Virtual U Program, 2003). Lastly, there are 18 possible chance cards. Chance cards are emergencies that arise during game play requiring immediate attention. Virtual University not only allows players to explore secondary and tertiary effects of several years worth of actions, but the game also allows the player to customize the experience adjusting everything from the size of the faculty and student body to the cost of maintaining campus roads and buildings (Conte, 2003).

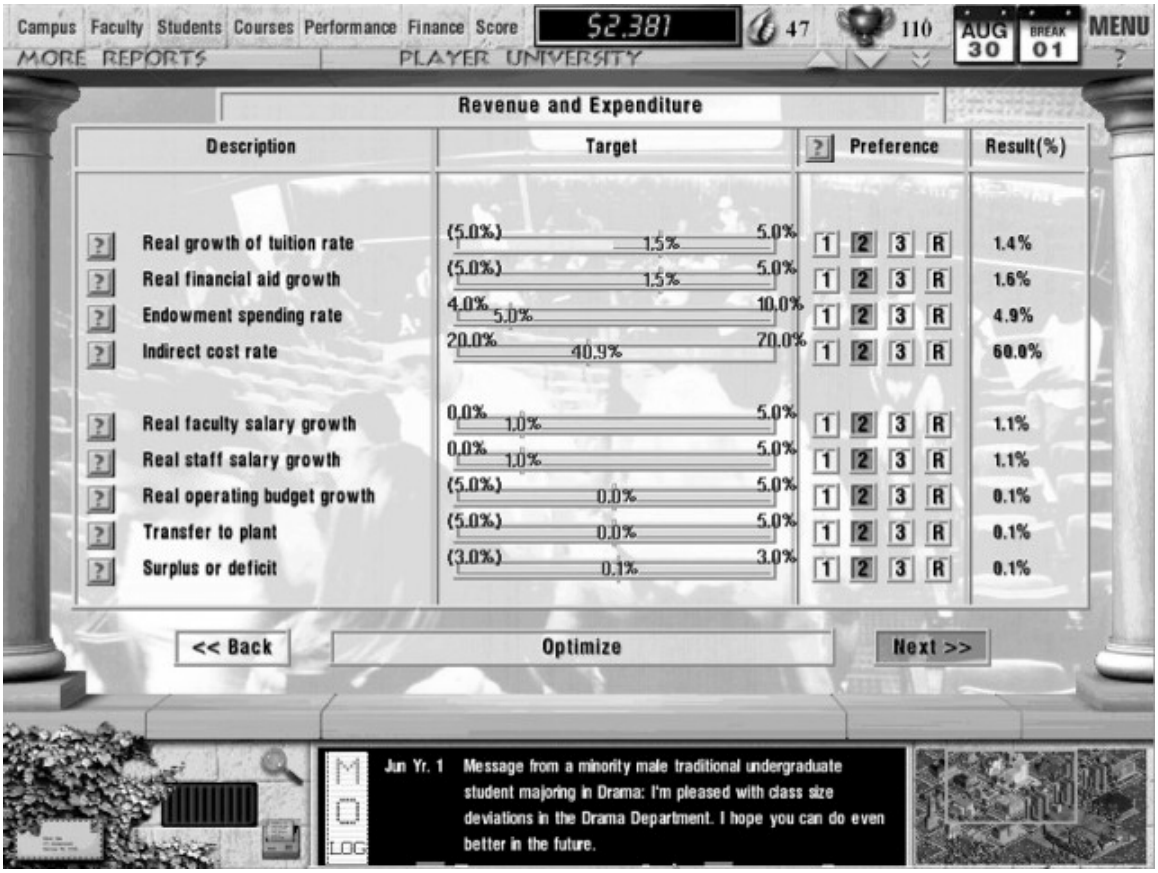



*Figure 6*. Virtual U budget screen. Used with permission.

Moore and Williams (2002) did, however, identify a few limitations in the Virtual university system:

1. One needs to have extensive administrative knowledge or experience to play Virtual U effectively. The amount of prior knowledge required may prohibit some of the audiences from using the system.

2. There is lack of assessment-informed decision making in the game. The "teach better" goal is one of the game scenarios, yet there is nowhere a link between the teacher quality and the student learning.

3. Educational quality and prestige indicators are the two performance indicators the developer advises the player pay close attention to. Within the educational quality framework, one only has access to quantitative inputs and outputs (for example, number of degrees granted) rather than measures of quality. There are a limited number of variables which a player can chose or adjust (course mix, number of students shut out of courses, level of faculty teaching talent, class size, faculty morale, and faculty time devoted to teaching activities). The prestige indicator is even more limited.

4. A final Virtual U limitation identified by Moore and Williams (2002) is its lack of flexibility in the area of faculty management. While a player may reallocate departmental resources, teaching loads, and priorities in hiring new faculty, they cannot actually fire or remove faculty.

The developers acknowledge on several occasions that the game is complex and not easy for beginners (Massey, 1999). Although designed to simulate academia, younger students may be more easily attracted to such complex games and learn them quickly. Despite the above-mentioned limitations, Virtual U is a useful and laudable effort (Moore & Williams, 2002) and is a good introduction to running the day operation of a university (Waters & Toft, 2001).

Virtual U is designed to educate higher education administrators, not to teach general management principles. As Ausubel stated in 2002:

> I scarcely need to mention here that many of those who manage the higher education enterprise, including department chairs, deans, provosts, presidents, and trustees, have had little chance to play before they find themselves dealing with real students, real professors, and real alumni.

As part of a higher education management course, games such as Virtual U provide a vital learning experience. For one thing, students are actually willing to invest significant amounts of time in learning and mastering a video game (Marinelli & Pausch, 2004). It often takes 20 – 50 hours to play through such a game, sometimes more if the game is particularly complex (Marinelli & Pausch, 2004, p. B16). Although this is the same number of hours required in the average college course, students are often more willing to commit to this time investment than to their coursework and do so without the motivator of receiving a certain grade (Marinelli & Pausch, 2004). This time commitment alone can directly enhance learning, according to Marinelli and Pausch.

## Opposition to Game-Based Learning

Game-based learning also has its critics. These criticisms fall into two categories: general opposition to game-based learning and criticisms of proponents of game-based learning. Both are described here.

Two of the leading proponents of game-based learning are Marc Prensky and James Paul Gee. Prensky is an independent writer, speaker, and consultant while Gee is a Professor in the Department of Curriculum and Instruction at the University of Wisconsin-Madison. Prensky's advocation of game-based learning is his sole career. In his book, Digital Game-Based Learning (2001), he spends less than 1.5% of the space

addressing critics in a mocking and condescending way. Additionally, his work lacks scientific method and rigor. The fact that his livelihood depends on the adoption of his advocacy shows a clear possible conflict of interest.

Gee, on the other hand, is a serious academic. However, Gee is a student and an advocate of semiotics and that comes through his book, What Video Games Have to Teach Us About Learning and Literacy (2004). Semiotic theory runs throughout the 36 principles he develops in the book. Seeing the ideas surrounding game-based learning through the single lens of semiotic domains is limiting. Therefore, although Gee's work is considered by many as seminal, it may also be considered myopic.

Squire, like Gee, is a dedicated academic. Squire's doctoral dissertation is about using the video game Civilization III as a learning game. Squire is now a consultant for the company, Firaxis, who just released Civilization IV. There appears to be a conflict of interest as far as academic research is concerned.

One criticism of game-based learning is the lack of evidence that it works. As previously mentioned, Dr. Jan Cannon-Bowers (2006), challenged the efficacy of game-based learning during a panel discussion during the recent Training 2006 Conference:

> Simulations. We have plenty of empirical studies about simulations over the last 25 years. We know simulations work. We know simulation improve performance. We know simulations improve learning. Yet, I challenge anyone to show me a literature review of empirical studies about game-based learning. There are none. We are charging head-long into game-based learning without knowing if it works or not. We need studies.

Hostetter (2000) discussed the addictive nature of video gaming. He argued whether or not introducing such predilection to addiction is a good idea for academia. Additionally, he questioned whether game-based learning might lead to a lack of imagination because students are handed highly creative and imaginary worlds in the

games. According to Epic (2006), game-based learning often not only lacks the intended educational impact, but can be a distraction, a disappointment, and destructive to positive learning. While Bonk and Dennen (2005) pointed out how prohibitively expensive learning video games are to create, Guetl, Dreher, and Maurer (2005) spotlighted the added workload requirements for teachers and learning content providers.

Kyrylov, Bonanni, Kyrylova, and Love (2004) studied the rising trend of business games and found several weaknesses. They believed that existing business games did not provide effective training for future managers. Part of their work was grouping business game weaknesses into the three categories of content, pedagogy, and design. Table 7 summarizes the weaknesses they found.

Table 7.

*Business Games Weaknesses*

| Content related weaknesses | Pedagogical weaknesses | Design related weaknesses |
|---|---|---|
| • Poor curriculum coverage<br>• Lack of synergy<br>• Unnecessary learning overheads | • Lack of flexibility<br>• Lack of benchmarking<br>• Lack of support for debriefing | • Poor emotional engagement<br>• Poor visualization<br>• Insufficient support of distributed learning |

## Conclusion

Video game-based learning shows promising potential as an effective learning environment, because many of the components that makes a good video game are the same components that underlay any successful learning experience. Good video games provide an interactive learning environment where content occurs in an effective context, where learners engage actively in a process of learning discovery and progress on to more complex activities and learning situations as their abilities and learning experience

increase. Attracting players through fun and challenge, good video games provide a high level of engagement, which motivates the player to work hard, practice, and seek out learning experiences. When such engagement adds to substantive learning opportunities, in any forum, real and significant learning occurs. Unfortunately, while this is a typical situation within the video game realm, fewer of today's students, particularly those who have experienced the difference of such learning in a gaming environment, are led to or can muster similar engagement (and therefore learning success) in traditional schooling situations. Therefore, this study examines the impact of using video game-based learning in a business curriculum.

Using Bloom's taxonomy and game design theory as starting points, it is easy to associate game genres to each level of the taxonomy to create a game-based learning taxonomy. This would indicate what game genre would be best to support the desired learning objectives or terminal outcomes. Instructional Designers can use this modified taxonomy when designing game-based learning if they are designing the game from the beginning for learning purposes. Table 8 presents such a model.

Table 8.

*Using Bloom's Learning Taxonomy for Games*

| Stage of learning | Taxonomy with verbs | Learning activities | Game genres |
|---|---|---|---|
| Evaluation | appraise, argue, assess, attach, choose compare, defend estimate, judge, predict, rate, core, select, support, value, evaluate | arrange, define, duplicate, label, list, memorize, name, order, recognize, relate, recall, repeat, reproduce state | Game show competition<br>Sports games<br>Flash card games |
| Synthesis | arrange, assemble, collect, compose, construct, create, design, develop, formulate, manage, organize, plan, prepare, propose, set up, write | classify, describe, discuss, explain, express, identify, indicate, locate, recognize, report, restate, review, select, translate | Open ended simulation<br>Role-play games<br>Adventure games<br>Strategy games |
| Analysis | analyze, appraise, calculate, categorize, compare, contrast, criticize, differentiate, distinguish, examine, experiment, question, test | apply, choose, demonstrate, dramatize, employ, illustrate, interpret, operate, practice, schedule, sketch, solve, use, write | Persistent state games<br>Role-play games<br>Adventure games<br>Timed games |
| Application | apply, choose, demonstrate, dramatize, employ, illustrate, interpret, operate, practice, schedule, sketch, solve, use, write | analyze, appraise, calculate, categorize, compare, contrast, criticize, differentiate, distinguish, examine, experiment, question, test | Strategy games<br>Adventure games<br>Mystery games |
| Comprehension | classify, describe, discuss, explain, express, identify, indicate, locate, recognize, report, restate, review, select, translate | arrange, assemble, collect, compose, construct, create, design, develop, formulate, manage, organize, plan, prepare, propose, set up, write | Strategy game<br>Detective games<br>Mystery games<br>Simulation games |
| Knowledge | arrange, define, duplicate, label, list, memorize, name, order, recognize, relate, recall, repeat, reproduce state | appraise, argue, assess, attach, choose compare, defend estimate, judge, predict, rate, core, select, support, value, evaluate | Strategy games<br>Role-play games<br>Simulation games<br>Mystery games |

As previously discussed, Brookfield's ideas are very similar to John Keller's ARCS model of learning as well as Chris Clark's Principles of game-based learning (Figure 3). Comparing a representation of Keller's ARCS model with a representation of Clark's video game model shows a striking similarity in Figure 7.

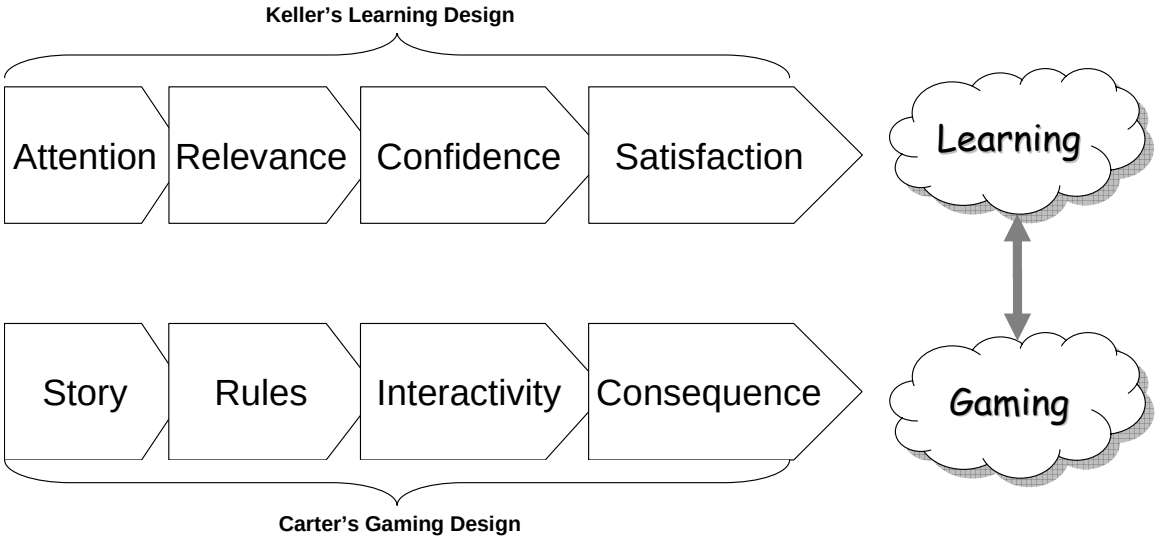



*Figure 7.* Comparison on Keller's ARCS to Clark's Game-based learning.

This chapter provided literature review, the major sections of which are adult learning theory, traditional instructions, video game-based learning, how gamers think, and an overview of business, economics, and management video games. The chapter also includes a section on the implications of related research for the focus and methodology of this study.

Next, chapter 3 explicates the research methods used for the dissertation. It presents an overview of the research methodology and rationale, a review of the research questions, the research design, and procedures. Lastly, it discusses the methodology of data analysis and interpretation.

# CHAPTER 3:
# RESEARCH METHOD

## Research Design and Methodology

A causal-comparative (ex post facto) study was conducted at a nationally known university campus in Arlington, VA to examine the effectiveness of the addition of a commercially available game not originally designed to teach principles of management to an upper level undergraduate management principles course. Some instructors started using a video game as a teaching supplement in the middle of 2005. Consequently, a video game was added to most of the remaining classes teaching 3rd year management students. The video game, Virtual U, is a free downloadable game produced by Enlight Software, the Jackson Hole Higher Education Group, and the Institute for Research on Higher Education at the University of Pennsylvania. Virtual U is a commercially available off-the-shelf game not originally designed to teach principles of management. It is available at www.virtual-u.org and was to students as a supplement to the regular classroom curriculum.

Causal-comparative research investigates whether one or more preexisting conditions have possibly caused differences in groups of participants. It attempts to determine reasons, or causes, for the existing condition. In causal-comparative research, the researcher attempts to determine the cause, or reason, for preexisting differences in groups of individuals (Wallen & Fraenkel, 2001, pp. 330-348). The basic causal comparative approach involves starting with an effect and seeking possible causes. Such causal-comparative studies are far more common in educational research. Causal-comparative studies typically involve two (or more) groups and one independent variable,

Characteristics of causal-comparative research include the fact that conditions have already been met, there is a complete lack of control or ability to manipulate the variable under study. The most commonly used inferential statistics are:

1. *t* test, used to determine whether the means of two groups are statistically different from one another.
2. ANOVA, used to determine if there is significant difference among the means of three or more groups.
3. Chi square, used to compare group frequencies, or to see if an event occurs more frequently in one group than another.

Despite its several key advantages, causal-comparative research does have some serious limitations that should also be kept in mind:

1. Since the independent variable has already occurred, the same kinds of controls cannot be exercised as in an experimental study.
2. Lack of randomization, manipulation, and control are also weaknesses.
3. Lack of researcher control.
4. An apparent cause and effect relationship may not be what it seems
5. Causes and effects may be reversed.
6. An external third factor may actually be responsible for both the hypothesized case and the hypothesized effect.
7. The results are, at best, tentative in most cases.
8. Requires repeated measures to yield definitive results (Wallen & Fraenkel, 2001, pp. 330-348).

The study generated a variety of data sets, allowing comparison of various student groupings with relevance to whether they did or did not participate in the game. Data sets also included gender, race, and age.

The various data groups were compared using a bank of standardized test questions provided with the course text, *Management, (8th ed.)* (Griffin, 2004). All students used this text for the management principles course and it serves as the guiding text for professors. Therefore, using questions from this text ensured that students have the same access to text and class content apart from game use and reinforces the credibility of results as being attributable to participation in the Virtual U game.

This study employed A causal-comparative research method, measuring student-learning outcomes as expressed by scores on a standardized test. Because of the type of data produced from student tests, and to test the effectiveness of the game supplement, the researcher performed comparisons of means, *t* tests, ANOVA, and chi-squared tests. Data was analyzed from this research and results obtained using Microsoft Excel. As the data were expected to be approximately normally distributed, normal curve goodness of fit testing was used to test these assumptions. These tests were based on different pairs of sample data as laid out in the research questions and accompanying hypothesis previously described. In addition, a standard six-step hypothesis test for each research question was used to determine whether to reject the null hypothesis.

## Method of Inquiry

This study examined the learning enhancement afforded by a commercially available off-the-shelf game not originally designed to teach principles of management,

Virtual U, as measured by standardized test scores of students in an introductory management course at ABC University in Arlington, VA. This game was supplemental to the traditional classroom instruction and text provided to all students in the course, and the researcher selected test questions from a bank provided by the textbook publisher to ensure comparability between the sample group and remaining students. All students were tested using identical testing situations and materials to allow a quantitative comparison of the scores of students participating in the game and students not participating in game play.

