Knowledge Area Module VII:
Teaching College Level Economics With Video Games

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Abstract

Video game-based learning can potentially influence learning in higher education in positive ways. This research tested whether adding a simulation game to a college level economics course improved student understanding and application of concepts, as measured by standardized tests. Significant elements included game participation, with a substantial improvement in test scores for students playing the video game Zapitalism. Female students posted the greatest improvements compared to their male counterparts through participation in the game. This research highlights the need for incorporation of experiential learning activities, such as game-based learning activities, into college economics curricula. It also shows ways to incorporate such learning activities despite the resistance to change typically found in higher education environments.

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INTRODUCTION

The technological revolution, in combination with new discoveries in learning theory, has led to a dramatic increase in technology-based instruction and use of computers in supporting traditional instruction. Black (2001, p. 6) found that a "… survey of AACSB member schools by A.J. Faria (1998) disclosed that 97.5% of respondents used at least one business simulation game in their business curriculum." while Doyle and Brown (2000, p. 331) report similar findings. Gee (2004, p. 66) and Walters and Coalter (1997, p. 170), among others, report that simulation games in particular are enjoying increased popularity in numerous educational programs. Doyle and Brown (2000, p. 331) and Walters and Coalter (1997, p. 172) all reported that simulation games are particularly effective teaching methods, especially for students who grew up with computers and computer-based learning. This effectiveness of teaching methodology is also true for general business curriculum, and more specialized majors, such as economics.

The rapidly changing face of our societal, business, and educational environments has led to the development of a number of theories related to change. As the focus of this research generated data which will hopefully impact social change in education, a general change theory based on the Theory to Practice Continuum model advanced by McNeal and Christy (2001, p. 3) was first considered, followed by three specific organizational change methods of analysis: cultural web theory, change kaleidoscope theory, and forcefield analysis theory.

This case study explained the effectiveness of the incorporation of a computer-based simulation game, *Zapitalism*, into a third-year economics course at DeVry

University in Washington, D.C. 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. All test questions came from the test bank that accompanied the students' text for the course, *Economics*, 7th edition, by Stephen L. Slavin, published by McGraw-Hill 2005. After courses were complete, testing data was obtained from the Academic Department. Ad hoc reports collected class unit numbers, test scores, and gender data while keeping the student identity anonymous. Knowing which class unit numbers used games and which did not enabled the data analysis of the test scores and genders.

In this study, the overall hypothesis was first presented, followed by a description of the context and setting of the particular research conducted here, including methodology. Theories related to change, video game-based learning, video products, and economic games are reviewed as found in current literature. Following the review of current literature, data from this study are analyzed, and then salient and significant elements and findings reported. Review of outcomes, with specific emphasis on how the findings of this study can lead to a positive social change in education, conclude the case study.

PROBLEM STATEMENT

Today's college students were brought up with more technology than their parents were. Sixty-three percent of parents with children under the age of 18 say that computer and video games are a positive addition to their children's lives (ESA, 2005). Over 40 percent of today's gamers are under the age of 18 while 92 percent of children ages 2-17 play video games (Walsh, Gentile, VanOverbeke, & Chasco, 2002). Simulation games are becoming more prominent in business instruction in the United States and abroad, with most business schools using at least one simulation exercise as part of their standard curriculum (Walters & Coalter, 1997, p. 170; Black 2001, p. 6). Such simulations are most effective when used to supplement lectures and other instruction methods. The knowledge students gain from lectures, reading, and other classroom learning affords them greater understanding of the game's deeper meanings, while the game playing reinforces and provides 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, p. 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."

Problem Statement

Because of the pervasive presence of technology while growing up, today's college level students learn differently than the way most college instructors learned while they were growing up without technology. Yet, not enough research has been conducted to convince much of the academic community to change how instruction and learning environments are designed for today's younger generation learners.

REVIEW OF CONTEXT AND SETTING

This study examined test scores from college students enrolled in ECON 312 Principles of Economics at DeVry University in Washington, D.C. Each test was created from standard test banks of questions that accompanied the test *Economics*, by Stephen L. Slavin. This was the text required for course, and all professors taught from it and required students to read it. Since the same text and set of test banks was used for all students, differences in scores could therefore be considered directly attributable to the game supplement, rather than differences in texts. In addition, students were drawn from a variety of professors and days and times of class meetings to minimize any potential grouping caused by such scheduling, for example, younger traditional day students versus older, non-traditional evening students. Such potential groupings were anticipated to affect scores due to areas such as previous business experience, and therefore minimized as much as possible. Students were also not allowed to self-select game-playing, as such would play both into potential grouping, with younger, traditional students more likely to self-select, and a potential skewing of scores towards students who had already developed an affinity for video game-based learning. On average, students played the game one to two hours every other week during their weekly four-hour class. As course length was eight weeks, this resulted in total playing time of four to eight hours per student participating.

Change theory in relation to individual learning was considered, with particular emphasis on the greater effectiveness of engaged learning in an experiential framework. Three systemic change theories were also employed in the development of outcomes from these results and their potential impact on a higher education organization: cultural

web, change kaleidoscope, and forcefield analysis. Cultural web theory examines how cultural forces within an organization and its constituents work to shape and guide change (Johnson & Scholes, 2002, p. 540). This was particularly relevant to social change considerations related to this study, as many of the forces resisting change are believed by the researcher to be cultural. Change kaleidoscope theory allows for consideration of a complex variable mix in planning and implementing change (Anon, 2002, p. 20). Forcefield analysis theory identifies factors for and against change, and is appropriate in considering if and how video games should be implemented in a higher education organization (Johnson & Scholes, 2002, p. 544).

This study analyzed the results of student text scores in relation to five research questions and accompanying hypothesis statements, with independent variables of group, gender, and grade, and score as a dependent variable. Group (game players versus non-game players) is the most noteworthy variable in that it will directly support or not support the overall hypothesis that video game supplements enhance scores. Gender is also considered, as there is a stereotypical assumption that males are more likely to both participate in and benefit from video game playing, even though games increasingly include female characters and women report similar enjoyment from games as do men (Rouse, 2001, p. 56). The view that women will avoid video games can be a resistive factor to incorporation of video games into college curriculum, and therefore affects the likelihood of change in such courses. It was, however, anticipated that males would derive slightly more benefit from game playing than females, primarily because research has shown men to be more likely to make significant commitment to game playing and

because they have a slightly increased exposure to game contexts and semiotic domains typical of video game environments (Rouse, 2001, p. 56).