## Research Population

The population participating in this study was 3rd year, junior-level college students enrolled in an introductory management course. Testing and other data such as gender, age, and ethnicity were obtained from the Academic Department. This comparison provides additional credibility for use in results in justifying incorporation of this or a similar video game at other ABC campuses and in other college environments.

Some instructors started using the video game as a teaching supplement in 2005. It was the individual instructors who did or did not choose to use the video game as a learning supplement. Consequently, the video game was added to half the classes teaching 3rd year management students. Classes using the game did so for 2 hours every other class period. Students first were made to play the game tutorial. After that, instructors assigned progressively harder scenarios that supported the subject lectures in the curriculum. Students were also assigned reflective “lessons learned” after each game session in an online threaded discussion. Students had the opportunity to comment on

each other's learning. The study sample were all student scores from all MGMT 303 Principles of Management classes taught in a standard 15-week day format, an 8-week accelerated night and/or weekend format. Approximately one half of students participated in the game playing, drawn randomly across courses and instructors.

## Examples of Research Data

This study collected test scores from all students enrolled in the management principles course at the Arlington, VA, campus of ABC University. Additional data collection included the following while keeping the student identity confidential: (a) class number, (b) test score, (c) gender, (d) ethnicity, and (e) age. These data were used both in data analysis of test scores and in making demographic generalizations between the sample population, the local campus population, and ABC University students on other campuses. Such data was kept in the ABC University Oracle Student System database and accessible to faculty and staff via the University's Wide Area Network.

## Data Analysis

### *Instructor Grading*

The first set of tests determined if there was any significant difference between instructor grade means. There were seven instructors. One instructor never used the game in their class. Four instructors used the game in some, but not all their classes. Two instructors used the game in all their classes.

*Instructor Grading Question and Hypotheses*

Question A: What was the difference in academic achievement between groups of students taught by different instructors who did not use the video game? Table 9 presents the hypotheses and null hypotheses corresponding to Instructor Grading Question A.

Table 9.

*Hypotheses for Question A: Instructors Not Using the Video Game*

| Hypothesis A | | Hypothesis statement |
|---|---|---|
| Null Hypothesis A | $H_0$ $\mu_1 = \mu_2 = \mu_3 = \mu_4 = \mu_5$ | There is no difference in test scores between instructors who did not use Virtual U, where<br>• $\mu_1$ is the mean test score of Instructor A who did not play,<br>• $\mu_2$ is the mean test score of Instructor B who did not play,<br>• $\mu_3$ is the mean score of Instructor C who did not play,<br>• $\mu_4$ is the mean scores of Instructor D who did not play,<br>• $\mu_5$ is the mean test score of Instructor E who did not play. |
| Alternate Hypothesis A | Not all five $\mu_i$ are equal | There is a difference in test scores between instructors who did not use Virtual U, where<br>• $\mu_1$ is the mean test score of Instructor A who did not play,<br>• $\mu_2$ is the mean test score of Instructor B who did not play,<br>• $\mu_3$ is the mean score of Instructor C who did not play,<br>• $\mu_4$ is the mean scores of Instructor D who did not play,<br>• $\mu_5$ is the mean test score of Instructor E who did not play. |

Question B: What was the difference in academic achievement between groups of students taught by different instructors who did use the video game? Table 10 presents the hypotheses and null hypotheses corresponding to Instructor Grading Question B.

Table 10.

*Hypotheses for Question B: Instructors Using the Video Game*

| Hypothesis B | | Hypothesis statement |
|---|---|---|
| Null Hypothesis B | $H_0$ $\mu_2 = \mu_3 = \mu_4 = \mu_5 = \mu_7 = \mu_7$ | There is no difference in test scores between instructors who did use Virtual U, where<br>• $\mu_2$ is the mean test score of Instructor B who did play,<br>• $\mu_3$ is the mean score of Instructor C who did play,<br>• $\mu_4$ is the mean scores of Instructor D who did play,<br>• $\mu_5$ is the mean test score of Instructor E who did play,<br>• $\mu_6$ is the mean test score of Instructor F who did play,<br>• $\mu_7$ is the mean test score of Instructor G who did play. |
| Alternate Hypothesis B | Not all six $\mu_i$ are equal | There is a difference in test scores between instructors who did use Virtual U, where<br>• $\mu_2$ is the mean test score of Instructor B who did play,<br>• $\mu_3$ is the mean score of Instructor C who did play,<br>• $\mu_4$ is the mean scores of Instructor D who did play,<br>• $\mu_5$ is the mean test score of Instructor E who did play,<br>• $\mu_6$ is the mean test score of Instructor F who did play,<br>• $\mu_7$ is the mean test score of Instructor F who did play. |

*Demographic Generalization Tests*

The final tests undertaken in this study were general comparisons between ethnic demographics of the sample and ethnic demographics of the local campus and ABC campuses worldwide. This was accomplished using data obtained from the university's Oracle Student System database previously mentioned and oriented such as Table 11.

Table 11.

*Ethnic Demographics*

| | Sample | Arlington Campus | ABC University |
|---|---|---|---|
| White | 12.82% | 18% | 42.4% |
| Black | 68.72% | 74% | 31% |
| Hispanic | 15.04% | 5% | 20.1% |
| Asian | 3.42% | 3% | 6.07% |

General demographic comparisons eliminate the possibility of skewing specific to one campus or geographical area and increase the usefulness of study findings for the

university as a whole. A number of tests are available to determine if the relationship between two crosstabulated variables such as grade and with/without game is significant. One of the more common tests is the chi-square test for homogeneity that compares several data sets to determine whether they might be distributed the same across a set of categories. One of the advantages of chi-square is that it is appropriate for almost any kind of data. (Archambault, 2000; SPSS, 2005).

### *Independent and Dependent Variables*

The data included both independent and dependent variables. Independent variables are group (whether students are in the sample group who participated in playing the game or those who did not), overall course grade, gender, race, and age. The dependent variable in this study is score on the standardized test.

### *Null and Alternate Hypothesis Statements*

#### *Research Question 1 and Hypotheses*

Research Question 1: What was the difference in academic achievement between students who did use video games in learning and those who did not? Table 12 presents the hypotheses and null hypotheses corresponding to Research Question 1.

Table 12.

*Hypotheses for Research Question 1: Overall Effect of Playing the Game*

| Hypothesis 1 | | Hypothesis statement |
|---|---|---|
| Null Hypothesis 1 | $H_0$ $\mu_1 \geq \mu_2$ | The average test score for students who did not play Virtual U is greater than or equal to the average score for students who did play Virtual U, where $\mu_1$ is the mean test score of students who did not play the game and $\mu_2$ is the mean test score of students who did play the game. |
| Alternate Hypothesis 1 | $H_1$ $\mu_1 < \mu_2$ | The average test score for students who did play Virtual U is greater than the average test score for students who did not play Virtual U, where $\mu_1$ is the mean test score of students who did not play the game and $\mu_2$ is the mean test score of students who did play the game. |

*Research Question 2 and Hypotheses*

Research Question 2: What was the difference in academic achievement between male and female students who did use video games in learning and those who did not? Table 13 presents the hypotheses and null hypotheses corresponding to Research Question 2.

Table 13.

*Hypotheses for Research Question 2: Effect by Gender*

| Hypothesis 2 | | Hypothesis statement |
|---|---|---|
| Null Hypothesis 2 | $H_0$ $\mu_1 = \mu_2 = \mu_3 = \mu_4$ | There is no difference in test scores between genders who did and did not play Virtual U, where<br>• $\mu_1$ is the mean test score of Males who did not play,<br>• $\mu_2$ is the mean test score of Females who did not play,<br>• $\mu_3$ is the mean score of Males who did play,<br>• $\mu_4$ is the mean scores of Females who did play. |
| Alternate Hypothesis 2 | Not all four $\mu_i$ are equal | There is a difference in test scores between genders who did and did not play Virtual U, where<br>• $\mu_1$ is the mean test score of Males who did not play,<br>• $\mu_2$ is the mean test score of Females who did not play,<br>• $\mu_3$ is the mean score of Males who did play,<br>• $\mu_4$ is the mean scores of Females who did play. |

*Research Question 3 and Hypotheses*

Research Question 3: What was the difference in academic achievement between ethnic groups of students who did use video games in learning and those who did not? Table 14 presents the hypotheses and null hypotheses corresponding to Research Question 3.

Table 14.

*Hypotheses for Research Question 3: Effect by Race/Ethnicity*

| Hypothesis 3 | | Hypothesis statement |
|---|---|---|
| Null Hypothesis 3 | $H_0$ $\mu_1 = \mu_2 = \mu_3 = \mu_4 = \mu_5 = \mu_6 = \mu_7 = \mu_8$ | There is no difference in test scores between ethnicities who did and did not play Virtual U, where<br>• $\mu_1$ is the mean test score of Whites who did not play,<br>• $\mu_2$ is the mean test score of Blacks who did not play,<br>• $\mu_3$ is the mean score of Hispanics who did not play,<br>• $\mu_4$ is the mean scores of Asians who did not play,<br>• $\mu_5$ is the mean test score of Whites who did play,<br>• $\mu_6$ is the mean test score of Blacks who did play,<br>• $\mu_7$ is the mean score of Hispanics who did play,<br>• $\mu_8$ is the mean scores of Asians who did play. |
| Alternate Hypothesis 3 | Not all eight $\mu_i$ are equal | There is a difference in test scores between ethnicities who did and did not play Virtual U, where<br>• $\mu_1$ is the mean test score of Whites who did not play,<br>• $\mu_2$ is the mean test score of Blacks who did not play,<br>• $\mu_3$ is the mean score of Hispanics who did not play,<br>• $\mu_4$ is the mean scores of Asians who did not play,<br>• $\mu_5$ is the mean test score of Whites who did play,<br>• $\mu_6$ is the mean test score of Blacks who did play,<br>• $\mu_7$ is the mean score of Hispanics who did play,<br>• $\mu_8$ is the mean scores of Asians who did play. |

*Research Question 4 and Hypotheses*

Research Question 4: What was the difference in academic achievement between age groups of students who did use video games in learning and those who did not? Table 15 presents the hypotheses and null hypotheses corresponding to Research Question 4.

Table 15.

*Hypotheses for Research Question 4: Effect by Age*

| Hypothesis 4 | | Hypothesis statement |
|---|---|---|
| Null Hypothesis 4 | $H_0$ $\mu_1 = \mu_2 = \mu_3 = \mu_4 = \mu_5 = \mu_6$ | There is no difference in test scores between ages who did and did not play Virtual U, where<br>• $\mu_1$ is the mean score of students 18 – 20 who did not play,<br>• $\mu_2$ is the mean score of students 21 – 30 who did not play,<br>• $\mu_3$ is the mean score of students 31 – 40 who did not play,<br>• $\mu_4$ is the mean scores of students 41 – 50 who did not play,<br>• $\mu_5$ is the mean score of students 18 – 20 who did play,<br>• $\mu_6$ is the mean score of students 21 – 30 who did play,<br>• $\mu_7$ is the mean score of students 31 – 40 who did play,<br>• $\mu_8$ is the mean scores of students 41 – 50 who did play. |
| Alternate Hypothesis 4 | Not all six $\mu_i$ are equal | There is a difference in test scores between ages who did and did not play Virtual U, where<br>• $\mu_1$ is the mean score of students 18 – 20 who did not play,<br>• $\mu_2$ is the mean score of students 21 – 30 who did not play,<br>• $\mu_3$ is the mean score of students 31 – 40 who did not play,<br>• $\mu_4$ is the mean scores of students 41 – 50 who did not play,<br>• $\mu_5$ is the mean score of students 18 – 20 who did play,<br>• $\mu_6$ is the mean score of students 21 – 30 who did play,<br>• $\mu_7$ is the mean score of students 31 – 40 who did play,<br>• $\mu_8$ is the mean scores of students 41 – 50 who did play. |

*Analysis*

Each research question was analyzed using the following statistical tests:

1. Instructor Grading Question A was analyzed with a one way ANOVA test. The One-Way ANOVA procedure produces a one-way analysis of variance for a quantitative dependent variable by a single factor (independent) variable. Analysis of variance is used to test the hypothesis that several means are equal. This technique is an extension of the two-sample *t* test. (SPSS, 2005).

2. Instructor Grading Question B was analyzed with a one way ANOVA test.

3. Demographic generalizations was tested using chi-square testing. A number of tests are available to determine if the relationship between two crosstabulated variables

such as grade and with/without game is significant. One of the more common tests is chi-square. One of the advantages of chi-square is that it is appropriate for almost any kind of data. (Archambault, 2000; SPSS, 2005).

4. Research Question 1 was analyzed using a one tail t test. The one tail t test compares means for two groups of cases. Ideally, the participants should be randomly assigned to the two groups, so that any difference in response is due to dependent variable and not to other factors. However, we already know this is not the case with this study. In such situations, you should ensure that differences in other factors, such as instructor grading variations, are not masking or enhancing a significant difference in means (SPSS, 2005).

5. Research Question 2 was analyzed with a one way ANOVA test with a follow-on Tukey's Post Hoc.

6. Research Question 3 was analyzed with a one way ANOVA test with a follow-on Tukey's Post Hoc.

7. Research Question 4 was analyzed with a one way ANOVA test with a follow-on Tukey's Post Hoc.

*Confidentiality*

The ABC University Academic Affairs Department provided the data. The researcher obtained 579 test scores along with the following information: gender, ethnicity, age, and class unit. The class unit identified which test scores came from classes taught with and without the game supplement. The information was put on a Microsoft Excel spreadsheet. Only the researcher had access to the file on a password-

protected laptop PC kept in a locked office. The data file was not accessible via the university network. Again, once the researcher obtained the data file, there were no student names collected.

ABC University is primarily a teaching school and not a research school and, consequently, does not have an Institutional Review Board (IRB). However, the researcher applied for authorization to access student records, for research purposes, from the Vice President of Academic Affairs, to conduct secondary analyses with a confidential dataset (with an acknowledgement that the researcher would be working with de-identified data).

# CHAPTER 4:
# RESULTS

## Introduction

This chapter contains the overall data analysis, presentation, interpretation, and explanation of the data. Tables and figures are given in order to make the data analysis clear. Outcomes are clearly interpreted within the context of the research questions. Data collected included student test scores, class number, test score, gender, ethnicity, and age. Because of the type of data produced, and to test the effectiveness of the game supplement, means tests, ANOVA, chi-squared tests, and *t* tests were performed. Data from this research were analyzed and results were obtained using Microsoft Excel. These tests were based on different pairs of sample data as laid out in the six questions and accompanying hypothesis previously described. See Table 16 for the descriptive statistics of this case.

Table 16.

*Descriptive Statistics*

| | *n* | Mean | Sample Variance | Sample Standard Deviation | Min | Max | Normal Curve GOF *p-value* |
|---|---|---|---|---|---|---|---|
| Instructor AAA w/o Game | 100 | 69.63 | 387.87 | 19.69 | 28 | 102 | .1748 |
| Instructor BBB w/o Game | 49 | 69.80 | 364.29 | 19.09 | 27 | 100 | .7872 |
| Instructor CCC w/o Game | 23 | 65.39 | 528.34 | 22.99 | 20 | 100 | .8894 |
| Instructor DDD w/o Game | 29 | 67.17 | 464.58 | 21.55 | 17 | 100 | .2106 |
| Instructor EEE w/o Game | 51 | 66.84 | 441.09 | 21.00 | 20 | 100 | .4971 |
| Instructor BBB w/Game | 31 | 90.65 | 334.44 | 18.29 | 22 | 105 | 8.38E-14 |
| Instructor CCC w/Game | 55 | 92.18 | 196.89 | 14.03 | 50 | 105 | 4.85E-24 |
| Instructor DDD w/Game | 45 | 89.96 | 239.91 | 15.49 | 45 | 102 | 2.31E-17 |
| Instructor EEE w/Game | 22 | 89.23 | 300.28 | 17.33 | 40 | 102 | 3.19E-07 |
| Instructor FFF w/Game | 75 | 89.89 | 293.93 | 17.14 | 35 | 101 | 1.50E-35 |
| Instructor GGG w/Game | 98 | 88.82 | 324.15 | 18.00 | 30 | 100 | 2.16E-50 |
| All w/o Game | 252 | 68.43 | 411.13 | 20.28 | 17 | 102 | .0008 |
| All w/Game | 326 | 89.99 | 280.45 | 16.75 | 22 | 105 | 6.05E-140 |
| Male w/o Game | 152 | 69.57 | 404.39 | 20.11 | 17 | 102 | .0131 |
| Female w/o Game | 100 | 66.70 | 420.56 | 20.51 | 20 | 100 | .0730 |
| Male w/Game | 192 | 90.68 | 276.72 | 16.63 | 22 | 105 | 3.80E-84 |
| Female w/Game | 134 | 89.01 | 286.26 | 16.92 | 30 | 102 | 2.56E-57 |
| White w/o | 47 | 72.15 | 409.43 | 20.23 | 28 | 100 | .3476 |
| White w | 26 | 83.96 | 272.12 | 16.50 | 50 | 100 | .0007 |
| Black w/o | 175 | 67.64 | 436.23 | 20.89 | 17 | 102 | .0123 |
| Black w | 225 | 89.43 | 306.86 | 17.52 | 30 | 105 | 5.95E-89 |
| Hispanic w/o | 30 | 67.20 | 263.82 | 16.24 | 33 | 92 | .4579 |
| Hispanic w | 56 | 92.43 | 229.96 | 15.16 | 22 | 102 | 4.42E-29 |
| Asian w | 19 | 97.74 | 26.09 | 5.11 | 80 | 101 | 1.65E-13 |
| 18-20 w/o | 46 | 63.59 | 346.47 | 18.61 | 20 | 93 | .6933 |
| 18-20 w | 34 | 92.79 | 87.56 | 9.36 | 60 | 100 | 3.29E-06 |
| 21-30 w/o | 140 | 65.20 | 440.84 | 21.00 | 17 | 100 | .0912 |
| 21-30 w | 209 | 90.16 | 286.42 | 16.92 | 22 | 105 | 7.92E-93 |
| 31-40 w/o | 48 | 76.88 | 272.79 | 16.52 | 33 | 100 | .0514 |
| 31-40 w | 49 | 96.37 | 74.61 | 8.64 | 60 | 105 | 3.56E-28 |
| 41-50 w/o | 18 | 83.39 | 206.72 | 14.38 | 50 | 102 | .2290 |
| 41-50 w | 34 | 76.97 | 517.30 | 22.74 | 30 | 105 | .0001 |

For the normal curve goodness of fit test, $\alpha = .05$

## Distribution

One of the assumptions for ANOVA tests and *t* tests is that the data were approximately normally distributed (SPSS, 2005). As highlighted in Table 1, several of

the sample groups are not normally distributed ($\alpha = 0.05$). Since the ANOVA is quite robust over moderate violations of the distribution assumption (Steckler & Oleson, 2005), it was still used. Additionally, Research Question 1 was analyzed using the Microsoft Data Analysis one-tail *t* test assuming unequal variances and not the one-tail *t* test assuming equal variances.

## Instructor Grading

The first set of tests was used to determine if there was any significant difference between instructor grade means. There were seven instructors. One instructor never used the game in the class. Four instructors used the game in some, but not all, of their classes. Two instructors used the game in all their classes.

### *Instructor Grading Question and Hypotheses*

Question A: What is the difference in academic achievement between groups of students taught by different instructors who did not use the video game? Table 17 presents the hypotheses and null hypotheses corresponding to Instructor Grading Question A.

Table 17.

*Hypotheses for Question A: Instructors Not Using the Video Game*

| Hypothesis A | | Hypothesis statement |
|---|---|---|
| Null Hypothesis A | $H_0$ $\mu_1 = \mu_2 = \mu_3 = \mu_4 = \mu_5$ | There is no difference in test scores between instructors who did not use Virtual U, where<br>• $\mu_1$ is the mean test score of Instructor A who did not play,<br>• $\mu_2$ is the mean test score of Instructor B who did not play,<br>• $\mu_3$ is the mean score of Instructor C who did not play,<br>• $\mu_4$ is the mean scores of Instructor D who did not play,<br>• $\mu_5$ is the mean test score of Instructor E who did not play. |
| Alternate Hypothesis A | Not all five $\mu_i$ are equal | There is a difference in test scores between instructors who did not use Virtual U, where<br>• $\mu_1$ is the mean test score of Instructor A who did not play,<br>• $\mu_2$ is the mean test score of Instructor B who did not play,<br>• $\mu_3$ is the mean score of Instructor C who did not play,<br>• $\mu_4$ is the mean scores of Instructor D who did not play,<br>• $\mu_5$ is the mean test score of Instructor E who did not play. |

Instructor Grading Question A was analyzed with a one-way ANOVA test. The one-way ANOVA procedure produces a one-way analysis of variance for a quantitative dependent variable by a single factor (independent) variable. Analysis of variance was used to test the hypothesis that several means are equal. This technique is an extension of the two-sample *t* test. (SPSS, 2005). Table 18 shows the ANOVA test found no significant difference between Instructor means who taught without the game.

Table 18.
*Question A One Way ANOVA*

| *Source* | *SS* | *df* | *MS* | *F* | *p-value* |
|---|---|---|---|---|---|
| Treatment | 622.08 | 4 | 155.521 | 0.37 | .8267 |
| Error | 102,571.6 | 247 | 415.270 | | |
| Total | 103,193.7 | 251 | | | |
| *As p > .05, accept $H_0$* | | | | | |

1. Hypothesis A:
   $H_0$: $\mu_1 = \mu_2 = \mu_3 = \mu_4 = \mu_5$
   $H_1$: Not all five means are equal
2. $\alpha = .05$
3. Test statistic: *F*-statistic

4. Decision criterion: Reject $H_0$ and accept $H_1$ if *p-value* < .05
5. Calculation: *p-value* = 0.8267
6. Conclusion: Based on the results of this sample and analysis, accept the null hypothesis. There was no significant difference between Instructor means who taught without the game.

Question B: What is the difference in academic achievement between groups of students taught by different instructors who did use the video game? Table 19 presents the hypotheses and null hypotheses corresponding to Instructor Grading Question B.

Table 19.

*Hypotheses for Question B: Instructors Using the Video Game*

| Hypothesis B | | Hypothesis statement |
|---|---|---|
| Null Hypothesis B | $H_{0:}\ \mu_2 = \mu_3 = \mu_4 = \mu_5 = \mu_7 = \mu_7$ | There is no difference in test scores between instructors who did use Virtual U, where<br>• $\mu_2$ is the mean test score of Instructor B who did play,<br>• $\mu_3$ is the mean score of Instructor C who did play,<br>• $\mu_4$ is the mean scores of Instructor D who did play,<br>• $\mu_5$ is the mean test score of Instructor E who did play,<br>• $\mu_6$ is the mean test score of Instructor F who did play,<br>• $\mu_7$ is the mean test score of Instructor G who did play. |
| Alternate Hypothesis B | Not all six means are equal | There is a difference in test scores between instructors who did use Virtual U, where<br>• $\mu_2$ is the mean test score of Instructor B who did play,<br>• $\mu_3$ is the mean score of Instructor C who did play,<br>• $\mu_4$ is the mean scores of Instructor D who did play,<br>• $\mu_5$ is the mean test score of Instructor E who did play,<br>• $\mu_6$ is the mean test score of Instructor F who did play,<br>• $\mu_7$ is the mean test score of Instructor F who did play. |

Again, a One-Way ANOVA procedure was used. Table 20 shows the ANOVA test found there was no significant difference between Instructor means who taught with the game.

Table 20.

*Question B One Way ANOVA*

| *Source* | *SS* | *df* | *MS* | *F* | *p-value* |
|---|---|---|---|---|---|
| Treatment | 426.08 | 5 | 85.216 | 0.30 | .9123 |
| Error | 90,720.89 | 320 | 283.503 | | |
| Total | 91,146.97 | 325 | | | |
| *As p > .05, accept $H_0$* | | | | | |

1. Hypothesis B:
   $H_0$: $\mu_1 = \mu_2 = \mu_3 = \mu_4 = \mu_5$
   $H_1$: Not all five means are equal
2. $\alpha = .05$
3. Test statistic: *F*-statistic
4. Decision criterion: Reject $H_0$ and accept $H_1$ if *p-value* < .05
5. Calculation: *p-value* = 0.9123
6. Conclusion: Based on the results of this sample and analysis, accept the null hypothesis. There was no significant difference between Instructor means who taught with the game.

## Demographic Generalization Tests

The next tests undertaken in this study were general comparisons between gender and ethnic demographics of the sample and gender and ethnic demographics of the local campus and ABC campuses worldwide. This was accomplished using data obtained from the university's Oracle Student System database previously mentioned. A number of tests were available to determine if the relationship between two crosstabulated variables such as location and gender/ethnicity significant. One of the more common tests is chi-square. One of the advantages of chi-square is that it is appropriate for almost any kind of data. Tables 21 shows the gender demographic of the test sample is representative of the campus and larger university while Table 22 shows the demographic of the ethnicity test sample is not representative of the larger university.

Table 21.

*Gender Chi-Squared Test*

| | | Women | Men | Total |
|---|---|---|---|---|
| University | Observed | 39 | 61 | 100 |
| | Expected | 39.02 | 60.78 | 99.80 |
| Campus | Observed | 38 | 62 | 100 |
| | Expected | 39.10 | 60.90 | 100.00 |
| Sample | Observed | 40 | 60 | 100 |
| | Expected | 39.10 | 60.90 | 100.00 |
| Total | Observed | 117 | 183 | 300 |
| | Expected | 117.21 | 182.59 | 299.80 |
| chi-square | .12 | | | |
| df | 2 | | | |
| *p-value* | .9412 | | | |
| *As p > .05, accept $H_0$* | | | | |

1. Hypothesis:
   $H_0$ = The three groups are homogeneous
   $H_1$ = The three groups are different
2. $\alpha = .05$
3. Test statistic: *Chi-Squared*
4. Decision criteria: Reject $H_0$ and accept $H_1$ if *p-value* > .05
5. Calculation: *p-value* = 0.9412
6. Conclusion: Accept the Null Hypothesis. The gender demographic of the test sample is representative of the campus and larger university.

Table 22.

*Ethnicity Chi-Squared Test*

| | | Asian | Black | Hispanic | White | Total |
|---|---|---|---|---|---|---|
| University | Observed | 6 | 31 | 20 | 42 | 100 |
| | Expected | 4.15 | 57.74 | 13.34 | 24.34 | 99.57 |
| Campus | Observed | 3 | 74 | 5 | 18 | 100 |
| | Expected | 4.17 | 57.99 | 13.40 | 24.44 | 100.00 |
| Sample | Observed | 3 | 69 | 15 | 13 | 100 |
| | Expected | 4.17 | 57.99 | 13.40 | 24.44 | 100.00 |
| Total | Observed | 12 | 174 | 40 | 73 | 300 |
| | Expected | 12.49 | 173.72 | 40.14 | 73.22 | 299.57 |
| chi-square | 49.66 | | | | | |
| df | 6 | | | | | |
| *p-value* | 5.50E-09 | | | | | |
| *As p < .05, reject $H_0$* | | | | | | |

1. Hypothesis:
   $H_0$ = The three groups are homogeneous
   $H_1$ = The three groups are different
2. $\alpha = .05$
3. Test statistic: *Chi-Squared*
4. Decision criteria: Reject $H_0$ and accept $H_1$ if *p-value* > .05
5. Calculation: *p-value* = 5.50E-09
6. Conclusion: The samples are significantly different. The ethnicity demographic of the test sample is not representative of the larger university.

## Research Questions

### *Research Question 1*

Research Question 1 was analyzed using a one-tail *t* test. The one-tail *t* test compares means for two groups of cases. Ideally, the participants should be randomly assigned to the two groups, so that any difference in response is due to dependent variable and not to other factors. However, it is already known this is not the case with this study. Care was taken to ensure differences in other factors, such as instructor grading variations, was taken into account to prevent masking or enhancing a significant difference in means (SPSS, 2005).

To decide which *t* test to use, an F-test was used to test the equality of variances. Table 23 shows the Calculated value is greater than the Critical value, which indicates no difference between the variances and so a *t* test assuming equal variances can be used.

Table 23.

*Test for Equality of Variances*

| | *All w/o Game* | *All w/Game* |
|---|---|---|
| Mean | 68.42857143 | 89.99079755 |
| Variance | 411.1303358 | 280.4522227 |
| Observations | 252 | 326 |
| df | 251 | 325 |
| Calculated F Value | 1.465954991 | |
| P(F<=f) one-tail (f) | 0.00060238 | |
| F Critical one-tail | 1.214549757 | |

Research Question 1: What is the difference in academic achievement between students who use video games in learning and those who do not? Table 24 presents the hypotheses and null hypotheses corresponding to Research Question 1.

Table 24.

*Hypotheses for Research Question 1: Overall Effect of Playing the Game*

| Hypothesis 1 | | Hypothesis statement |
|---|---|---|
| Null Hypothesis 1 | $H_0$ $\mu_1 \geq \mu_2$ | The average test score for students who did not play Virtual U is greater than or equal to the average score for students who did play Virtual U, where $\mu_1$ is the mean test score of students who did not play the game and $\mu_2$ is the mean test score of students who did play the game. |
| Alternate Hypothesis 1 | $H_1$ $\mu_1 < \mu_2$ | The average test score for students who did play Virtual U is greater than the average test score for students who did not play Virtual U, where $\mu_1$ is the mean test score of students who did not play the game and $\mu_2$ is the mean test score of students who did play the game. |

A one-tail *t* test for equality of means was used in the analysis, as emphasis was on higher scores representing one end of the sampling distribution. The set of test scores from those students who did not use the game was compared to the set of test scores from students who did use the game in Table 25.

Table 25.
One-tail *t* Test

| | *All w/o Game* | *All w/Game* |
|---|---|---|
| Mean | 68.428571 | 89.9907975 |
| Variance | 411.13034 | 280.452223 |
| Observations | 252 | 326 |
| df | 482 | |
| *t* Stat | -13.6597 | |
| *P* (T<=t) one-tail | 1.929E-36 | |
| t Critical one-tail | 1.6480211 | |
| *As p < .05, reject $H_0$* | | |

1. Hypothesis:

$H_0$: $\mu_1 \geq \mu_2$
$H_1$: $\mu_1 < \mu_2$

2. $\alpha = .05$
3. Test statistic: *t* statistic for a one-tail *t* test equality of the means
4. Decision criterion: Reject $H_0$ and accept $H_1$ if *p-value* < .05
5. Calculation: *p-value* = 1.929E-36
6. Conclusion: Based on the results of this sample and analysis, adopt the research hypothesis. There was a significant difference between the two means. The average test score for students who did play Virtual U is significantly greater than the average test score for students who did not play Virtual U.

*Research Question 2*

Research Question 2: What is the difference in academic achievement between male and female students who use video games in learning and those who do not? Table 26 presents the hypotheses and null hypotheses corresponding to Research Question 2.

Table 26.

*Hypotheses for Research Question 2: Effect by Gender*

| Hypothesis 2 | | Hypothesis statement |
|---|---|---|
| Null Hypothesis 2 | $H_0$ $\mu_1 = \mu_2 = \mu_3 = \mu_4$ | There is no difference in test scores between genders who did and did not play Virtual U, where<br>• $\mu_1$ is the mean test score of Males who did not play,<br>• $\mu_2$ is the mean test score of Females who did not play,<br>• $\mu_3$ is the mean score of Males who did play,<br>• $\mu_4$ is the mean scores of Females who did play. |
| Alternate Hypothesis 2 | Not all four means are equal | There is a difference in test scores between genders who did and did not play Virtual U, where<br>• $\mu_1$ is the mean test score of Males who did not play,<br>• $\mu_2$ is the mean test score of Females who did not play,<br>• $\mu_3$ is the mean score of Males who did play,<br>• $\mu_4$ is the mean scores of Females who did play. |

Again, a one way ANOVA test was used with a follow-on Tukey's Post Hoc. As the ANOVA showed significant difference, the Tukey test was used to show which means were different. Table 27 presents the ANOVA test.

Table 27.

*Gender ANOVA Test*

| *Source* | *SS* | *df* | *MS* | *F* | *p-value* |
|---|---|---|---|---|---|
| Treatment | 66,796.51 | 3 | 22,265.503 | 66.01 | 1.12E-36 |
| Error | 193,625.31 | 574 | 337.326 | | |
| Total | 260,421.82 | 577 | | | |
| *As p < .05, reject $H_0$* | | | | | |

1. Hypothesis:
   $H_0$: $\mu_1 = \mu_2 = \mu_3 = \mu_4$
   $H_1$: Not all four means are equal
2. $\alpha = .05$
3. Test statistic: *F*-statistic
4. Decision criteria: Reject $H_0$ and accept $H_1$ if *p-value* > .05
5. Calculation: *p-value* = 1.12E-36
6. Conclusion: Based on the results of this sample and analysis, adopt the research hypothesis. Not all four means are equal.

The Tukey test was used to show pairwise *p-value*s. This test compares each pair of data in the table which, in this case, means comparing the means from each row with the means for each column. Table 28 shows that if the *p-value* is less than .05, that pair shows a significant difference.

Table 28.

*Research Question 2 Tukey Test*

Post hoc analysis: Tukey *p-value*s for pairwise *t* tests

| | | Female w/o Game | Male w/o Game | Female w/Game | Male w/Game |
|---|---|---|---|---|---|
| | | 66.7 | 69.6 | 89.0 | 90.7 |
| Female w/o Game | 66.7 | | | | |
| Male w/o Game | 69.6 | .2261 | | | |
| Female w/Game | 89.0 | 7.08E-19 | 5.61E-18 | | |
| Male w/Game | 90.7 | 4.82E-24 | 4.77E-24 | .4197 | |

*p-value* for experiment pairwise error rate: $\alpha = 0.05$

From the Tukey's Post Hoc, the following pairs are significantly different:

- Female w/o Game – Female w/Game
- Female w/o Game – Male w/Game
- Male w/o Game – Male w/Game
- Male w/o Game – Female w/Game

*Research Question 3*

Research Question 3: What is the difference in academic achievement between ethnic groups of students who use video games in learning and those who do not? Table 29 presents the hypotheses and null hypotheses corresponding to Research Question 3.

Table 29.

*Hypotheses for Research Question 3: Effect by Race/Ethnicity*

| Hypothesis 3 | | Hypothesis statement |
|---|---|---|
| Null Hypothesis 3 | $H_0$ $\mu_1 = \mu_2 = \mu_3 = \mu_4 = \mu_5 = \mu_6 = \mu_7 = \mu_8$ | There is no difference in test scores between ethnicities who did and did not play Virtual U, where<br>• $\mu_1$ is the mean test score of Whites who did not play,<br>• $\mu_2$ is the mean test score of Blacks who did not play,<br>• $\mu_3$ is the mean score of Hispanics who did not play,<br>• $\mu_4$ is the mean scores of Asians who did not play,<br>• $\mu_5$ is the mean test score of Whites who did play,<br>• $\mu_6$ is the mean test score of Blacks who did play,<br>• $\mu_7$ is the mean score of Hispanics who did play,<br>• $\mu_8$ is the mean scores of Asians who did play. |
| Alternate Hypothesis 3 | Not all eight means are equal | There is a difference in test scores between ethnicities who did and did not play Virtual U, where<br>• $\mu_1$ is the mean test score of Whites who did not play,<br>• $\mu_2$ is the mean test score of Blacks who did not play,<br>• $\mu_3$ is the mean score of Hispanics who did not play,<br>• $\mu_4$ is the mean scores of Asians who did not play,<br>• $\mu_5$ is the mean test score of Whites who did play,<br>• $\mu_6$ is the mean test score of Blacks who did play,<br>• $\mu_7$ is the mean score of Hispanics who did play,<br>• $\mu_8$ is the mean scores of Asians who did play. |

A one way ANOVA test was used with a follow-on Tukey's Post Hoc. As the ANOVA showed significant difference, the Tukey test was used to show which means were different. Table 23 presents the ANOVA test.

Table 30.

*Ethnicity ANOVA Test*

| *Source* | *SS* | *df* | *MS* | *F* | *p-value* |
|---|---|---|---|---|---|
| Treatment | 69,375.34 | 6 | 11,562.557 | 34.56 | 1.16E-35 |
| Error | 191,046.48 | 571 | 334.582 | | |
| Total | 260,421.82 | 577 | | | |
| *As p < .05, reject $H_0$* | | | | | |

1. Hypothesis:
   $H_0$: $\mu_1 = \mu_2 = \mu_3 = \mu_4 = \mu_5 = \mu_6 = \mu_7 = \mu_8$
   $H_1$: Not all eight means are equal
2. $\alpha = .05$
3. Test statistic: *F*-statistic
4. Decision criteria: Reject $H_0$ and accept $H_1$ if *p-value* > .05
5. Calculation: *p-value* = 1.16E-35
6. Conclusion: Based on the results of this sample and analysis, adopt the research hypothesis. Not all four means are equal.