The first question asked if students who used the game to supplement their classroom learning would score higher on the standardized test than those who did not. This was analyzed using a one-tailed *t* test for equality of means. The second and third questions and hypothesis considered whether gender played a role in scoring, considering male and female scores of those playing the game in the second hypothesis, and male and female scores of those not playing the game in the third hypothesis. Both of these were analyzed using a two-tailed *t* test for equality of means. The fourth and fifth questions and hypotheses considered male students who played and did not play the game, and female students who did and did not play the game, respectively. These two hypotheses both were analyzed using one-tailed *t* tests for equality of means.

Assumptions

The researcher brought several assumptions related to both theories of change and theories of learning to this study, which should be noted. First, it is believed that many in positions of authority in higher education are resistant to change because they have become comfortable in one certain teaching method (Prensky, 2000, p.342-347). They learned material using one method, and discount less "academic" instructional methods as opposed to how they learned. These professors and administrators often enjoy tenured positions, which make them less likely to feel obligated to explore new or innovative teaching options. It is the further opinion of this researcher that continuing to ignore the cultural forces changing both learning preferences among younger generations and

teaching options provided by technology renders higher education less effective than it could be (Prensky, 2000, p.342-347).

- Individual tests scores came from all ECON312 courses taught during the time of the study
- All test questions came from the same test bank that accompanied the common textbook
- All test scores came from the three DeVry University locations within the Washington, D.C. metropolitan area
- Students who participated in the game supplement were drawn from a variety of professors to minimize any skewing caused by differences in instructor method or effectiveness
- Students who participated in the game were also taken from a variety of days and times of class meeting to minimize any grouping caused by such scheduling, such as younger, traditional day students versus older, non-traditional evening students
- 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.

EXAMINATION OF ECONOMICS GAMES LITERATURE

The Case Study

Compared to such pedagogic methods as "the Socratic Method," the case study approach is comparatively new. Initially utilized in the fields of medicine and law, the case study began to grow in popularity as psychologists, sociologists and management theorists utilized it. Presently, in addition to the previous applications, the case study is widely employed as a teaching tool in the fields of education, ethics, and philosophy.

While the case study, as a research design, is defined somewhat differently by various researchers, there is strong consistent agreement present throughout the literature. This consistent thematic agreement is aptly captured by the following elements from various sources such as:

- Each case is considered in its own right, rather than as a sample from a population (Canada, 2005)
- Captures a unique contextual situation (Bromley, 1986, p. ix)
- In-depth, multifaceted investigation (Feagin, 1991, p. 2)
- One of the great advantages of the case study as a research design is its flexibility (Canada, 2005)
- "Move from tidy abstractions to messy reality" (Costanzo & Handelsman, 1998, p. 97)
- Have real-life scenarios at their heart (Gartland & Field, 2004, p. 30).
- Are often "problematic" in nature (Burian, 2001, p. 384)

- Uses many different research methods, such as surveys, in-depth interviews, ad hoc surveys of populations affected, administrative data analysis, key informant interviews (Canada, 2005).

In the quest of pinning down the essence of what a "case study" is, one researcher perhaps expressed it most succinctly when she indicated that, "as a formal research design, a case study is defined as a strategy for doing research which involves an empirical investigation of a particular contemporary phenomenon within its real life context using multiple sources of evidence." (Canada, 2005). The case study as a research method has been used for decades because of its ability to bring understanding to very complex organization issues. In particular, social scientists use case studies because the case study can express qualitative research in a contextual setting. However, critics believe the case study methodology to be flawed because, as most case studies are small, they offer no way to establish the validity and reliability of the data and findings. (Soy, 1996). The issue of qualitative and quantitative is likely at the heart of most claims of inferiority. Both Bromley and Al Talal squarely address and effectively refute assertions that the case study method is inherently not "scientific" as they affirm the method possesses each of the following:

1.) Reliability

2.) Generalizability

3.) Validity (Bromley, 1986, pp.107-113 ; Al Talal, 2002, p. 36)

Through focusing on case studies in psychology, Bromley copiously indicates the 'ingredients' in the recipe for a proper case study including the "six rules for a case study" and "ten procedural steps" in the construction of a proper study (Bromley, 1986,

pp.24-26). In advocating the case study as a method, Bromley indicates that is it particularly useful to provide global understanding of an issue, to reveal social structures, processes, and relationships and in situations in which there is a 'non-standard solution set" (Bromley, 1986, pp.14, 132 & 156).

Inherent in any methodology are the disadvantages of a particular course of action. Not to be unexpected, perhaps the chief weakness of the case study comes from the accusations of those who would argue that it is not "reliable" or "valid", preferring instead to take their stand with methods more quantifiable and statistically verifiable. To address this concern, Al Talal indicates that even surveys are a reflection of a particular time and place (Al Talal, 2002, p. 36). Regardless, case studies *are* more susceptible to such accusations of bias due to the simple fact that there are investigator effects such as stereotypes and personal bias (Costanzo & Handelman, 1998, p. 385; Bromley, 1956, pp. 243, 309; Burian, 2001, pp. 384-385).

Applications of the Case Study Method

Aside from the obvious fields of endeavor such as psychology, business, medicine and the social sciences in which case studies are already a large part of the curriculum, there are number of potential special circumstances for which the case study seems to be quite appropriate. One such application stems from the common problem of most universities in which some (typically lower-level undergraduate) classes have a great many students and only one instructor. Due to the inherent structural issues, a great many students are not fully engaged in the learning process. It was this problem that led Olorunnisola, et al to conduct experiments in which the interjection of case studies was among the chief dependent variables in an experiment designed to engage the students in

"active" vs. "passive" (lecture-based) learning. In this experiment, researchers concluded that, with the proper support system, the case study approach can be utilized to increase learning through the two key mechanisms of managing the expectation of learning and, secondly, increasing the 'engagement' and satisfaction with the learning process (Olorunnisola, et al 2003, pp. 192-193).