The Tukey test in Table 31 shows that if the *p-value* is less than .05, that pair shows a significant difference.

Table 31.

*Research Question 3 Tukey Test*

Post hoc analysis: Tukey *p-value*s for pairwise *t* tests

| | | Hispanic w/o | Black w/o | White w/o | White w | Black w | Hispanic w | Asian w |
|---|---|---|---|---|---|---|---|---|
| | | 67.2 | 67.6 | 72.1 | 84.0 | 89.4 | 92.4 | 97.7 |
| Hispanic w/o | 67.2 | | | | | | | |
| Black w/o | 67.6 | .9032 | | | | | | |
| White w/o | 72.1 | .2474 | .1341 | | | | | |
| White w/Game | 84.0 | .0007 | 2.55E-05 | .0085 | | | | |
| Black w/Game | 89.4 | 7.95E-10 | 5.57E-29 | 6.61E-09 | .1497 | | | |
| Hispanic w/Game | 92.4 | 2.00E-09 | 1.31E-17 | 3.25E-08 | .0516 | .2723 | | |
| Asian w/Game | 97.7 | 1.99E-08 | 2.45E-11 | 3.67E-07 | .0129 | .0577 | .2748 | |

*p-value* for experiment pairwise error rate: $\alpha = 0.05$

From the Tukey's Post Hoc, the following pairs are significantly different:

- White w/Game – Hispanic w/o Game
- White w/Game – Black w/o Game
- White w/Game – White w/o Game
- Black w/Game – Hispanic w/o Game
- Hispanic w/Game – Black w/o Game
- Hispanic w/Game – White w/o Game
- Asian w/Game – Hispanic w/o Game
- Asian w/Game – Black w/o Game

- Black w/Game – Black w/o Game
- Black w/Game – White w/o Game
- Hispanic w/Game – Hispanic w/o Game
- Asian w/Game – White w/o Game
- Asian w/Game – White w/Game

*Research Question 4*

Research Question 4: What is the difference in academic achievement between age groups of students who use video games in learning and those who do not? Table 32 presents the hypotheses and null hypotheses corresponding to Research Question 4.

Table 32.
*Hypotheses for Research Question 4: Effect by Age*

| Hypothesis 4 | | Hypothesis statement |
|---|---|---|
| Null Hypothesis 4 | $H_0$ $\mu_1 = \mu_2 = \mu_3 = \mu_4 = \mu_5 = \mu_6$ | There is no difference in test scores between ages who did and did not play Virtual U, where<br>• $\mu_1$ is the mean score of students 18 – 20 who did not play,<br>• $\mu_2$ is the mean score of students 21 – 30 who did not play,<br>• $\mu_3$ is the mean score of students 31 – 40 who did not play,<br>• $\mu_4$ is the mean scores of students 41 – 50 who did not play,<br>• $\mu_5$ is the mean score of students 18 – 20 who did play,<br>• $\mu_6$ is the mean score of students 21 – 30 who did play,<br>• $\mu_7$ is the mean score of students 31 – 40 who did play,<br>• $\mu_8$ is the mean scores of students 41 – 50 who did play. |
| Alternate Hypothesis 4 | Not all six means are equal | There is a difference in test scores between ages who did and did not play Virtual U, where<br>• $\mu_1$ is the mean score of students 18 – 20 who did not play,<br>• $\mu_2$ is the mean score of students 21 – 30 who did not play,<br>• $\mu_3$ is the mean score of students 31 – 40 who did not play,<br>• $\mu_4$ is the mean scores of students 41 – 50 who did not play,<br>• $\mu_5$ is the mean score of students 18 – 20 who did play,<br>• $\mu_6$ is the mean score of students 21 – 30 who did play,<br>• $\mu_7$ is the mean score of students 31 – 40 who did play,<br>• $\mu_8$ is the mean scores of students 41 – 50 who did play. |

A one way ANOVA test was used with a follow-on Tukey's Post Hoc. As the ANOVA showed significant difference, the Tukey test was used to show which means were different. Table 33 presents the ANOVA test.

Table 33.

*Age Groups ANOVA Test*

| *Source* | *SS* | *df* | *MS* | *F* | *p-value* |
|---|---|---|---|---|---|
| Treatment | 84,101.04 | 7 | 12,014.434 | 38.84 | 1.35E-44 |
| Error | 176,320.79 | 570 | 309.335 | | |
| Total | 260,421.82 | 577 | | | |
| *As p < .05, reject $H_0$* | | | | | |

1. Hypothesis:
   $H_0$: $\mu_1 = \mu_2 = \mu_3 = \mu_4 = \mu_5 = \mu_6 = \mu_7 = \mu_8$
   $H_1$: Not all eight means are equal
2. $\alpha = .05$
3. Test statistic: *F*-statistic
4. Decision criteria: Reject $H_0$ and accept $H_1$ if *p-value* > .05
5. Calculation: *p-value* = 1.35E-44
6. Conclusion: Based on the results of this sample and analysis, adopt the research hypothesis. Not all four means are equal.

The Tukey test in Table 34 shows that if the *p-value* is less than .05, that pair shows a significant difference.

Table 34.

*Research Question 4 Tukey Test*

Post hoc analysis: Tukey *p-value*s for pairwise *t* tests

| | | 18-20 w/o Game | 21-30 w/o Game | 31-40 w/o Game | 41-50 w/ Game | 41-50 w/o Game | 21-30 w/ Game | 18-20 w/ Game | 31-40 w/ Game |
|---|---|---|---|---|---|---|---|---|---|
| | | 63.6 | 65.2 | 76.9 | 77.0 | 83.4 | 90.2 | 92.8 | 96.4 |
| 18-20 w/o Game | 63.6 | | | | | | | | |
| 21-30 w/o Game | 65.2 | .5896 | | | | | | | |
| 31-40 w/o Game | 76.9 | .0003 | .0001 | | | | | | |
| 41-50 w/Game | 77.0 | .0008 | .0005 | .9807 | | | | | |
| 41-50 w/o Game | 83.4 | .0001 | 4.17E-05 | .1808 | .2111 | | | | |
| 21-30 w/Game | 90.2 | 3.61E-19 | 5.39E-34 | 2.99E-06 | .0001 | .1177 | | | |
| 18-20 w/Game | 92.8 | 7.27E-13 | 1.53E-15 | .0001 | .0002 | .0671 | .4180 | | |
| 31-40 w/Game | 96.4 | 1.79E-18 | 2.22E-24 | 7.22E-08 | 1.02E-06 | .0076 | .0265 | .3631 | |

*p-value* for experiment pairwise error rate: $\alpha = 0.05$

From the Tukey's Post Hoc, the following pairs are significantly different:

- 31-40 w/o Game – 18-20 w/o Game
- 31-40 w/o Game – 21-30 w/o Game
- 18-20 w/Game – 18-20 w/o Game
- 18-20 w/Game – 21-40 w/o Game

- 41-50 w/Game – 18-20 w/o Game
- 41-50 w/Game – 31-40 w/o Game
- 41-50 w/o Game – 18-20 w/o Game
- 41-50 w/o Game – 31-40 w/o Game
- 21-30 w/o Game – 18-20 w/o Game
- 21-30 w/o Game – 21-30 w/o Game
- 21-30 w/o Game – 31-40 w/o Game
- 21-30 w/o Game – 41-50 w/o Game
- 18-20 w/Game – 31-40 w/o Game
- 18-20 w/Game – 41-50 w/o Game
- 31-40 w/Game – 18-20 w/o Game
- 31-40 w/Game – 21-30 w/o Game
- 31-40 w/Game – 31-40 w/o Game
- 31-40 w/Game – 41-50 w/Game
- 31-40 w/Game – 41-50 w/o Game
- 31-40 w/Game – 21-30 w/Game

## Summary

This chapter concentrated on the actual analysis of the data collected. Using ANOVA, chi-squared, and *t* tests, all the research questions can now be answered. Highlights of this chapter include the findings of no significant differences in instructor grading between those instructors teaching without using the game. Additionally, there were no significant differences in instructor grading between those instructors teaching with using the game. Research Question 1 that those classes using the game had significantly higher means than those classes that did not use the game. Research Question 2 found no significant differences between male or female scores regardless of game play while both genders scored significantly higher with game play than without game play. Research Question 3 found there were some significant differences between and among ethnic groups who did and did not play the game. Lastly, Research Question 4 found there were some significant differences between and among age groups who did and did not play the game.

Next, chapter 5 concludes the study and brings it into context. Topics addressed include a report and interpretation of the findings, implications for social change, recommendations for action and further study. It answers the four research questions within the context of the research and brings the study to a close.

# CHAPTER 5:
# CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

## Introduction

This study started with the acknowledgement that the public and private sectors are faced with challenges in expanding technology-based solutions to make their personnel more efficient, effective, knowledgeable, and flexible. Also acknowledged was the need for studies about game-based learning, which led to this study's problem statement, to determine the relationship between the use of video games and learning. Topics addressed include a report and interpretation of the findings, implications for social change, recommendations for action and further study. Lastly, it answers the four research questions within the context of the research. This fulfills the purpose of this study by (a) validating current game-based learning literature, (b) demonstrating a positive relationship between game-based teaching and traditional teaching and (c) adding to the body of knowledge of game-based learning.

## Interpretation of Findings

The overall purpose of this study was to examine the effectiveness of the addition of the video game, Virtual U, as a supplement to the MGMT 303 Principles of Management class at ABC University in Arlington, VA. Following the analysis of the data conducted in chapter 4, the following findings are accepted:

1. Question A: There was no significant difference between Instructor means who taught without the game.

2. Question B: There was no significant difference between Instructor means who taught with the game.

3. Research Question 1: From the one tail *t* test in chapter 4, the average test score for students who did play Virtual U was significantly greater than the average test score for students who did not play Virtual U. Figure 8 shows the means of test scores with and without game play.

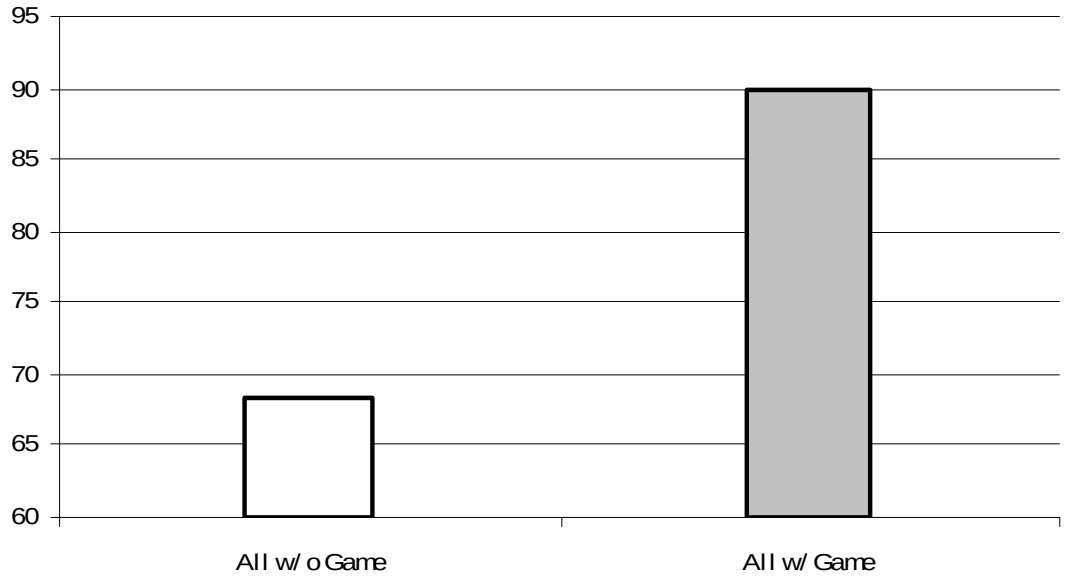



*Figure 8.* With and without game averages

4. Research Question 2: From the one way ANOVA and Tukey test in chapter 4, both genders scored significantly higher with game play than without game play. No significant differences between male or female scores regardless of game play. Figure 9 show the means of gender test scores with and without game play.

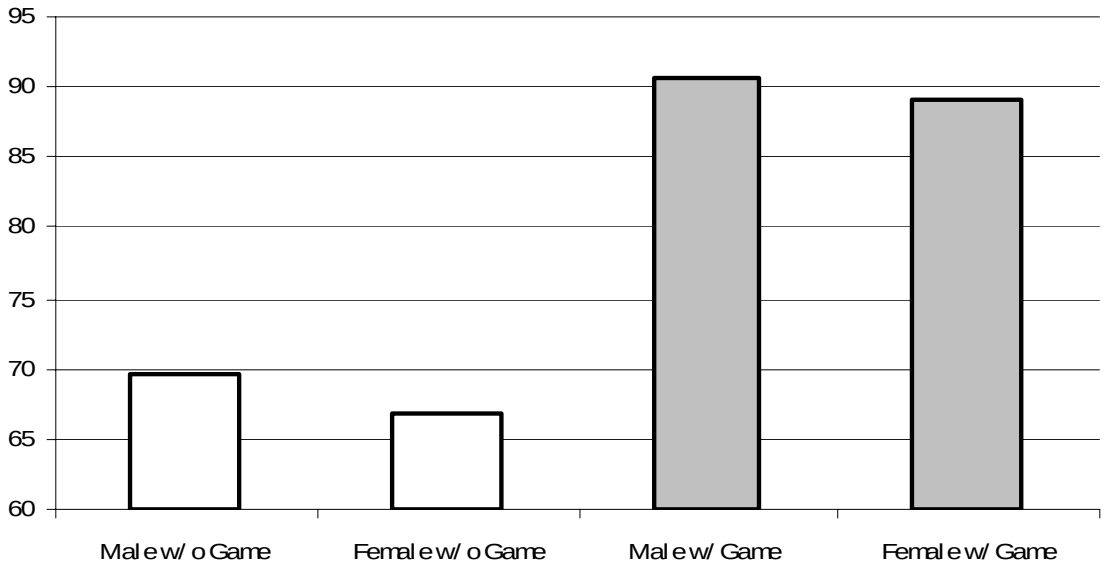



*Figure 9.* Male and female, with and without game averages

5. Research Question 3: From the one way ANOVA and Tukey test in chapter 4, White students with game scored significantly higher than White, Black, or Hispanic students without game.

6. Research Question 3: From the one way ANOVA and Tukey test in chapter 4, Black students with game scored significantly higher than Black, White, or Hispanic students without game.

7. Research Question 3: From the one way ANOVA and Tukey test in chapter 4, Hispanic students with game scored significantly higher than Black, White, or Hispanic students without game.

8. Research Question 3: From the one way ANOVA and Tukey test in chapter 4, Asian students with game scored significantly higher than Black, White, or Hispanic students without game. Figure 10 show the means of ethnic test scores with and without game play.

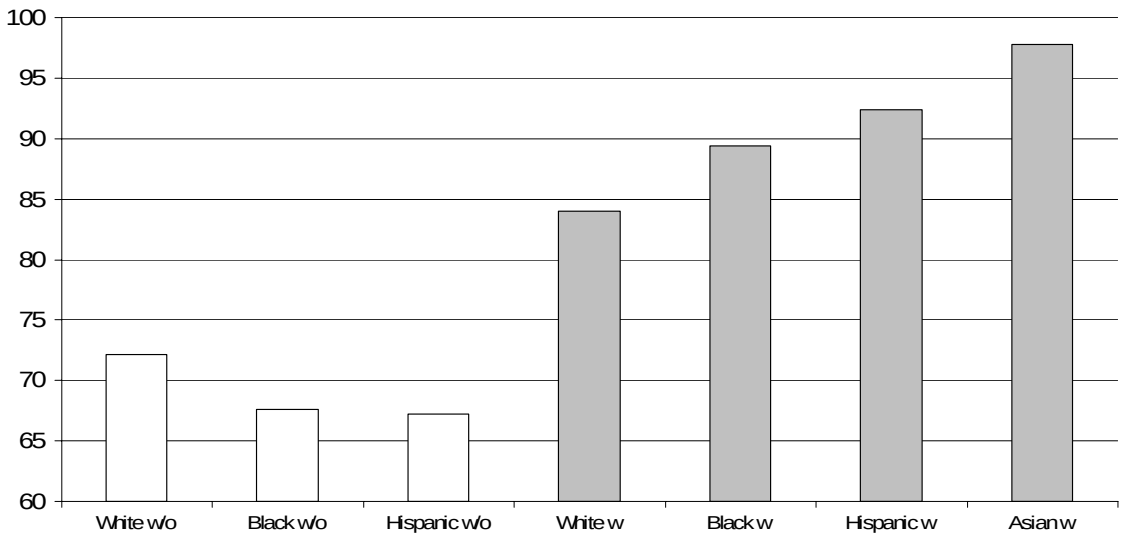



*Figure 10.* Ethnic Groups, with and without game averages

9. Research Question 4: From the one way ANOVA and Tukey test in chapter 4, 18 – 20 year old students with game scored significantly higher than 18 – 20, 21 – 30, 31 – 40, and 41 – 50 year old students without game.

10. Research Question 4: From the one way ANOVA and Tukey test in chapter 4, 21 – 30 year old students with game scored significantly higher than 18 – 20, 21 – 30, 31 – 40, and 41 – 50 year old students without game.

11. Research Question 4: From the one way ANOVA and Tukey test in chapter 4, 31 – 40 year old students with game scored significantly higher than 18 – 20, 21 – 30, 31 – 40, and 41 – 50 year old students without game.

12. Research Question 4: From the one way ANOVA and Tukey test in chapter 4, 41 – 50 year old students with game scored significantly higher than 18 – 20, 21 – 30 year old students without game.

13. Research Question 4: From the one way ANOVA and Tukey test in chapter 4, 31 – 40 year old students without game scored significantly higher than 18 – 20, 21 – 30 year old students without game.

14. Research Question 4: From the one way ANOVA and Tukey test in chapter 4, 41 – 50 year old students without game scored significantly higher than 18 – 20, 21 – 30 year old students without game. Figure 11 show the means of age group test scores with and without game play.

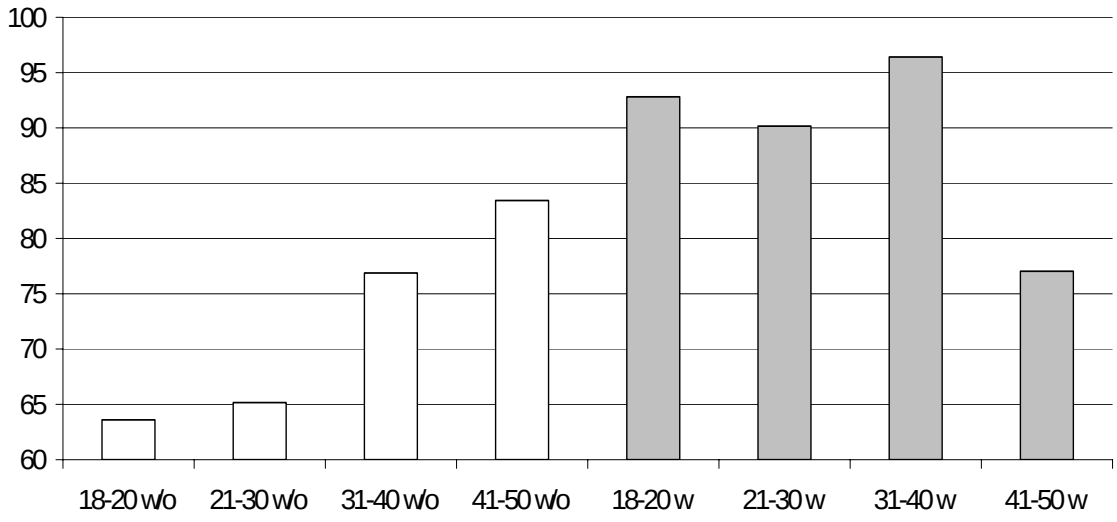



*Figure 11.* Age groups, with and without game averages.

Although not a finding, of particular note within the Age groups is the 41-50 without game students scored significantly higher than the 18-20 without game students. Also, although the 41-50 with game students was not significantly lower than the 41-50 without game students, it was, however lower. This anecdotal evidence reinforces the

perception that older age groups learns better through parochial “tell-test” methods they grew up with than through technology-enhanced environments.

## Implications for Social Change

This research documents dramatic results with an addition of only 4 to 8 hours of game playing time. As many instructors participated in this research, the game is already locally available, it is a change that could be implemented quickly. The University has the capacity to implement the change. The video game is free, open source, and available immediately. Since most students have computers in their homes, and computer labs are available to those who do not, this is an innovative way to help students “want” to do homework.

The fact the game is free and partial implementation as part of this research study also serve as pushing factors. General support from the administration and a number of key personnel for incorporation of video game-based learning across the business curriculum at ABC University is another pushing factor, as is reported student enjoyment of the game activity.

Resisting factors include an unwillingness of faculty to surrender precious classroom time to game playing, a lack of support by a limited number of faculty on video games as an appropriate college instructional method, and potential dissatisfaction from students regarding use of a video game during class times. Based on this research, a suggestion has been made to make Virtual U a regular part of the MGMT 303 curriculum at ABC University. Additionally, the game is now installed on every computer station on campus. However, due to change considerations presented above, it is proposed to be a

supplement students will play on their own time as part of recommended study, rather than devoting classroom time to the game. This greatly reduced resistance within the organization. It gives students the option to play the game at home, or use the game at one of the University's computer labs. This also frees faculty from any substantial changes to their course preparation.

On a national level, the findings of this study could lead to a wider adoption of game-based learning. As more studies like this emerge concerning game and simulation based learning, students will learn more effectively. Such games may assist students in applying, practicing, and ultimately developing greater understanding. Obviously, such a dramatic increase in student understanding of learning materials could lead to the recommendation that simulation and games be included as supplementation learning and teaching tools in most areas curriculum. Publishers and educators could consider the creation of such simulations as a needed component of textbook and curriculum development, with more publishers providing game simulations as accompaniments to college course texts.

*Management Theory*

This research adds to the body of management theory by presenting findings showing that game-based learning increases learning over traditional classroom-based learning. Game-based learning fosters many management skill-sets including understanding and working toward organizational goals and decision making. Game-based learning enables more, or faster learning. This research provides another way for

organizations to gain competitive advantage because “he who learns fastest, wins” (Ring, 2002, p. 26).

*Management Research*

This study adds to management research because it fills the need articulated by Dr. Jan Canon-Bowers: “We are charging head-long into game-based learning without know if it works or not. We need studies.” (2006). This study is used to show game-based learning can work to increase learning. In order to develop the management theory and practices for game-based learning, more research needs to be done beyond this study. This research provides the first quantifiable study of game-based learning and associated results.

*Management Practice*

This study is used to show that by using games, management students gets to practice their management decision making skills in a safe environment. Much of game-based learning and simulation-based learning is about making decisions. The decisions sometimes made slowly, sometimes quickly, sometimes very quickly. The advantage to games and simulations is the player gets to view and analyze the consequences of decisions without actual risk to people, resources, capital, or reputation. Practiced routinely, game-based learning can, as this study is used to show, increase learning which leads to increased competitive advantage.

## Recommendations for Action

As the father of action research, Kurt Lewin, said, "No research without action, no action without research" (Romero, 2003). This study showed that classes using the game scored significantly higher means than classes that did not. As a result of this study, the following recommendations are offered as a way to translate this research into positive social change.

1. Present this study to the President and Dean of Academic Affairs at ABC University. Besides a full copy of the dissertation for each, an executive level briefing should be developed to bring to their attention the potential, within their campus, of teaching with games and/or simulations.

2. Submit an article detailing the study to the ABC University national internal newsletter to help raise awareness outside the local campus but inside the university as a whole.

3. Submit an article for publication to the International Journal of Applied Management and Technology (IJAMT).

4. Submit an article for publication to the Institute for Operations Research and Management Science (INFORMS) Transactions on Education.

5. Submit conference papers/presentations to the Interservice/Industry Training, Simulation and Education Conference (I/ITSEC), TechLearn Conference, the Masie Center TechLearn Trends, Learning 2006 Conference, Training 2007 Conference and Expo, Serious Games Summit 2007, and others.

6. Send out information and offer of free copies to the Serious Games community of practice via list serve.

7. Send out information and offer of free copies to the Department of Defense Game Developers community of practice via list serve.

8. Brief the DoD Game Laboratory staff at the Advanced Distributed Learning (ADL) Co-Lab.

9. Brief the Defense Modeling and Simulation Office (DMSO).

## Recommendations for Further Study

As this study is one of the first of its kind, there is plenty of research work left concerning game-based learning. As previously noted, Dr. Jan Cannon-Bowers (2006) recently challenged the efficacy of game-based learning: “I challenge anyone to show me a literature review of empirical studies about game-based learning. There are none … We need studies.” Consequently, this study presents several areas for additional research.

1. Several studies of other participants using other games.

2. A study of the commercial-off-the shelf games that could easily be adapted to teaching. There are literally hundreds of games on the market that support business, management, economics, mathematics, the sciences, the social sciences, history, and more. Some of these games are relatively inexpensive at $5.00 to $10.00 while many textbooks cost ten or more times that. The more studies produced the more will be known about game-based learning.

3. A study into why there is a positive relationship between learning and video games. This was a quantitative study, and there needs to be more. However, such studies do answer the more open-ended questions of how or why game-based learning works.

4. A study into the costs of using cots video games versus custom content video games. The game used in this study was free. Additionally, it was only used as a supplement to the usual curriculum. As previously mentioned, such commercial off the shelf games can be inexpensive. However, there are some games specifically designed to substitute traditional textbook-based curricula entirely. Tabula Digita's (2006) newly released Dimenxian: Learn Math or Die Trying is designed to be a stand alone introduction to algebra that meets state learning standards. Such specific games are expensive. Therefore, studies need to be done to determine which participants, and levels of participants, might best be supported by commercial off the shelf games versus very specific content games.

5. A study into the presentation of different learning styles in learning video games. Knowledge Adventure's Jumpstart Learning System (2006) tests children from preschool through fourth grade for their learning style. The game then presents its learning content to that child in that style for improved learning. Games designed for adults do not yet determines learning styles for content presentation.

6. A study into what is and is not acceptable video game character behaviors by targeted age group. The Entertainment Software Ratings Board (ESRB) now rates all entertainment software, providing both age ratings and content descriptions. Such a rating system could be used for school systems as well. However, some school systems may wish to devise their own rating system.

7. A study into the parental acceptance of game-based learning. The difficulties of academia accepting game-based learning were previously discussed. There is little to no research into the acceptance of game-based learning by parents.

8. A study of business models (learning industry v gaming industry) and what will have to be done to bring them closer together. There are hundreds of e-learning companies, yet only a handful of game-based learning companies. While the words "game" and "simulation" are entering many e-learning companies' lexicon, there are no companies yet that fully integrate the concept.

9. A study on what impact using game-based learning will have on academic programs focusing on Instructional Systems Design (ISD) majors such as how curriculum will have to change. ISD curricula do not currently include game-based learning using video games. A meta analysis of ISD curricula would be able to list and quantify which ISD curricula have to game or simulation instruction in them, which might have game show or puzzle type instruction in them, and which ones might be reception to including video game-based learning design in them.

10. A study to explore the relationship between attrition and video game-based learning. ABC University experienced 43 percent attrition in business majors (Giancola, 2005). There are a variety of reasons for this high attrition rate, and low grades is one of the top reasons. It may be that introduction of interactive games may help to decrease attrition by increasing student interest and thus improving grades.

## Conclusion

In the year 2006, $125,000,000 is being spent this year on game-based learning without knowing if it works or not. The problem addressed by this research, then, was to determine the relationship between the use of video games and learning. A causal-comparative exploratory study was conducted to examine the difference in academic

achievement between students who use video games in learning and those who do not, differences based on gender, ethnicity, or age. Historical test scores from classes of students from a nationally known university in Arlington, VA who did and did not participate in game play were examined. A management video game was added to approximately half the students' curriculum of 3rd year (junior) business students. Identical testing situations and test materials were provided to all students. Data collected included student test scores, class number, test score, gender, ethnicity, and age. Because of the type of data produced, and to test the effectiveness of the game supplement, means tests, ANOVA, chi-squared tests, and *t* tests were performed.

The data analysis found classes using the game had significantly higher means than those classes that did not use the game. There were no significant differences between male or female scores, regardless of game play, while both genders scored significantly higher with game play than without. There were no significant differences between ethnic, while all ethnic groups scored significantly higher with game play. Lastly, students age 40 year and under scored significantly higher with game play, those students 41 and older did not.

The implications for social change are enormous. Such games may assist students in applying, practicing, and ultimately developing greater understanding. Such a dramatic increase in student understanding of learning materials could lead to the recommendation that simulation and games are included as teaching tools in most curriculum areas. If game-based learning should prove to increase learning, America's education decline, might not only be stopped, but also reversed.

# REFERENCES


Abernathy, D. J. (1999). Thinking outside the evaluation box. *Training & Development, 53*(2), 18.

Aczel, A. D., & Sounderpandian, J. (2006). *Complete business statistics* (6th ed.). Boston: McGraw-Hill.

Adair, C. H., & Foster, J. T. (1972). *A guide to simulation design*. Tallahassee, FL: Instructional Simulation Design, Inc.

Aldridge, C. (2006, March 7). *The state of gaming and simulation.* Paper presented at the Training 2006 Conference and Expo, Orlando, FL.

Alliger, G. M., & Janak, E. A. (1989). Kirkpatrick's levels of training criteria: Thirty years later. *Personnel Psychology, 42*(2), 331.

Alvisi, A., Narduzzo, A., & Zamarian, M. (2003). Play Station and the Power of Unexpected Consequences. *Information, Communication & Society, 6*(4), 608-627.

Anderson, L. W., Krathwohl, D. R., & Bloom, B. S. (2001). *A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives* (Complete ed.). New York: Longman.

Anselmi, K., & Frankel, R. (2004). Modular experiential learning for business-to-business marketing courses. *Journal of Education for Business, January/February*, 169-175.

Archambault, S. (2000). Psychology 205 Review Site. Retrieved February 23, 2006, from http://www.wellesley.edu/Psychology/Psych205/index.html.

Army, D. o. t. (1999). Pamphlet 611-21: Personnel Selection and Classification, Military Occupational Classification and Structure.

Association, E. S. (2005). ESA’s 2005 essential facts about the computer and video game industry. Washington, DC: Author.

Ausubel, J. (2002). Virtual U: Origins and new release. *Remarks to First Adopters Workshop.* Retrieved February 3, 2006, from http://www.virtual-u.org/documentation/ausubelremarks.asp.

Barab, S. A., Barnett, M., & Squire, K. (2002). Developing an empirical account of a community of practice: Characterizing the essential tensions. *The Journal of the Learning Sciences, 11*(4), 489-542.

Barab, S. A., Barnett, M., Yamagata-Lynch, L., Squire, K., & Keating, T. (2002). Using activity theory to understand the systemic tensions characterizing a technology-rich introductory astronomy course. *Mind, Culture, and Activity, 9*(2), 76-107.

Barab, S. A., & Duffy, T. (Eds.). (2000). *From practice fields to communities of practice.* Mahwah, NJ: Lawrence Erlbaum.

Barab, S. A., Hay, K., Barnett, M., & Squire, K. (2001). Constructing virtual worlds: tracing the historical development of learner practices. *Cognition and Instruction, 19*(1), 47-94.

Barab, S. A., & Squire, K. (2004). Design-based research: Putting a stake in the ground. *The Journal of Learning Sciences, 13*(1), 1-14.

Barrese, J., Scordis, N., & Schelhorn, C. (2003). Teaching introductory concepts of insurance company management: A simulation game. *Review of Business, 24*(1), 43.

Bartle, R. A. (2004). *Designing virtual worlds*. Indianapolis, IN: New Riders Pub.

Bates, B. (2001). *Game design: The art & business of creating games*. Roseville, Calif.: Prima Tech.

Beck, J. C., & Wade, M. (2005). Gaming the future. *Across the Board, 42*(1), 48.

Bizzocchi, J., & Woodbury, R. F. (2003). A case study in the design of interactive narrative: The subversion of the interface. *Simulation and Gaming, 34 (4)*, 550-568.

Black, W. (2001). Benefits of including a capstone simulation course in community college business curricula. Retrieved June 22, 2005, from www.ebscohost.com

Bloom, B. S. (1956). *Taxonomy of educational objectives; the classification of educational goals* (1st ed.). New York: Longmans, Green.

Blumenstyk, G. (2000). A computer game lets you manage the university. *The Chronicle of Higher Education* Retrieved 18, 46, from http://proquest.umi.com/pqdweb?did=47712857&Fmt=7&clientId=8189&RQT=309&VName=PQD

Bonk, C. J., & Dennen, V. P. (2005). *Massive multiplayer online gaming: A research framework for military training and education*. Office Of The Under Secretary Of Defense For Personnel And Readiness

Booz, A. H. (2003). ADDIE model of instructional design. McLean, VA: Learning Systems Services Team, Booz Allen Hamilton.

Branson, R. K. (1978). The interservice procedures for instructional systems

development. *Educational Technology*.

Brawer, F. (1997). Simulation as a vehicle in entrepreneurship education. *Kauffman Center for Entrepreneurial Leadership, ERIC* Retrieved June 22, 2005, from www.ebscohost.com

Bray, H. (2004, April 28). Entertainment with a learning curve. *The Boston Globe*.

Brookfield, S. (1986). *Understanding and facilitating adult learning: A comprehensive analysis of principles and effective practices*. San Francisco: Jossey-Bass.

Brougere, G. (1999). Some elements relating to children's play and adult simulation/gaming. *Simulation and Gaming, 30*(2), 134-146.

Bruner, J. (1986). *Actual minds, possible worlds*. Cambridge, MA: Harvard University Press.

Caillois, R. (1958). *Les jeux et les hommes [Games and men]*. Paris: Gallimard.

Canada, G. o. (2005). Case study. Retrieved November 5, 2005, from http://www.dsc.gc.ca/en/hip/lld/lssd/lip/lipguidelines.shtml

Canny, E. A. (2001). Virtual U: A simulation of university system management [Electronic Version]. *Information Technology, Learning, and Performance Journal*, 19, 55 from http://proquest.umi.com/pqdweb?did=77042147&Fmt=7&clientId=8189&RQT=309&VName=PQD

Canon-Bowers, J. (2006, March 7). *The state of gaming and simulation.* Paper presented at the Training 2006 Conference and Expo, Orlando, FL.

Carlson, S. (2003). Can grand theft auto inspire professors? *Chronicle of Higher Education, 49*(49), A31.

Carnevale, D. (2005). Video game helps firefighters train for terrorist attacks. *Chronicle of Higher Education, 51*(42), A30-A30.

Chavez, A. H. (2004). A formative and summative evaluation of a multimedia economic program: a quasi-experimental study. University Of Phoenix.

Christopher, E., & Smith, L. (1987). Leadership training through gaming.

Clark, C. (2004). *Principles of game based learning.* Paper presented at the Learning Strategies Consortium Conference, Arlington, VA.

Clements, D. H., & Sarama, J. (2004). Building abstract thinking through math. *Early Childhood Today, 18*(5), 34-40.

Conner, M. L. (2004). How adults learn. from

http://agelesslearner.com/intros/adultlearning.html

Conte, C. (2003). Honey, I shrunk the deficit! *Governing* Retrieved 3, 17, from http://proquest.umi.com/pqdweb?did=77042147&Fmt=7&clientId=8189&RQT=309&VName=PQD

Coppard, L. C. (1976). *Gaming simulation and the training process*. New York, NY: Mcgraw-Hill.

Corbeil, P. (1999). Learning from the children: Practical and theoretical reflections on playing and learning. *Simulation and Gaming, 30*(2), 163-180.

Crawford, C. (2003). *Chris crawford on game design*. Indianapolis, Ind.: New Riders.

Declan, D., & Brown, F. W. (2000). Using a business simulation to teach applied skills - the benefits and the challenges of using student teams from multiple countries. *Journal of European Industrial Training, 24*(6), 330.

DeKanter, N. (2005). Gaming redefines interactivity for learning. *TechTrends: Linking Research & Practice to Improve Learning, 49*(3), 26-31.

Dickey, M. (2005). Engaging by design: How engagement strategies in popular computer and video games can inform instructional design. *ETR&D, 53*(2), 67-83.

Din, F., & Caleo, J. (2000). The effects of playing educational video games on kindergarten achievement. *Child Study Journal, 31*(2), 95-103.

DMSO. (1998). *DoD modeling and simulation (m&s) glossary*. Retrieved March 7, 2006. from https://www.dmso.mil/public/library/policy/guidance/p500059m.pdf.

Doyle, D., & Brown, F. W. (2000). Using a business simulation to teach applied skills - the benefits and the challenges of using student teams from multiple countries. *Journal of European Industrial Training, 25*(6), 330-336.