In an additional educational experiment, researchers examined the feelings of undergraduate students taking a "capstone"-type strategic management course. These types of courses typically pull disparate elements of a student's education together in one course that requires both problem-solving skills and the ability to think through ambiguous scenarios. As aptly expressed by Gartland & Field, such a course is an example of one "…used to conceptualize knowledge that students typically receive in a linear, fragmented way through separate courses…" (Gartland & Field 2004, p. 30). In summary, the investigation conducted by Rippen, et al concluded that, to be effective, the case study must have the proper support elements. For example, a long and complex case with little guidance is likely to be ineffective, at best. Also notable is that case studies such as those that are designed to elicit critical thinking skills can frustrate students without the proper support system especially those who may be accustomed to 'bounded thinking' as much as studies with the proper support can be a crucial part of their education (Rippin, et al 2002, pp. 438-440).

What the Future Holds

The case study is still largely thought of a hard copy, paper product in the today's digital world. Part of the continuing success of the case study is that though *what* it is and does has not changed though other aspects have changed (Shinn, 2004, p.30). For

example, the case study is adaptable to multiple issues and in different fields of study. Though 100 years ago, the case study was utilized, the issues that were relevant have likely changed. In addition, the delivery systems have changed. Though most case studies are probably printed, it may not be. Rather, the case may be delivered electronically and printed by the user (Shinn, 2004, p. 32).

In short, the case study appears to be here to stay. It is still the stalwart of such a luminary institution as the Harvard Graduate School of Business in which the case study method is the sole method of instruction. At other business schools, it occupies ¼ to ½ of the curriculum. The case method is the essence on the clinical component of medical training. Additionally, it is perhaps the dominant method for teaching ethics as it is ideally suited to teaching moral development, generalization, and theorization (Gathard & Field, 2004, p. 32; Feagin 1991, p. 13). In conclusion, it is in such seemingly self-evident statement, "we learn how to learn as we learn" as that in Costanzo & Handelsman that illustrate the enduring value of the case study method (Costanzo & Handelsman, 1998, p. 399).

This Case

This case study considered the impact of using a video game about economics on student learning. As such, a number of related areas of literature were relevant. Parochial "tell-test" models of learning are still prevalent in most school systems (Prensky, 2000, p. 342-347). Transitioning to using video games as learning tools will be a large change in the way students are taught. Consequently, a consideration of change theory, and how change is implemented in an organization related directly to why some professors employ video game supplements and others do not. It also addressed the

potential social change in education that may be recommended based on findings of this study. Learning theory helps to predict why the overall hypothesis was developed and explain the rationale of employing video game supplements. It also addressed change theory as it related to individual learning. Considering video game-based learning further defined this area, as did a review of games specifically targeted at economics content and learning.

Change Theory

Changes related to individual learning are addressed in the next section of this examination of literature, covering learning theory. McNeal and Christy's (2001, p. 4) Theory to Practice Continuum idea asserts that school improvement needs to begin at a localized level, as it will be more greatly supported and more effective to actual school issues. Individual instructors embrace specific, effective theories and apply them in their daily practice (McNeal & Christy, 2001, p. 4). These effective practices are then recognized by administration and other instructors, who also employ the specific theories (McNeal & Christy 2001, p. 4). These events then not only provide support for widespread approval and adoption of the theory into the educational system, but also contribute to continued theory refinement and improvement (McNeal & Christy, 2001, p. 4).

For this to occur, however, organizations and the environments within which they operate must have certain factors that allow for or facilitate change (McNeal & Christy, 2001, p. 4). These are typically evaluated using one or more commonly accepted strategic change models (McNeal & Christy, 2001, p. 4). Three specific change models, all of which have particular impact on higher education, are considered in this literature

examination: cultural web theory, change kaleidoscope theory, and forcefield analysis theory.

Cultural web theory examines social and cultural contexts for change within a specific organization or sector (Johnson & Scholes, 2002, p. 540). For example, some organizations culturally support a more open exchange of ideas, where individuals of various rank and power base are free to make suggestions or implement individual change (Johnson & Scholes, 2002, p. 543). Other organizations may only accept or encourage suggestions or allow individual change from those players with established seniority or power (Johnson & Scholes, 2002, p. 540). For example, in an academic context where tenure is available, this may mean tenured faculty have the option to initiate change along the Theory to Practice Continuum, but junior or adjunct instructors do not.

Cultural web theory also considers the wider social factors influencing change at an organization (Johnson & Scholes, 2002, p. 541). For example, in some countries age is much more highly revered than in the US. Cultural web would predict that in these cultures it is easier and considered more appropriate for older persons to suggest or initiate change than younger persons.

Change kaleidoscope theory incorporates eight change contexts: scope, time, power, capacity, readiness, capability, uniformity, and preservation (Anon, 2002, p. 20). The first four contexts are typical considerations, and commonly considered by organizations contemplating change (Anon, 2002, p. 20). How large or small the change will be, how quickly it need be implemented, the power of leadership to impose change,

and the capacity as far as financial and other resources to successfully see the change through are usual considerations (Anon, 2002, p. 20).

The readiness of those in the organization to accept change includes awareness on the part of all major players that change is needed and of the type of change employed, and a corresponding commitment to the change (Anon, 2002, p. 20). As discussed in cultural web theory, lack of awareness and commitment to change on the part of key personnel or departments can undermine successful implementation (Johnson & Scholes, 2002, p. 540). This is something often overlooked, and a major factor in entities such as higher education organizations, where the faculty responsible for implementing change in the classroom are often seen as distinct from the administration in charge of systemic issues (Johnson & Scholes, 2002, p. 540).

Capability considers the ability of leadership to implement change, something some leaders never consider, and should be a factor in time planning for change (Anon, 2002, p. 20). Uniformity of how the change efforts apply to everyone is particularly important in organizations that are diverse, as the change may not be viewed or implemented homogenically across the organization (Anon, 2002, p. 20). A final consideration, preservation, deals with the current operations of the organization, and how they will survive the change (Anon, 2002, p. 20). In higher education, for example, where many faculty have certain areas of interest or projects of particular importance to them, how such areas or projects will be preserved is an important consideration.