Epic. (2006). Hall of fame: Gee. Retrieved March 9, 2006, from http://www.epic.co.uk/content/resources/email_newsletter/Gee.htm

Epic. (2006). Hall of fame: Prensky. Retrieved March 9, 2006, from http://www.epic.co.uk/content/resources/email_newsletter/Prensky.htm

Ertmer, P. A., & Newby, T. J. (1993). Behaviorism, cognitivism, constructivism: Comparing critical features from an instructional design perspective. *Performance Improvement Quarterly, 6*(4), 50-70.

ESA. (2005). ESA's 2005 essential facts about the computer and video game industry. Washington, D.C.: Entertainment Software Association.

Gagné, R., Marx, M. H., Bunch, M. E., & Adams, J. A. (1977). *Fundamentals and*

*applications of learning*. New York: Macmillan.

Gagné, R. M. (1985). *The conditions of learning and theory of instruction* (4th ed.). New York: Holt, Rinehart and Winston.

Gagné, R. M., Briggs, L. J., & Wager, W. W. (1988). *Principles of instructional design* (3rd ed.). Fort Worth: Holt, Rinehart, and Winston.

Gamespot. (2005). Tabloid tycoon company line. Retrieved November 23, 2005, from http://www.gamespot.com/pc/strategy/tabloidtycoon/news.html?sid=6128249

Gamespy. (2005). Tabloid tycoon. Retrieved August 24, 2005, from http://www.download-free-games.com/simulation/tabloid_tycoon.htm

Ganzert, R., & Helms, A. (1998). Playing to learn: A community outreach framework in action. *T H E Journal, 26*(5), 53.

Gardner, H. (1991). *The unschooled mind: how children think and how schools should teach*. New York: BasicBooks.

Gary, L. (2003). Got game? *Harvard Management Update, 8*(10), 3-3.

Gay, L. R., Mills, G. E., & Airasian, P. W. (2006). *Educational research: competencies for analysis and applications* (8th ed.). Upper Saddle River, N.J.: Pearson Merrill Prentice Hall.

Gee, J. P. (2003). *What video games have to teach us about learning and literacy*. New York & London: Palgrave Macmillan.

Gee, J. P. (2004). *Situated language and learning: A critique of traditional schooling.* London: Routledge.

Geraldine, E. H. (2002). Strategies for teaching managerial communication. *Business Communication Quarterly, 65*(3), 86.

Giancola, J. (2005). State of ABC university. Arlington, VA.

Gibilisco, S. (2004). *Statistics demystified*. New York: McGraw-Hill.

Gonick, L., & Smith, W. (1993). *The cartoon guide to statistics* (1st HarperPerennial ed.). New York, NY: HarperPerennial.

Gravetter, F. J., & Wallnau, L. B. (2005). *Essentials of statistics for the behavioral sciences* (5th ed.). Belmont, CA: Thomson/Wadsworth.

Green, L. (2004). Junior achievement program turns students into business titans. *THE Journal, 32*(2), 26.

Guetl, C., Dreher, H., Williams, R., & Maurer, H. (2005). Game-based e-learning

applications by applying the e-tester: A tool for auto-generated questions and automatic answer assessment. Retrieved March 9, 2006, from http://www2.iicm.edu/cguetl/papers/GameBasedLearning_ED-MEDIA2005/GamebasedLearning_ED-MEDIA2005.pdf

Haywood, M. E., McMullen, D. A., & Wygal, D. E. (2004). Using games to enhance student understanding of professional and ethical responsibilities. *Issues in Accounting Education, 19*(1), 85-99.

Heinich, R., Molenda, M., Russell, J. D., & E.Smaldino, S. (1996). *Instructional media and technologies for learning* (5th ed.). Englewood Cliffs, NJ: Prentice Hall.

Herman, L., Horwitz, J., Kent, S., & Miller, S. (2004). The history of video games. from http://www.gamespot.com/gamespot/features/video/hov/p2_01.html

Herz, J. C. (1997). *Joystick nation: how videogames ate our quarters, won our hearts, and rewired our minds* (1st ed.). Boston: Little, Brown, and Co.

Hoffjan, A. (2005). Calvados – a business game for your cost accounting course. *Issues in Accounting Education, 20*(1), 63-80.

Hostetter, O. (2002). Video games – the necessity of incorporating video games as part of constructivist learning. Retrieved March 9, 2006, from http://www.game-research.com/art_games_contructivist.asp

Islam, K. (2002). Is e-learning floundaring? *Learning and Training Innovations*, from http://www.ltimagazine.com

Johassen, D. H., & McAleese, T. M. R. (2004). A Manifesto for a constructivist approach to technology in higher education. Retrieved October 19, 2004, from Available:http://led.gcal.ac.uk/clti/papers/TMPaper11.html

Johnson, G., & Scholes, K. (2002). *Exploring corporate strategy: text & cases* (6th ed.). Harlow, England ; New York: Financial Times Prentice Hall.

Jonassen, D. H. (1991). Objectivism versus constructivism: do we need a new philosophical paradigm? *Educational Technology Research and Development, 39*(3), 5-14.

Jonasson, J. D. (2004). Thinking technology: Toward a constructivist design model. Retrieved October 19, 2004, 2004, from http://ouray.cudenver.edu/~slsanfor/cnstdm.txt

JoWood. (2005). Industry Giant II. Retrieved November 2, 2005, from www.ig2.jowood.com

Jump Start. (2006). Jump start learning system. Retrieved May 13, 2006, from http://www.jumpstart.com

Kaplan, R. S., & Norton, D. P. (1992). The balanced scorecard--measures that drive performance., *Harvard Business Review* (Vol. 70, pp. 71): Harvard Business School Publication Corp.

Keller, J. M. (1987). Development and use of the ARCS model of motivational design. *Journal of Instructional Development, 10*(3), 2-10.

Keller, J. M. (1997). Motivational design and multimedia: Beyond the novelty effect. *Strategic Human Resource Development Review, 1*(1), 188-203.

Keller, J. M. (1999). Using the ARCS motivational process in computer-based instruction and distance education. *New Directions for Teaching & Learning*(78), 39.

Kelly, G. (1963). *A theory of personality*. New York: Norton.

Kent, S. L. (2001). *The ultimate history of video games: The story behind the craze that touched our lives and changed the world.* Roseville, CA: Prima.

Kevin, M. (2004). Halo 2 reveals new generation gap: Boomers vs. gamers, *USA Today*.

Kinder, M. (1991). *Playing with power in movies, television, and video games: from Muppet Babies to Teenage Mutant Ninja Turtles*. Berkeley: University of California Press.

King, L. (2002). *Game on: the history and culture of videogames*. New York, N.Y.: Universe Pub. Distributed to the U.S. trade by St. Martin's Press.

Kippenberger, T. (2002). Leave the ready-made solutions on the shelf. *Strategic Direction, 18*(6), 19.

Kirkley, S. E., & Kirkley, J. R. (2005). Creating next generation blended learning environments using mixed reality, video games and simulations. *TechTrends: Linking Research & Practice to Improve Learning, 49*(3), 42-89.

Kirkpatrick, D. (1976). *Evaluation of training* (2d ed.). New York: McGraw-Hill.

Kirriermuir, J., & McFarlane, A. (2004). Literature review in games and learning. *NESTA FUTURELAB SERIES* Retrieved September 25, 2004, from http://www.nestafuturelab.org

Klabbers, J. H. G. (2000). Learning as acquisition and learning as interaction., *Simulation & Gaming* (Vol. 31, pp. 380): Sage Publications Inc.

Klabbers, J. H. G. (2001). The emerging field of simulation & gaming: Meanings of a retrospect., *Simulation & Gaming* (Vol. 32, pp. 471): Sage Publications Inc.

Klabbers, J. H. G. (2003). Simulation and gaming: Introduction to the art and science of design., *Simulation & Gaming* (Vol. 34, pp. 488-494): Sage Publications Inc.

Knowles, M. S. (1970). *The modern practice of adult education: From pedagogy to andragogy*. Englewood Cliffs: Prentice Hall.

Knowles, M. S. (1973; 1990). *The adult learner: A neglected species* (4th ed.). Houston: Gulf Publications.

Knowles, M. S. (1984). *Andragogy in action* (1st ed.). San Francisco: Jossey-Bass.

Krathwohl, D. R. (2002). A revision of Bloom's taxonomy: An overview., *Theory Into Practice* (Vol. 41, pp. 212): Ohio State University.

Kriz, W. C. (2003). Creating effective learning environments and learning organizations through gaming simulation design. *Simulation and Gaming, 34*(4), 495-511.

Kyrylov, V., Bonanni, C., Kyrylova, T., & Love, E. (2004). Advanced simulation gaming technology and business education. from http://www.sfu.ca/~vkyrylov/Publications/Vadim_Games_In_business_education_Sep_06.pdf

Lavamind. (2005). Zapitalism. Retrieved August 24, 2005, from www.lavamind.com

Lave, C. A., & March, J. G. (1993). *An introduction to models in the social sciences*. Lanham, Md.: University Press of America.

Lave, J. (1988). *Cognition in practice: Mind, mathematics, and culture in everyday life.* Cambridge, UK: Cambridge University Press.

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

Leemkuil, H., Jong, T. d., & Ootes, S. (2000). Review of educational use of games and simulations [Electronic Version] from http://kits.edte.utwente.nl/documents/D1.pdf.

Leigh, E., & Spindler, L. (2004). Simulations and games as chaordic learning contexts. *Simulation and Gaming, 35*(1), 53-69.

Lewin, K. (1938). *The conceptual representation and the measurement of psychological forces*. Durham,: N. C., Duke university press.

LoPiccolo, P. (2005). We could be heroes. *Computer Graphics World, 28*(3), 4-4.

Maccoby, M. (2005). Understanding the people you manage. *Research Technology Management, 48*(3), 58-60.

Maney, K. (2004, November 17). 'Halo 2' shows new generation gap: Boomers vs. gamers. Retrieved November 23, 2005, from http://www.usatoday.com/tech/columnist/kevinmaney/2004-11-16-halo2-

generation-gap_x.htm

Marinelli, D., & Pausch, R. (2004). Edutainment for the College Classroom. *Chronicle of Higher Education, 50*(28), B16-B16.

Massy, W. (2003). Virtual U enhancements in version 2.1. Retrieved February 3, 2005, from http://www.virtual-u.org/documentation/vu21-enhancements.asp

Massy, W. F. (1999). Virtual U: The university simulation game. from http://search.epnet.com/login.aspx?direct=true&db=eric&an=ED450722&loginpage=Login.asp&site=ehost

Maxis. (2000). The sims. *The Sims* Retrieved July 13, 2005, from http://thesims.ea.com/us/index.html

Mayo, M. J. (2005, October 31). *Ender's game for science and engineering: games for real, for now, or we lose the brain war*. Paper presented at the Serious Games Summit, Arlington, VA.

McCarthy, J. (2002). Enterprise play. *InfoWorld, 24*(41), 44.

McClatchey, C. A., & Kuhlemeyer, G. A. (2000). Incorporating stock market games into the classroom: A survey of faculty teaching investments. *Journal of Applied Finance, 10-2*(Fall/Winter), 208-221.

Meigs, T. (2003). *Ultimate game design: Building game worlds*. New York: McGraw-Hill/Osborne.

Mencher, M. (2003). *Get in the game!: Careers in the game industry* (1st ed.). Indianapolis, Ind.: New Riders.

Merriam, S., & Cafarella, R. (1999). *Learning in adulthood: A comprehensive guide*. San Francisco: Jossey-Bass Publishers.

Merrill, M. D. (1991). Constructivism and instructional design. *Educational Technology, May*, 45-53.

Mezirow, J. (1991). Transformative dimensions of adult learning. from http://adulted.about.com/cs/learningtheory/a/mezirow.htm

Mezirow, J. (1999). *Transformation theory - postmodern issues.* Paper presented at the AERC Conference, DeKalb, Illinois.

Milliken, D. (2006, March 7). *The state of gaming and simulation.* Paper presented at the Training 2006 Conference and Expo, Orlando, FL.

Molenda, M. (2003). The ADDIE model., from http://www.indiana.edu/~mmweb98

Moore, D. L., & Williams, K. (2002). Virtual U. *Assessment Update* Retrieved 1, 14,

from http://search.epnet.com/login.aspx?direct=true&db=aph&an=10350107&loginpage=Login.asp&site=ehost

Morrison, M. (2003). *Sams teach yourself game programming in 24 hours*. Indianapolis, Ind.: Sams Pub.

Mulligan, J., & Patrovsky, B. (2003). *Developing online games: An insider's guide*. Indianapolis, Ind.: New Riders.

Newswire, P. (2000). Virtual U released: University management goes high tech computer simulation tackles the management challenges of higher education. from http://proquest.umi.com/pqdweb?did=55540413&Fmt=7&clientId=8189&RQT=309&VName=PQD

Omernick, M. (2004). *Creating the art of the game*. Indianapolis, Ind.: New Riders.

Orbanes, P. (2002). Everything I know about business I learned from monopoly. *Harvard Business Review, March*, 3-8.

Packet, P. (2005). The peter packet challenge. Retrieved August 24, 2005, from www.peterpacket.org

Pape, S., Bel, C., & Yetkin, I. (2003). Developing mathematical thinking and self-regulated learning: A teaching experiment in a seventh-grade mathematics classroom. *Educational Studies in Mathematics*, *53*, 179-202.

Phillips, J. J. (1996). How much is the training worth? (Cover story), *Training & Development* (Vol. 50, pp. 20): American Society for Training & Development.

Piaget, J. (1967). *Biologies et connaissances, essais sur les relations entre les regulations organiques et les processus cognitifs [Biologies and knowledge: Essays on the relations between organic regulations and cognitive processes]*. Paris: Gallimard.

Piaget, J. (1969). *Psychologie et pédagogie [Psychology and pedagogy]*. Paris: Denoël-Gonthier.

Poole, S. (2000). *Trigger happy: Videogames and the entertainment revolution*. New York: Arcade.

Prensky, M. (2000). *Digital game-based learning*. New York: McGraw-Hill.

Rainwater, T., Salkind, N., Sawyer, B., & Massy, W. (2003). Virtual U 1.0 strategy guide. from http://www.virtual-u.org/downloads/vu-strategy-guide.pdf

Rejeski, D. (2002). Gaming our way to a better future. Retrieved February 3, 2005, from http://www.avault.com/developer/getarticle.asp?name=drejeski1

Results.gov. (2006). The stoplight scoring system. *The President's Management Agenda. Retrieved* July 13, 2006 from http://www.whitehouse.gov/results/agenda/scorecard.html.

Reynolds, R., Sinatra, G., & Jetton, T. (1996). Views of knowledge acquisition and representation: a continuum from experience centered to mind centered. *Educational Psychologist, 31*(2), 93-104.

Ring, J. (2002). Learning by doing: Getting faster every lap. *Transforming Culture: An Executive Briefing on the Power of Learning.* Retrieved May 29, 2006, from http://www.darden.virginia.edu/Batten/clc/Articles/LearningbyDoing.pdf

Robinson, J., Lewars, T., Perryman, L. S., Crichlow, T., & et al. (2000). Royal flush: A cross-cultural simulation. *Business Communication Quarterly, 63*(4), 83.

Rogers, A. (2003). *What is the difference? A new critique of adult learning and teaching*. Leicester: NIACE.

Rogers, C., & Freiberg, H. J. (1969, 1983, 1993). *Freedom to learn*. New York: Merrill.

Rolfe, J. (1991). SAGSET 1990 – The proof of the pudding: the effectiveness of games and simulations. *Simulation/Games for Learning, 21*(2), 99-117.

Rollings, A., & Adams, E. (2003). *Andrew rollings and ernest adams on game design* (1st ed.). Indianapolis, Ind.: New Riders.

Rollings, A., & Morris, D. (2004). *Game architecture and design* (New ed.). Indianapolis, Ind.: New Riders.

Romero, V. (2003). MBA student stereotypes entirely accurate. Retrieved May 10, 2006, from http://www.psychologicalscience.org/observer/getArticle.cfm?id=1317

Romme, A. G. L., & Putzel, R. (2002). Designing management education: Practice what you teach. *Simulation and Gaming, 34*(4), 512-530.

Rose, C. P., & Nicholl, M. J. (1997). *Accelerated learning for the 21st century: The six-step plan to unlock your master-mind*. New York: Delacorte Press.

Rouse, R. (2001). *Game design: Theory and practice*. Plano, TX: Worldware Publishing.

Ruben, B. D., & Lederman, L. C. (1982). Instructional simulation gaming: Validity, reliability, and utility. *Simulation and Games, 13*(2), 233-244.

Rucker, R. v. B. (2002). *Software engineering and computer games*. New York: Addison Wesley.

Rumsey, D. J. (2003). *Statistics for dummies*. Hoboken, N.J.: Wiley.

Saettler, P. (1990). *The evolution of american educational technology*. Englewood, CO: Libraries Unlimited, Inc.

Sakthivel, T. (2003). Learning and teaching in practice. *Pharmacy Education* (Vol. 3, pp. 217-222): Taylor & Francis Ltd.

Salen, K., & Zimmerman, E. (2003). *Rules of play: game design fundamentals.* Cambridge, Mass.: MIT Press.

Salopek, J. J. (2003). Going native: Cross the generation gap by learning to speak game., *T+D* (Vol. 57, pp. 17): American Society for Training & Development.

Saltzman, M. (1999). *Game design: Secrets of the sages*. Indianapolis, IN: Brady Pub.

Saltzman, M. (2004). *Game creation and careers: insider secrets from industry experts* (1st ed.). Indianapolis, Ind.: New Riders.

Sarane, S. B. (1966). An experimental study of the learning effects of two games with simulated environments. *The American Behavioral Scientist (pre-1986), 10*(2), 8.

Sawyer, B. (2003). Serious games: Improving public policy through game-based learning and simulation. *Foresight & Governance Project at the Woodrow Wilson Center:* Publication 2002-1, from http://wwics.si.edu/foresight/index.htm

Schaller, D. T., & Allison-Bunnell, S. (2003). Practicing what we teach: How learning theory can guide development of online educational activities. *Museums and the Web 2003.* Retrieved June 6, 2005, from www.ebscohost.com

Schank, R. C. (1997). *Virtual learning: a revolutionary approach to building a highly skilled workforce*. New York: McGraw-Hill.

Schevitz, T. (2000). University game plan/professor emeritus' computer simulation lets players test skills as college administrators. *San Francisco Chronicle*, from http://proquest.umi.com/pqdweb?did=47957859&Fmt=7&clientId=8189&RQT=309&VName=PQD

Schrage, M. (2000). Mirror, mirror. *CIO, 13*(14), 240.

Schriesheim, C. A., & Yaney, J. P. (1975). The motivation of business game participants. *Training and Development Journal*.

Schwienhost, K. (2002). Why virtual, why environments? Implementing virtual reality concepts in computer-assisted language learning. *Simulation and Gaming, 33*(2), 196-209.

Sheff, D. (1994). *Game over: How nintendo conquered the world* (1st Vintage Books ed.). New York: Vintage Books.

Sheff, D. (1994). *Video games: a guide for savvy parents* (1st ed.). New York: Random House.

Sia, A. P., & Sydnor, D. (1987). Promoting excellence: Some classroom evaluation alternatives.

Skinner, B. F. (1985). Cognitive science and behaviourism. *British Journal of Psychology* Retrieved June 8, 2005, from www.ebscohost.com,

Skurzynski, G. (1994). *Know the score: video games in your high-tech world* (1st ed.). New York, Toronto: Bradbury Press; Maxwell Macmillan Canada; Maxwell Macmillan International.

Smith, F. (1998). *The book of learning and forgetting*. New York: Teachers College Press.

Smith, M. K. (1999). Learning and theory. *The encyclopedia of informal education* Retrieved September 25, 2004, from http://www.infed.org/biblio/b-learn.htm

Smith, M. K. (2002). Malcolm Knowles, informal adult education, self-direction and anadragogy. *The encyclopedia of informal education* Retrieved September 25, 2004, from http://www.infed.org/thinkers/et-knowl.htm

Somers, J. A., & Holt, M. E. (1993). What's in a game? A study of games as an instructional method in an adult education class., *Innovative Higher Education* (Vol. 17, pp. 243): Kluwer Academic Publishing.

Song, S. H. (1998). *The effects of motivationally adaptive computer-assisted instruction through the ARCS model.* Unpublished Doctoral Dissertation, College of Education, Florida State University, Tallahassee, FL.

Soy, S. K. (1996, November 11, 1998). The case study as a research method. Retrieved November 5, 2005, from http://www.gslis.utexas.edu/~ssoy/usesusers/l391d1b.htm

SPSS. (2005). Statistical package for the social sciences (Version 13.0). Chicago, IL: SPSS.

Squire, K., Barnett, M., Grant, J., & Higginbotham, T. (2004). Electromagnetism supercharged! Learning physics with digital simulation games. from http://labweb.education.wisc.edu/room130/PDFs/squire2.pdf

Squire, K., & Steinkuehler, C. (2005). Meet the gamers. *Library Journal, April 15, 2005,* 38-42.

Steckler, M., & Oleson, K. (2005). SPSS guide. Retrieved March 26, 2006, from http://academic.reed.edu/psychology/RDDAwebsite/spssguide/anova.html

Sudnow, D. (1983). *Pilgrim in the microworld*. New York, N.Y.: Warner Books.

Suzuki, K., & Keller, J. M. (1996). *Creation and cross-cultural validation of an ARCS motivational design matrix.* Paper presented at the Japanese Association for Educational Technology, Kanazawa, Japan.

Sweller, J., & Chandler, P. (1991). Evidence for cognitive load theory., *Cognition & Instruction* (Vol. 8, pp. 351): Lawrence Erlbaum Associates.

Tabula Digita. (2006). Dimenxian: Learn math or die trying. Retrieved May 13, 2006, from http://www.tabuladigita.com

Tapscott, D. (1998). *Growing up digital: the rise of the net generation*. New York: McGraw-Hill.

Team, L. S. S. (2003). ADDIE model of instructional design. McLean, VA: Booz Allen Hamilton.

Thiagarajan, S. (1976). Help! I am trapped inside an ID model. *NSPI Journal, 10*(11).

Thiagarajan, S. (2002). On the night stand. *T+D* (Vol. 56, pp. 117): American Society for Training & Development.

Tolman, E. C. (1932). *Purposive behavior in animals and men*. New York: Appleton-Century-Crofts.

Toma, J. D., & Shaman, S. (2002). Virtual U: Using computer simulation in teaching and training in higher education management. from http://www.virtualupdate.org/Cases/CasesDownload/EAIR2002PaperFinal.doc

Toto, C. (2005). Art of game design. Retrieved November 23, 2005, from http://washingtontimes.com/metro/20050328-122028-7804r.htm

Turkle, S. (1984). *The second self: computers and the human spirit*. New York: Simon and Schuster.

Ulich, R. (1968). *History of educational thought* (Rev. ed.). [New York]: American Book Co.

Virtual U Project. (2003). Virtual U. Retrieved November 2, 2005, from http://www.virtual-u.org.

Visser, L. (1998). *The development of motivational communication in distance education support.* Unpublished Doctoral Dissertation, Educational Technology Department, University of Twente, Netherlands.

Vygotsky, L. S. (1986). *Thought and language*. Cambridge, MA: MIT Press.

Wallen, N. E., & Fraenkel, J. R. (2001). *Educational research: a guide to the process*

(2nd ed.). Mahwah, N.J.: Lawrence Erlbaum Associates.

Walters, B. A., & Coalter, T. M. (1997). Simulation games in business policy courses: Is there value for students? *Journal of Education for Business. 72*(3), 170-174.

Waters, B., & Toft, I. (2001, October). Virtual U: A university systems simulation. *Conflict Management in Higher Education Report* Retrieved 1, 2, from http://www.campus-adr.org/CMHER/ReportResources/Edition2_1/VirtualU2_1.html

Weisgerber, R. A. (1971). *Developmental efforts in individualized instruction.* Itasca, IL: Peacock.

Weisler, A., & McCall, R. B. (1976). Exploration and play: Résumé and redirection. *American Psychologist, 31*, 492-508.

Wolf, M. J. P., & Perron, B. (2003). *Video game theory*. New York; London: Routledge.

World, H. (2005). Force food. Retrieved August 24, 2005, from www.food-force.com

Zeller, S., & Lyhus, R. (2005). Training games. *Government Executive, 37*(1), 44-49.

Zhenyu, H., & Cappel, J. J. (2005). Assessment of a web-based learning game in an information systems course. *Journal of Computer Information Systems, 45*(4), 42-49.

# APPENDIX: LETTERS OF PERMISSION

**Allyn and Bacon A Pearson Education Company**
Copyright and Permissions Department
75 Arlington Street, Suite 300, Boston, MA 02116
Phone: 617-848-7264 Fax: 617-848-7320 Country Code: 01

Reference ISBN: 080131903x

Date March 30, 2006

Dear Richard Blunt

Allyn & Bacon grants permission for your March 23, 2006 request to reprint/adapt Tables On Page 28 ¿ from A Taxonomy For Learning, Teaching, And Assessing (c) 2001 by Lorin W. Anderson & David R. Krathwohl for use in Dissertation

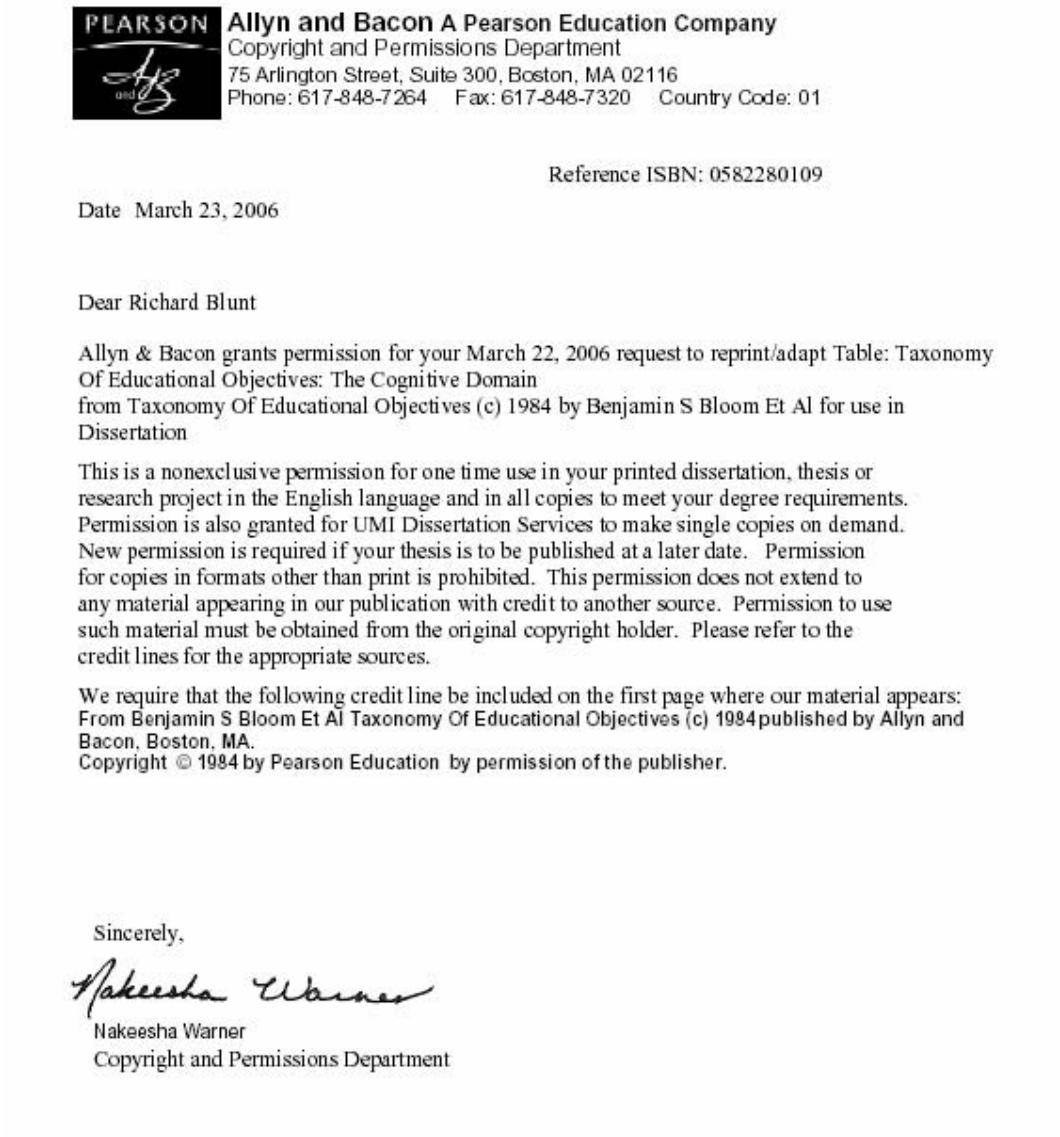
This is a nonexclusive permission for one time use in your printed dissertation, thesis or research project in the English language and in all copies to meet your degree requirements. Permission is also granted for UMI Dissertation Services to make single copies on demand. New permission is required if your thesis is to be published at a later date. Permission for copies in formats other than print is prohibited. This permission does not extend to any material appearing in our publication with credit to another source. Permission to use such material must be obtained from the original copyright holder. Please refer to the credit lines for the appropriate sources.

We require that the following credit line be included on the first page where our material appears:
**From Lorin W. Anderson & David R. Krathwohl A Taxonomy For Learning, Teaching, And Assessing (c) 2 published by Allyn and Bacon, Boston, MA.**
**Copyright © 2001 by Pearson Education by permission of the publisher.**

Sincerely,

Nakeesha Warner
Copyright and Permissions Department

Note. Table 2 is from *The conditions of learning and theory of instruction* (4th ed.), by R. M. Gagné, 1985, New York: Holt, Rinehart and Winston. Copyright Thompson Learning. Used with permission.



**Allyn and Bacon** A Pearson Education Company
Copyright and Permissions Department
75 Arlington Street, Suite 300, Boston, MA 02116
Phone: 617-848-7264 Fax: 617-848-7320 Country Code: 01

Reference ISBN: 0582280109

Date March 23, 2006

Dear Richard Blunt

Allyn & Bacon grants permission for your March 22, 2006 request to reprint/adapt Table: Taxonomy Of Educational Objectives: The Cognitive Domain
from Taxonomy Of Educational Objectives (c) 1984 by Benjamin S Bloom Et Al for use in Dissertation

This is a nonexclusive permission for one time use in your printed dissertation, thesis or research project in the English language and in all copies to meet your degree requirements. Permission is also granted for UMI Dissertation Services to make single copies on demand. New permission is required if your thesis is to be published at a later date. Permission for copies in formats other than print is prohibited. This permission does not extend to any material appearing in our publication with credit to another source. Permission to use such material must be obtained from the original copyright holder. Please refer to the credit lines for the appropriate sources.

We require that the following credit line be included on the first page where our material appears:
From Benjamin S Bloom Et Al Taxonomy Of Educational Objectives (c) 1984 published by Allyn and Bacon, Boston, MA.
Copyright © 1984 by Pearson Education by permission of the publisher.

Sincerely,

Nakeesha Warner

Nakeesha Warner
Copyright and Permissions Department

Note. Table 3 is from *Taxonomy of Educational Objectives, Handbook 1: Cognitive Domain*, by B. S. Bloom, 1956, New York: David McKay. Copyright Pearson Education. Used with permission.

Note. Table 4 is from *A Taxonomy for Learning, Teaching, and Assessing*, by L. W. Anderson, D. R. Krathwohl, & B. S. Bloom, 2001, New York: Longman. Copyright Pearson Education. Used with permission.

Note. Table 5 is from *A Taxonomy for Learning, Teaching, and Assessing*, by L. W. Anderson, D. R. Krathwohl, & B. S. Bloom, 2001, New York: Longman. Copyright Pearson Education. Used with permission.

---

From: Marc Prensky [mailto:prensky@attglobal.net]
Sent: Sat 8/6/2005 12:19 PM
To: 'Rick Blunt'
Subject: RE: [seriousgames] Economist Issue Highlights Games

Hi Rick.

Permission granted! Good luck!

FYI, my new book, to be published in the fall or spring, is "Don't Bother Me, Mom -- I'm Learning: The POSITIVE Guide for Parents Concerned About Their Kids' Video and Computer Game Playing" (Paragon 2005)

Best,
Marc

Marc Prensky | thought leader | speaker | writer | consultant | learning game designer

Founder & CEO, Games2train | Author, Digital Game-Based Learning

email: marc@games2train.com

phone: +1 917-826-6965

web sites:

www.marcprensky.com/blog (weblog)

www.marcprensky.com/writing/default.asp (writings)

www.dodgamecommunity.com

www.socialimpactgames.com

www.digitalmultiplier.org

www.gamesparentsteachers.com

www.games2train.com

Note. Table 6 is from *Digital Game-Based Learning*, by M. Prensky, 2000, New York: McGraw-Hill. 

**From:** Oehlert Mark [oehlert_mark@bah.com]
**Sent:** Sunday, July 16, 2006 12:33 PM
**To:** Rick Blunt
**Subject:** RE: Help Please
To Whom It May Concern:

Rick Blunt has the permission of Booz Allen Hamilton to use the ADDIE graphic cited as "Figure 1" in his dissertation.

Please feel to contact me with any additional questions.

v/r
Mark Oehlert

The Shortest Distance Across Your Learning Curve

**Mark Oehlert**
*Associate*

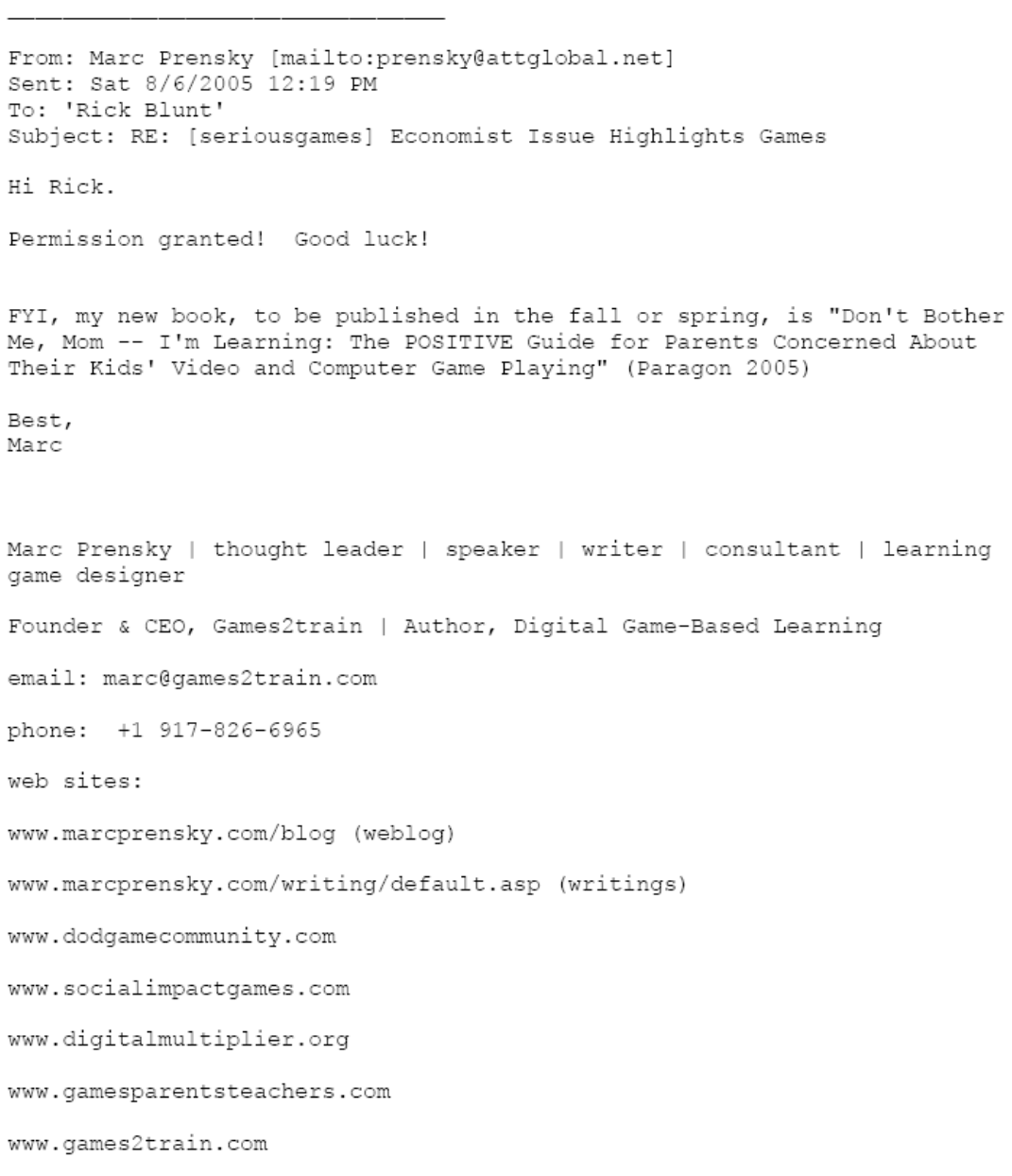
**Booz Allen Hamilton**
One Dulles
13200 Woodland Park Drive
Herndon, VA 20171

oehlert_mark@bah.com
http://blogoehlert.typepad.com/eclippings/

Skype ID: markoehlert
SkypeIn #: 703-879-6891

*Add me to your address book...* *Want a signature like this?*

Note. Figure 1 is from *ADDIE model of instructional design.* Booz, A. H. (2003). McLean, VA: Learning Systems Services Team, Booz Allen Hamilton. Copyright Booz Allen Hamilton. Used with permission.