Forcefield analysis theory identifies factors that push for and resist change in an organization, important considerations in planning and implementation (Johnson & Scholes, 2002, p. 544). It considers contexts identified by cultural web or change

kaleidoscope, and maps them as pushing, neutral, or resisting forces (Johnson & Scholes, 2002, p. 544). This allows pushing forces to be properly managed and directed, sometimes slowed if necessary and resisting forces to be addressed both individually and systemically (Johnson & Scholes, 2002, p. 544). For example, student preference for experiential learning might be a pushing factor, as students will often recommend certain instructors to each other. Courses taught by these instructors' then fill first, while other instructors' courses are left too undersubscribed to run. This would be a pushing factor, as it would put pressure on both administration and the specific faculty whose courses were undersubscribed to change. Tenured faculty who approach experiential learning additions to their classroom negatively, with a "but we've always done it this way" attitude, would be an example of a resisting factor. If these personnel are of critical mass in a department, change is unlikely. Similarly, change often requires additional expenditure, which may be an example of a resisting factor in many institutions.

Developing a realistic plan for implementing change in an educational environment, particularly a higher education environment, can therefore be quite complex. Cultural and organizational contexts must be identified and defined, with the impact of each on implementation of the proposed change thoroughly considered (Johnson & Scholes, 2002, p. 539). Addressing individual contexts in an appropriate and effective manner can then be undertaken (Johnson & Scholes, 2002, p. 540).

Learning Theory

There are a number of different important considerations when reviewing the effects of video game supplements in a college economics course. First, not everyone has the same learning preferences. Games, therefore, offer an opportunity for a wider variety

of learning experience and a greater chance that the student will find some part of the course geared to their particular learning style (Baruch 2004, p. 2). If a student can implement changes to their own learning practices and see results in increased effectiveness, this in itself is a potent learning experience (Baruch, 2004, p. 1). This can enhance the student's future academic, vocational, and recreational pursuits (Baruch, 2004, p. 1).

Learning theorists such as Gardner (1991, p. 7) indicate that different people learn in different ways. While different learning styles can be grouped into as many as twelve different categories, historically learning has been divided into three primary learning preferences (Gardner 1991, p. 8; Baruch, 2004, p. 2). Some people learn by hearing or reading words (Baruch, 2004, p. 4). The Baruch Group (2004, p. 4) explains that this means their brains process information in the form of words, making it easy for them to read, memorize, and respond to word-based teaching methods such as classroom lectures and textbooks. Baruch (2004, p. 4) estimates that over half the population thinks in this way, and points out that most educational institutions gear their instruction for this type of learner.

Baruch (2004, p. 6) continues that other learners are primarily visual, and learn by seeing, remembering, and understanding pictures or visual images. Their brains process information in the form of such images, and while that makes lectures and textbook reading more laborious for them, recent changes to make learning materials more visual and increased emphasis on visual aids in teaching have greatly improved their access to typical educational instruction (Baruch, 2004, p. 6). The Baruch Group (2004, p. 6) estimates that about a third of the population are visual learners. The third category

established by researchers at Baruch (2004, p. 8) are tactile / kinesthetic learners. These students learn by movement or by doing, and because their brains process information by experience, they have the most difficulty in a typical classroom environment (Baruch, 2004, p. 8). They comprise less than a quarter of the typical population (Baruch, 2004, p. 8). All learning groups are found to benefit from experiential learning, but it in particular provides additional access for students with visual or tactile / kinesthetic learning preferences (Baruch, 2004, p. 2).

Black (2001, p. 7) points out that today's traditionally aged students have grown up with computers, and the majority of adults in higher business education either have a computer at work, at home, or both. All these students have had to learn to use the computer, and therefore have at least some of the skills and learning necessary to engage in various computer applications, including games (Black, 2001, p. 7). Gee (2004, p. 8) found that students who regularly used computers in their lives developed a strong preference for active or experiential learning. Gee (2004, p. 8) continues that in this instructional method, students engage in real-life or simulated real-life activities, and "experience" learning outcomes, rather than being simply asked to memorize and repeat information abstract from their lives. Prensky (2000, p. 58) similarly reports that the students of today, who he calls the "game generation" are bored without opportunities for active learning. Because they have grown up with computers, this age group is used to being active learners and strongly prefers such instruction (Prensky, 2000, p. 58).

Haywood, McMullen and Wygal (2004, p. 90) conclude from their study in educational psychology that students experience both better learning and retention in active learning situations, while Anselmi and Frankel (2004, p. 169) similarly conclude

that emphasizing learning rather than teaching, as found in active learning situations, is significantly more effective. Barab, Barnett and Squire (2002, p. 532) report learning preferences in formal education are moving towards a more active learning foundation, and that students now expect active learning opportunities as part of their educational experience. They continue that such students are not willing to simply be exposed to passive learning, but will expect and seek out opportunities to learn for themselves (Barab, Barnett & Squire, 2002, p. 533).

The alternative to active learning is passive learning. In this type of classroom, the instructor has the answers or knowledge and provides them to the students, instead of the students discovering things themselves (Anselmi & Frankel, 2004, p. 169). The instructor tells students what they are supposed to learn, rather than encouraging them to discuss or work through situations and problems (Prensky, 2000, p. 145). Prensky (2000, p. 145) believes this bores the "game generation" and detracts from their learning. Brawer (1997, p. 3) Black (2001, p. 4) and Beck and Wade (2005, p. 49) all report that business programs in higher education continue to teach primarily from a passive learning standpoint, and are therefore less effective than they should be. Anselmi and Frankel (2004, p. 169), after reviewing a number of studies and reports, find that college professors typically spend too much time using passive teaching methods and not enough time to encouraging critical thinking and application of what they are learning. This both shortchanges the student and leaves them less prepared for their eventual careers. Barab et al (2001, p. 52) and Haywood, McMullen and Wygal (2004, p. 88) all find that students simply learn to repeat back what they are told, or to memorize the "correct" answer, rather than develop the skills that will prepare them for the future.

Prensky (2000, p. 162) argues that in contrast, game-based learning allows students to both learn actively and to place their new understanding and knowledge in the legitimate context of their own experiences. He further argues that games give students an opportunity to make decisions, take meaningful actions because of their decisions, and then experience the results. This both builds critical thinking and problem-solving skills and gives students a greater understanding of material (Prensky, 2000, p. 162). Anselmi and Frankel (2004, p. 169) continue in this vein, that the type of problem-solving and decision-making opportunities students experience in video games allows them to both conceptualize the deeper meanings in the subjects they are studying and to apply these concepts to new and more complex situations.

Video Game-Based Learning

The larger majority of computer-based economics teaching tools are computer-based teaching (CBT) rather than game-based products. CBT products provide content, typically presented in print or in a "talking head" format, followed by multiple-choice questions for reinforcement (Black 2001, p. 4). For example, a CD accompanying a typical economics text might present the concept of equilibrium in a manner similar to the presentation in the original text, and then ask students to repeat back the concept in the form of a correct answer. More involved CBT accompaniments might ask students to calculate equilibrium, and again respond by choosing the correct multiple-choice answer. Typically, when a student achieves a certain percentage of correct answers, he or she progresses to the next content area (Black, 2004, p. 4). This learning is passive, as opposed to experiential.

A game-based supplement is usually a simulation game of some kind. Video games as learning tools have become particularly more recognized and popular with the increase of computers in public schools and private homes (King 2002, p. 14). Many of these educational games are based on simulation, where an environment is replicated and players build a company or make similar real-life decisions to reach a predetermined goal (King, 2002, p. 15). In contrast with the CBT type of computer product described above, a simulation game asks the player to make real-life choices, and then allows him or her to experience the consequences (Black, 2001, p. 5). For example, a student may be asked to make a decision whether to increase, decrease, or maintain supply levels based on certain economic conditions existing in the game world environment. He or she then must deal with whatever ramifications occur because of this decision. The student "experiences" the results of changing supply, and therefore learns through doing about the effect of supply on equilibrium in a realistic market environment. As the student can also often play a game from one position, then replay the game as another, the student has the opportunity to experience a situation from multiple identities (LoPiccolo, 2005, p. 4). Gee (2004, p. 120) finds this idea of identity, where a student could imagine him or herself as a successful business executive or political leader, as strongly contributing to learning.

Haywood, McMullen and Wygal (2004, p. 92) note business courses at the college level often expose students to a large amount of content without providing opportunity for application. As many learning theorists are increasingly stressing the importance of context in learning, this area needs to be addressed in higher education (Anselmi & Frankel, 2004, p. 169; Haywood, McMullen & Wygal 2004; p. 90). Gee

(2004, p. 8) finds that students' past work experiences, background, culture, and many other factors influence their understanding and the amount of material they are able to comprehend. He continues that each of us operate from a semiotic domain that encompasses the values, restrictions, and goals of our environments (Gee, 2004, p. 24). Video games create their own semiotic domains, with commonalities similar to a real-life environment, such as values, restrictions (rules), and goals (Gee, 2004, p. 24). Players in a video game must learn the domain of the game to play it effectively (Gee, 2004, p. 25). Otherwise, players will be limited and unable to play the game to their full potential (Gee, 2004, p. 25).

Video business games are one effective way to provide both context and application experiences (Haywood, McMullen & Wygal 2004, p. 93). Students learn and assimilate to a domain that is similar to what they would experience in real life, providing them with invaluable learning opportunity (Gee, 2004, p. 25). For example, instead of just learning theoretically about what happens when a country simply increases its money supply to cover national debt payments, students can experience all the ramifications of such a course of action in a game. Both Walters and Coalter (1997, p. 172) and Doyle and Brown (2000, p. 331) point out that this not only increases the students' understanding of the complexities of what they are learning, but increases the likelihood that they will bring this new-found knowledge back to the classroom, potentially contributing significantly to classroom discussions and other activities.

In addition, Gee (2004, p. 29) reports that once students have become indoctrinated into a business game domain, their understandings of that environment influence both their future understanding of and conclusions about related topics and

material. It functions in an almost cyclical pattern, with the student or player becoming more fully indoctrinated into the game domain, and this in turn causing various responses to become commonplace, and these responses further influencing their interactions in the domain (Gee, 2004, p. 29). Gee (2004, p. 29) continues that in this way video games provide experience to students that are very much like the experience they would receive in real-world work experience, but without the risks. In the real world, if the student makes a mistake it can cost their company significant amounts of money, reputation, sales, and other negative consequences. If the student makes a mistake playing a simulation game, they only impact their game (Beck & Wade, 2005, p. 49).

Video game-based learning also improves students' engagement in and retention of their learning experiences. Gee (2004, p. 67) describes engagement as committed learning. Engagement is a term that refers to how interested in and committed to learning a student is regarding a particular method or body of knowledge (Gee, 2004, p. 67). Since the student is committed and interested, Gee (2004, p. 67) continues that the student is therefore likely to put in "lots of effort and practice" into learning when they are engaged, and that they therefore learn significantly more than if they are not engaged. Prensky (2000, p. 147) asserts that in terms of video games, most students find the games fun and entertaining, particularly when compared to a traditional classroom lecture or reading a text. He continues that because they do, they are likely to spend a lot of time learning the game domain, practicing their skills, and working to learn even more about the game content (Prensky, 2000, p. 150). This increased effort, not surprisingly, leads to increased learning (Gee, 2004, p. 67).

Video games also typically change each time a student plays (Prensky, 2000, p. 147). For example, if the player makes a decision to increase the asking price for a particular product in a business simulation game, this decision effects the rest of the game, such as how many of a product he or she can then sell, and the later economic health of their virtual company. This keeps learning fresh and provides continued increased engagement, further motivating the player to commit to and practice the game (Gee, 2004, p. 62; Prensky, 2000, p. 150). According to Gee's (2004, p. 62) concept of semiotic domains, because a game's progression and outcome will change with each decision or action by a player, the player is both empowered and motivated as a learner. Not surprisingly, this further encourages students playing an economics or similar simulation game to explore and internalize both the content and principles on which the game is based, in the case of an economics game the real business and political world (Prensky, 2000, p. 147).