_____

From: Marc Prensky [mailto:prensky@attglobal.net]
Sent: Sat 8/6/2005 12:19 PM
To: 'Rick Blunt'
Subject: RE: [seriousgames] Economist Issue Highlights Games

Hi Rick.

Permission granted! Good luck!

FYI, my new book, to be published in the fall or spring, is "Don't Bother Me, Mom -- I'm Learning: The POSITIVE Guide for Parents Concerned About Their Kids' Video and Computer Game Playing" (Paragon 2005)

Best,
Marc

Marc Prensky | thought leader | speaker | writer | consultant | learning game designer

Founder & CEO, Games2train | Author, Digital Game-Based Learning

email: marc@games2train.com

phone: +1 917-826-6965

web sites:

www.marcprensky.com/blog (weblog)

www.marcprensky.com/writing/default.asp (writings)

www.dodgamecommunity.com

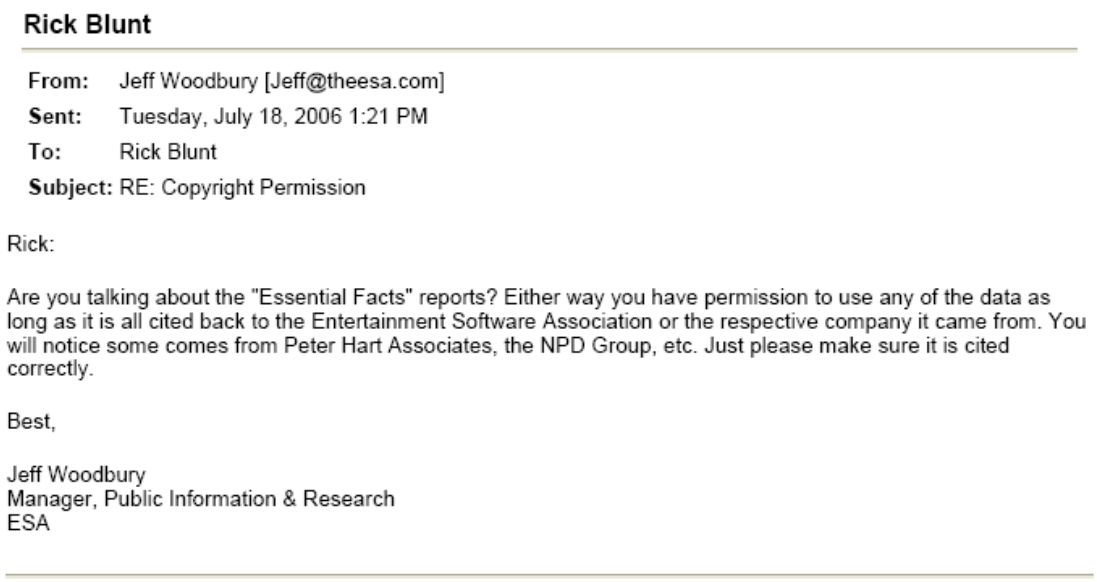
www.socialimpactgames.com

www.digitalmultiplier.org

www.gamesparentsteachers.com

www.games2train.com

Note. Figure 2 is from *Digital Game-Based Learning*, by M. Prensky, 2000, New York: McGraw-Hill. Copyright McGraw-Hill. Used with permission.



**Rick Blunt**

**From:** Jeff Woodbury [Jeff@theesa.com]
**Sent:** Tuesday, July 18, 2006 1:21 PM
**To:** Rick Blunt
**Subject:** RE: Copyright Permission

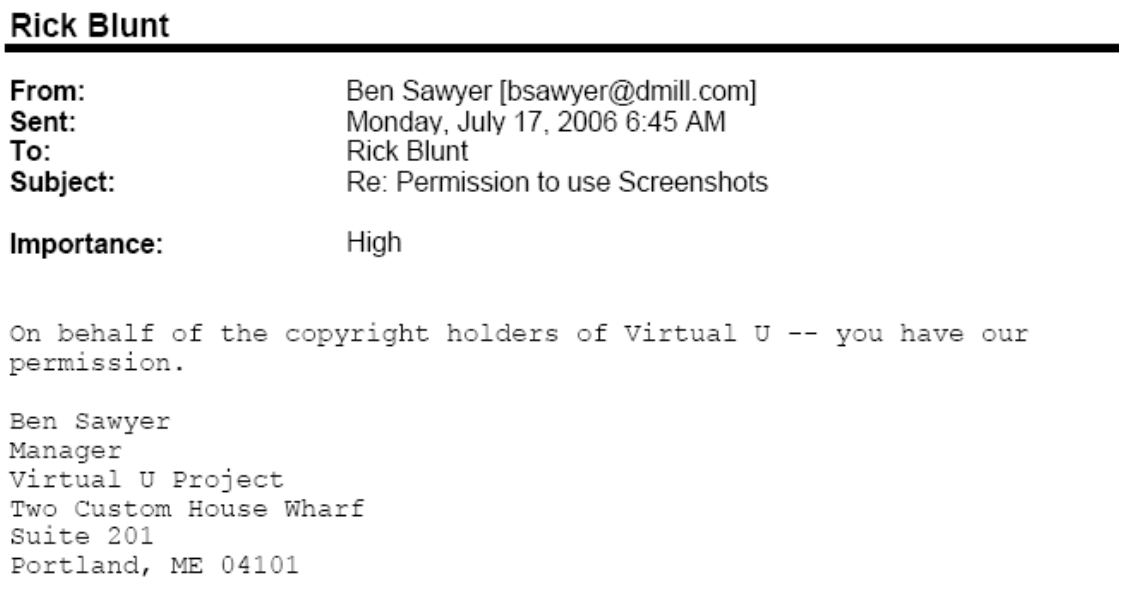
Rick:

Are you talking about the "Essential Facts" reports? Either way you have permission to use any of the data as long as it is all cited back to the Entertainment Software Association or the respective company it came from. You will notice some comes from Peter Hart Associates, the NPD Group, etc. Just please make sure it is cited correctly.

Best,

Jeff Woodbury
Manager, Public Information & Research
ESA

Note. Figure 4 is from *ESA's 2005 essential facts about the computer and video game industry.* ESA. (2005). Washington, D.C.: Entertainment Software Association. Copyright Entertainment Software Associate. Used with permission.



**Rick Blunt**

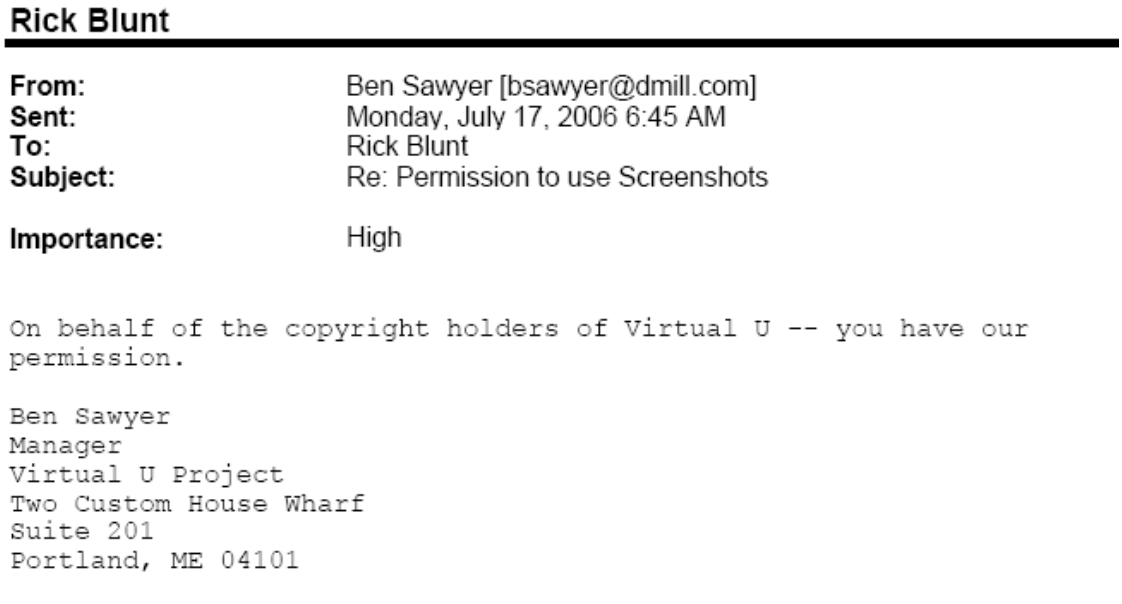
**From:** Ben Sawyer [bsawyer@dmill.com]
**Sent:** Monday, July 17, 2006 6:45 AM
**To:** Rick Blunt
**Subject:** Re: Permission to use Screenshots

**Importance:** High

On behalf of the copyright holders of Virtual U -- you have our permission.

Ben Sawyer
Manager
Virtual U Project
Two Custom House Wharf
Suite 201
Portland, ME 04101

Note. Figure 5 is from *Virtual U.* Virtual U Project. (2003). Portland, ME. No copyright. Used with permission.



**Rick Blunt**

**From:** Ben Sawyer [bsawyer@dmill.com]
**Sent:** Monday, July 17, 2006 6:45 AM
**To:** Rick Blunt
**Subject:** Re: Permission to use Screenshots

**Importance:** High

On behalf of the copyright holders of Virtual U -- you have our permission.

Ben Sawyer
Manager
Virtual U Project
Two Custom House Wharf
Suite 201
Portland, ME 04101

Note. Figure 6 is from *Virtual U.* Virtual U Project. (2003). Portland, ME. No copyright. Used with permission.

CURRICULUM VITA

**Professional Address:**
Business and CIS Dept., ABC University, 2450 Crystal Drive, Arlington, VA 22202
Office: 703-414-4169 E-Mail: rblunt@dc.ABC.edu
Web Address: www.rickblunt.com

**Education:**

| | | |
|---|---|---|
| M.S. Organizational Learning | George Mason University | 2000 |
| M.S. Management | Lesley College | 1997 |
| B.S. Physics | U.S. Naval Academy | 1981 |

**Current Professional Appointments:**

- *Associate Professo*r, ABC University (2004 – present)

**Current Research Activities:**

- Blunt, R. D. (2006). *Dissertation: Teaching college level management with video games.* Minneapolis, MN: Walden University

**Current Teaching Activities:**

- *Introduction to Business and Technology* (2004-present); Course Instructor, one semester undergraduate course introducing the roles of the major functional areas of business and to the interrelationships among them.
- *Principles of Management* (2004-present); Course Instructor, one-semester upper level course examines the fundamental management theories and the evolution of management thought and action within the last century.
- *Principles of Economics* (2004-present); Course Instructor, one-semester upper level course introduces the field of economics and shows how a system-level understanding of the interaction between micro- and macroeconomics greatly improves the quality of one's analysis.
- *Computer Applications for Business* (2004-present); Course Instructor, one semester course introduces basic concepts and principles underlying personal productivity tools that are widely used in business, such as word processors, spreadsheets, E-mail and Web browsers.
- *Fundamentals of E-Commerce* (2004-present); Course Instructor, freshman course provides an in-depth overview of the issues, technology and environment of electronic commerce. The knowledge gained in this course facilitates a more comprehensive and contemporary exploration of future coursework in marketing, operations, finance, business law, and database and web site management.
- *Total Quality Management* (2004-present); Course Instructor, one-semester, upper division course presents quality procedures and concepts for enhancing goods and services and the entire business environment.

**Previous Teaching Activities:**

- *Fundamentals of Total Quality* (1995-1997)

- *Implementing Total Quality* (1995-1997)
- *Team Skills and Concepts* (1995-1997)
- *Methods of Managing Quality* (1995-1997)
- *Systems Approach to Process Improvement* (1995-1997).

**Educational Publishing Activities:**

- *Reviewer*; McGraw-Hill/Irwin, Introduction to Game Design and Development. (2005).

**University Service Activities:**

- As BUSN/CIS Chair accomplished:
  - Concentrations: Added several concentrations to our offering:
    - CIS: Computer Forensics, Information System Security, Web Development and Administration
    - BSBA: Account, BIS, Project Management, Small Business Management and Entrepreneurship
  - Oracle determination finalized
  - i-Lab determination finalized
- Game and Simulation Programming lead for the campus:
  - Singularly wrote the Game and Simulation proposal lauded by OBT as "most well researched and written proposal that I have reviewed to date."
  - Facilitating the forming of the GSP Advisory Board
  - Coordinating hardware upgrades
  - Training faculty in game basics
- Helped plan University Day Professional Development curriculum
- Presented Game-Based Learning brief during University Day Professional Development
- Represented DeVry at McKinley High School Video Game Summit
- Represented DeVry at the Serious Games Summit
- Authored Business Program Review
- Drafted OBT GSP briefing
- Tysons Center Acting Dean during Dean leave of absence
- Performed as Acting CIS Dean

**Presented Research Papers and Posters:**

- Training 2006 Conference and Expo
- Conference on Distance Teaching & Learning (2000)
- Sixth Annual Asynchronous Learning Network Conference (2000)
- TechLearn 2000 (2000)
- TeleCon West 2000 Conference (2000).
- TeleCon East/TeleGov East 2000 (2000)

**Selected Publications:**

- Blunt, R. D. (2005). *A framework for the pedagogical evaluation of video game-based learning environments*. Minneapolis, MN: Walden University.

- Blunt, R. D. (2005). *Game-based learning for teaching business.* Minneapolis, MN: Walden University
- Blunt, R. D. (2005). *Teaching college level economics with video games.* Minneapolis, MN: Walden University
- Blunt, R. D. (2003, October). *Communities at the speed of business: Communities of practice as peer-to-peer learning networks.* New York: Writers Press.
- Blunt, R. D. (2001, January). *Knowledge management in the new economy.* New York: Writers Press.
- Blunt, R., Ahearn, C. 2000 Creating a Virtual Learning Community. Learning Decisions June

**Other Previous Experience:**

- Deputy Director, Learning Technologies, Office of the Assistant Secretary of Defense for Reserve Affairs, the Pentagon, Washington, D.C.
  - Responsibilities: monitors and reviews learning, training and education issues associated with equipment, courseware, devices, and learning technology; monitors National Guard and Reserve component access to use of learning resources and the adaptation of learning support to unique G/R requirements; and reviews/coordinates, as appropriate, on G/R training/training support planning, programming, and budget issues. Serves as executive secretary for a very high profile Secretary of Defense learning technology forum; Total Force Advanced Distributed Learning Action Team (TFADLAT).
  - Co-Authored and Co-Edited the Department of Defense's Advanced Distributed Learning (ADL) Implementation Plan that enabled consensus amongst the services to develop a department-wide, forward-thinking plan that will guide the DoD's ADL Initiative for the next decade and effect 3.3 million people. ADL is an evolution of distributed learning (distance learning) that emphasizes collaboration on standards-based versions of reusable objects, networks, and learning management systems yet may include some legacy methods and media.
  - Led and facilitated a Department-wide Reserve Component Distributed Learning Policy Integrated Process Team to provide compensation and credit for reservists who train and learn via distributed learning methodologies.
  - Directly responsible for the unparalleled collaborative efforts resulting in the first ever data collection supporting DoD's ADL Initiative.
- Chief Of Naval Operations, The Pentagon, Washington D.C.
  - Head of Personnel Policy, Director of Naval Reserve
    - Managed the coordination of Naval Reserve Policy on all personnel issues from recruiting to retirement including all aspects of assignment, pay, participation, promotion, advancement, retention and benefits.
- Naval Air Station South Weymouth, MA
  - Total Quality Leadership Coordinator, Administrative Officer, and Public Safety Officer.
    - Awarded Navy Commendation Medal for leading Total Quality success
    - Awarded Navy Commendation Medal for meritorious performance in Fighter Squadron Two Zero Two

    - Facilitated Executive Steering Committee through Strategic Planning and implementation of base closure (downsizing) process
    - Facilitated Labor-Management Boards for American Federation of Government Employees and International Association of Fire Fighters Unions
- Fighter Squadron Two Zero Two, Dallas, TX
  - Operations Officer, Maintenance Officer, Administrative Officer, Training Officer, Safety Officer.
    - Awarded Navy Achievement Medal for leading flawless Disestablishment (downsizing) of squadron
    - Led 200 person Maintenance Department to 20% increase in flyable assets & increased Fully Mission Capable rate by 17%
    - Managed Training Readiness Program increase from 60% to 93%
- Naval Air Station Dallas, TX
  - Assistant Reserve Programs Director, Reserve Services Division Officer, Program Manager, Mobilization Officer.
    - Awarded Navy Achievement Medal for flawless Mobilization of 600 Selected Reservists recalled for Operation Desert Shield/Storm
    - Naval Air Station Dallas Junior Officer of the Year
    - Developed Mobilization Recall order writing and reporting program that reduced workload by 90%
- Fighter Squadron One Zero One, Virginia Beach, VA
  - F-14 Tomcat Navy Fighter Jet Student.
- Training Squadron Ten, Pensacola, Fl
  - Flight Instructor, Academic Standardization Officer, Ground Safety Officer, Maintenance Division Officer.
    - Responsible for exceeding 80 % Full Mission Capable, 10% above goal
    - Increased staff instructor qualifications from 30% to 94% reduced T-47 NATOPS training time by 20%
    - Academic Instructor of the Quarter, Flight Instructor of the Quarter
- Fighter Squadron One Sixty One, Yokosuka, Japan
  - Legal Officer, Maintenance Branch Officer.
    - Responsible for unparalleled 87% Weapons Systems Availability of the F-4 Phantom II
    - Responsible for" Outstanding" during Commander, Far-West Pacific Triennial Command Inspection
- Naval Flight Officer School, Pensacola, FL
  - Naval Flight Officer Student and F-4 Phantom II Navy Fighter Jet Student.

**Areas of Expertise:**

- Teaching
- E-learning
- Management
- Leadership
- Mobile learning (m-learning)
- Communities of practice
- Advanced distributed learning
- Job performance aids
- Project management
- Business development
- Knowledge management
- Game-based learning