Hoffjan (2005, p. 63) and Haywood, McMullen and Wygal (2004, p. 90) all find that simulation games stimulate the students that play them and lead to both increased interest in the subject matter outside the game limitations and increased participation in other classroom activities, such as discussion. Both studies indicate that students will invest more preparation time before class on days when they knew games would be part of the day's activities than on days when they anticipated lectures or other passive instructional methods. For example, if a student knows he or she will be playing a game in class, they are more likely to find the information they will need to play successfully from their text or other sources and bring this to class, rather than waiting to do such studying or research only for an exam (Hoffjan, 2005, p. 63). All of this contributes to

increased learning for the student, and supports the overall hypothesis of this study that students who play an economics video game in addition to their regular coursework will experience greater and more effective learning.

Engaged students will also retain what they have learned from their experience longer than students who simply memorize information for an exam. Clements and Sarama (2004, p. 34) report that retention increases with both exposure and opportunity for application. They conclude that students who are highly engaged in decision-making learning, particularly that which requires them to abstractly consider new situations rather than simply repeat a method over and over, can remember and use their learned knowledge more effectively. Pape, Bell and Yetkin (2003, p. 191), in a study of students using game-based learning to master mathematical skills, similarly find that engaged learners, who reinforce the content they are trying to learn through a number of different avenues, memorize and retain information and methods more effectively. They continue that this in particularly true when at least one of the learning avenues employed requires critical thinking skills, where the student must make decisions or apply what he or she has memorized. Pape, Bell and Yetkin (2003, p. 191) report that students who are allowed or encouraged to memorize without critical thinking reinforcement are often unable to either recall or apply their "knowledge" when faced with a situation significantly dissimilar from the examples to which they have been exposed. McClatchey and Kuhlemeyer (2000, p. 208) reported that a number of studies regarding such retention all come to the finding that most students retain more with increased engagement and opportunity for application.

In relation to an economics course, many students have difficulty grasping the many and varied factors that play into a typical economic decision. For example, simply being presented with a list of factors that influence a change in interest rate is unlikely to lead them to a solid understanding of the concepts behind such decisions. Playing a game, where students can both be repeatedly exposed to the relevant factors and experience first-hand their impacts is a much more potent learning experience.

Economics Video Products

There is a wide variety of video games with 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 considered here, as 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 Airport Tycoon 3, Health and Fitness Club Tycoon, Lemonade Tycoon 2, Mall of America Tycoon, Prison Tycoon, Railroad Tycoon 3, Roller Coaster Tycoon 3, School Tycoon, Seaworld Adventure Park Tycoon 2, Starship Tycoon, Tabloid Tycoon, Tycoon City: New York, Zoo Tycoon 2 (Poole, 2000, p. 86). 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, p. 86). 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 must additionally

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" (Gamespy, 2005).

Zapitalism is another excellent example of a game where a specific business is simulated (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, 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 and 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 environmental aspects are fixed, such as the overall state of the economy, interest rates, and the like, but these must be analyzed and considered when making decisions (Gamespy, 2005). This category of economic video game provides excellent experiential learning for students studying either general business or some microform 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 involved building an entire country or city, such as ancient Rome (Poole, 2000, p. 86). 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.

A game 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. It 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 are forced to make 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 are expected 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 to teach various economics, business, and logistical concepts, and to educate players to 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 only allow 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).

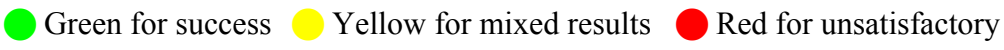
This research employs the game Zapitalism, mentioned above, as it is relevant to the career aspirations of many college students and works well within their current contextual understandings. The researcher believes that most business and economic students, particularly by their third year in college, have some general understanding of retail stores and investments in vehicles such as the stock market as dealt with in the game through personal life experience. This allowed students to move more quickly onto

domain integration of economic issues, rather than spending a lot of time assimilating to a game environment far removed from their real-world experiences.

Evaluation And Selection Of The Game

ECON 312 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. Microeconomic concepts, such as supply and demand serve as foundations for analyzing macroeconomic issues. Macroeconomic topics include gross domestic product (GDP), fiscal and monetary policies, and international topics such as global trade and exchange rates. The course also shows how human behavior and decision making translate into observable economic-system measures of performance. Emphasis is placed on interpreting economic variables and events, using fundamental analytical methods, and applying these to real-world issues.

Choosing a commercial off the shelf game as a teaching supplement is a simple, yet time-consuming process. The instructor must play the game to see how well, or not, the terminal course objectives are covered by the game. Inserting the Terminal Course Objectives from the ECON 312 learning objectives into the Game-Based Learning Taxonomy developed in KAM V yields the game type most appropriate to choose for a learning environment. Table 1 provides a summary evaluation of *Zapitalism*. Table 1 uses the Stoplight Scoring System widely used in both government and private sector organizations. The scorecard employs a simple grading system common today in well run businesses:



Given the results shown in Table 1 (next page), Zapitalism covers 10 of the 12 Terminal Course Objectives during game play. From the Lavamind (2005) website:

> Zapitalism combines beautifully rendered 3D graphic images with multi-player functionality in a game of business strategy. You will be able to make deals with the eccentric inhabitants of Zapinalia, invest in stocks & bonds, corner the market, and construct mega stores. You can also venture out to explore the islands of Mermadan in search of treasure and mysterious relics. The first player to build a retail empire and outwit the competition wins. You can even play-by-email over the Internet with up to six players!

Table 1
Zapitalism Evaluation to Teach ECON 312

Terminal Course Objectives	Evaluation
1. Given the basic economic problem of scarcity, compare and contrast the ways in which the economic systems of capitalism and socialism answer the three fundamental economic questions of what to produce, how to produce, and for whom to produce.	
2. Given a supply schedule, a demand schedule, and a change in one or more determinants of supply and demand, graph the supply and demand curves and illustrate the resulting change in the equilibrium price and quantity.	
3. Given the costs and production possibility curves for two products in a firm, analyze how the demand function under (a) perfect competition and (b) monopoly will each drive a different approach for maximizing profit.	
4. Given current National Income accounts data, calculate the Gross Domestic Product using both income and expenditure methods used by the U.S. Commerce Department.	
5. Given aggregate demand and supply curves, and a change in one of the determinants of aggregate demand and supply, evaluate the possibilities of inflation or recession in the given circumstances.	
6. Given a change in government purchases (G) or net taxes (T), and the Marginal Propensity to Consume (MPC) of the economy, analyze the effects of these fiscal policies on equilibrium real GDP.	
7. Given the assets and liabilities of a bank and the required reserve ratio, calculate the maximum potential of the banking system to create deposits, assuming no leakages from the banking system.	
8. Given hypothetical production possibilities curves for two countries, the only two products that can be produced in each country, and the exchange ratio, graphically demonstrate how both countries would be better off from specialization and trade.	
9. Given a market for a specific currency, a specified exchange-rate system, a time horizon, and a change in one of the determinants of exchange rates, determine the effects of the change on the value of the currency and the country's balance of payments.	
10. Given a need to make and defend a decision based on economic factors only, develop a rational approach for legitimizing both social issues and political agendas as part of a statement announcing this decision.	
11. Given historical data on the rates of inflation, unemployment, and interest, compare the actual versus the expected (theoretical) relationships between these three indicators by associating each pair of relationships with current governmental policies being exercised in both America and one foreign country.	
12. Given any of several well-established economic principles (e.g., lowering price increases demand, reducing taxes stimulates the economy, competition leads to higher innovation, etc.), indicate (in the simplest terms possible) the circumstances under which the expected results might be opposite to what is actually observed.	

EXAMINATION OF TRANSACTIONS, PROCESSES, AND ANALYSIS

Because of the type of data produced from student tests, and to test the effectiveness of the game supplement, Means tests, *t* tests, and Chi-squared tests were performed. Data from this research was analyzed and results were obtained using Microsoft Excel. As *t* tests for equality of means were used, an approximately normal distribution in scores was anticipated and equal standard deviations assumed. These tests were based on different pairs of sample data as laid out in the five questions and accompanying hypothesis previously described.

Descriptive Statistics

Table 2
Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
w/o Game Scores	234	0	100	77.86	27.016
w/Game Scores	322	65	100	94.81	9.011
w/o Game: Male Scores	161	0	100	78.65	26.782
w/o Game: Female Scores	73	0	100	76.12	27.631
w/Game: Male Scores	189	65	100	94.07	9.306
w/Game: Female Scores	133	66	100	95.85	8.500

Hypothesis 1: Game Versus No Game Means

The first question considered whether mean scores would be higher among students who played the game than those who did not. A null and alternative hypothesis was considered:

Null Hypothesis: $H_0\ \mu_1 \geq \mu_2$

> The average test scores among students who did not play is greater than or equal to the average score of those who did play where $\mu 1$ is the mean test score for the group of students without game use and μ_2 is the mean test score for the group of students with game use.

Alternate Hypothesis: (H_1 $\mu_1 < \mu_2$)

> The average test scores among students who did play is greater than the average test scores among the students who did not play where μ_1 is the mean test score for the group of students without game use and μ_2 is the mean test score for the group of students with game use.

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 (Scores w/o Game = μ_1) was compared to the set of test scores from students who did use the game (Scores w/Game = μ_2).

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 eqauality of the means
4. Decision criterion: Reject H_0 and accept H_1 if p-value < .05
5. P calculation = 3.99E-18 (one-tail is ½ of two-tail Sig. ½ of 3.99E-18 is 1.995E-18)
6. Conclusion: Based on the results of this sample and analysis, there appeared was a significant difference between the two means. Adopt the research hypothesis. Results of analysis are located in Table 3:

Table 3
One-tail *t* test

t-test: Hypothesis 1	*Scores w/o Game*	*Scores w/Game*
Mean	77.85897	94.80745
Variance	729.8556	81.19646
Observations	234	322
df	271	
t Stat	-9.23078	
P (T<=t) one-tail	3.99E-18	
t Critical one-tail	1.650496	
As Sig. < .05, reject H_0		

The mean score was significantly higher for those who played the game, approximately 95 compared to 78, and *Significance* value is substantially less than five percent (.05). The null hypothesis was rejected, and the alternate was accepted. The

average test scores among students who did play were greater than the average test scores among the students who did not play the game.

Hypothesis 2: Male Versus Female Means With Game

The second question considered whether mean scores would be different between male and female students who participated in the supplemental game. A null and alternative possible hypothesis was considered:

Null Hypothesis: H_0 $\mu_1 = \mu_2$

> There is no difference between the average test scores between male and female students who received supplemental play where μ_1 is the mean test score for the male students with game use and μ_2 is the mean test score for the female students with game use.

Alternate Hypothesis: H_1 $\mu_1 \neq \mu_2$.

> There is a difference between the average test scores between male and female students who received supplemental play where μ_1 is the mean test score for the male students with game use and μ_2 is the mean test score for the female students with game use.

A two-tailed *t* test was used in analysis, allowing for consideration of both ends of the sampling distribution as set for the critical region. The set of test scores from those Male students who did use the game (Male w/Game = μ_1) was compared to the set of test scores from Female students who did use the game (Female w/Game = μ_2).

1. Hypothesis:
   H_0 $\mu_1 = \mu_2$
   H_1 $\mu_1 \neq \mu_2$
2. $\alpha = .05$
3. Test statistic: *t* statistic for a two-tail *t* test eqauality of the means
4. Decision criterion: Reject H_0 and accept H_1 if p-value < .05
5. P value = .081679

6. Conclusion: Based on the results of this sample and analysis, there was no significant difference between the two means, adopt the null hypothesis. Results of analysis are located in Table 4:

Table 4
Two-tail *t* test for Equality of the Means

t-Test: Hypothesis 2	*Male w/Game*	*Female w/Game*
Mean	94.07407	95.84962
Variance	86.60087	72.24994
Observations	189	133
Pooled Variance	80.68111	
df	320	
t Stat	-1.74653	
P (T<=t) two-tail	0.081679	
t Critical two-tail	1.967405	
As Sig. > .05, adopt H_0		

This comparison of equality of means showed a *Significance* value more than five percent (.05). Therefore, the null hypothesis was accepted and the alternate was rejected. There was no significant difference between Male and Female students who did use the game.

Hypothesis 3: Male Versus Female Means Without Game

The third question considered whether mean scores were different among male and female students who did not participate in the supplemental game. A null and alternative possible hypothesis was considered:

Null Hypothesis: H_0 $\mu_1 = \mu_2$

> There is no difference between the average test scores between male and female students who did not receive supplemental play where μ_1 is the mean test score for the male students without game use and μ_2 is the mean test score for the female students without game use.

Alternate Hypothesis: H_1 $\mu_1 \neq \mu_2$

> There is a difference between the average test scores between male and female students who did not receive supplemental play where μ_1 is the

mean test score for the male students without game use and μ_2 is the mean test score for the female students without game use.

A two-tail *t* test was used in analysis, allowing for consideration of both ends of the sampling distribution as set for the critical region. The set of test scores from those Male students who did not use the game (Male w/o Game = μ_1) was compared to the set of test scores from Female students who did not use the game (Female w/o Game = μ_2).

1. Hypothesis:
   H_0 $\mu_1 = \mu_2$
   H_1 $\mu_1 \neq \mu_2$
2. $\alpha = .05$
3. Test statistic: *t* statistic for a two-tail *t* test eqauality of the means
4. Decision criterion: Reject H_0 and accept H_1 if p-value < .05
5. P value = .47970506
6. Conclusion: Based on the results of this sample and analysis, there was no significant difference between the two means, adopt the null hypothesis. Results of analysis are located in Table 6:

Table 5
Two-tail *t* test for Equality of the Means

t-Test: Hypothesis 3	*Male w/o Game*	*Female w/o Game*
Mean	78.5125	75.791667
Variance	718.905503	766.11092
Observations	160	72
df	230	
t Stat	0.70793072	
P (T<=t) two-tail	0.47970506	
t Critical two-tail	1.97033172	
As Sig. > .05, adopt Ho		

There was no statistically relevant difference between the average test scores between male and female students who did not receive supplemental play.

Hypothesis 4: Males With Game Versus Males Without Game

The fourth question considered whether mean scores would be different among male students who did and did not participate in the supplemental game. A null and alternative possible hypothesis was considered:

Null Hypothesis: H_0 $\mu_1 \geq \mu_2$

> The average test scores among males who did not play is greater than or equal to the average score of those males who did play where μ_1 is the mean test score for the group of students without game use and μ_2 is the mean test score for the group of students with game use.

Alternate Hypothesis: H_1 $\mu_1 < \mu_2$

> The average test scores among male students who did play is greater than the average test scores among the male students who did not play where μ_1 is the mean test score for the group of students without game use and μ_2 is the mean test score for the group of students with game use.

A one-tail t test was used in analysis, as emphasis was on higher scores representing one end of sampling distribution. The set of test scores from those Male students who did not use the game (Males w/o Game = μ_1) were compared to the set of test scores from Male students who did use the game (Males w/Game = μ_2).

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 eqauality of the means
4. Decision criterion: Reject H_0 and accept H_1 if p-value < .05
5. P value = 4.2007E-13 (one-tail is ½ of two-tail. ½ of 4.2007E-13 is 2.10035E-13)
6. Conclusion: Based on the results of this sample and analysis, there was significant difference between the two means. Adopt the research hypothesis: The average test scores among male students who did play was greater than the average test scores among the male students who did not play.
   Results of analysis are located in Table 8:

Table 6
One-tail *t* test

t-Test: Hypothesis 4	*Male w/Game*	*Male w/o Game*
Mean	94.0425532	78.5125
Variance	86.8751849	718.9055
Observations	188	160
Df	346	
t Stat	7.43308552	
P (T<=t) one-tail	4.2007E-13	
t Critical one-tail	1.64926947	
As Sig. < .05, reject Ho		

The mean score was significantly higher for those male students who played the game, approximately 94 compared to 79, and significance level is substantially less than five percent (.05). This caused the null hypothesis to be rejected, and the alternate to be accepted. The average test scores among male students who did play were greater than the average test scores among the male students who did not play the game.

Hypothesis 5: Females With Game Versus Females Without Game

The fifth question considered whether mean scores would be different among female students who did and did not participate in the supplemental game. A null and alternative possible hypothesis was considered:

Null Hypothesis: H_0 $\mu_1 \geq \mu_2$

> The average test scores among females who did not play is greater than or equal to the average score of those females who did play where μ_1 is the mean test score for the group of students without game use and μ_2 is the mean test score for the group of students with game use.

Alternate Hypothesis: H_1 $\mu_1 < \mu_2$

> The average test scores among female students who did play is greater than the average test scores among the female students who did not play

where μ_1 is the mean test score for the group of students without game use and μ_2 is the mean test score for the group of students with game use.

A one-tail t test was used in analysis, as emphasis was on higher scores representing one end of sampling distribution. The set of test scores from those Female students who did use the game (Female w/Game = μ_1) were compared to the set of test scores from Female students who did not use the game (Female w/o Game = μ_2).

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 eqauality of the means
4. Decision criterion: Reject H_0 and accept H_1 if p-value < .05
5. P value = 3.2677E-13 (one tail is ½ of two tail. ½ of 3.2677E-13 is 1.63385E-13)
6. Conclusion: Based on the results of this sample and analysis, there was a significant difference between the two means. Adopt the research hypothesis. Results of the analysis are located in Table 9:

Table 7
One-tail *t* test

t-Test: Hypothesis 5	*Female w/Game*	*Female w/o Game*
Mean	95.8181818	75.791667
Variance	72.6689799	766.11092
Observations	132	72
Df	202	
t Stat	7.68462819	
P (T<=t) one-tail	3.2677E-13	
t Critical one-tail	1.65243196	
As Sig. < .05, reject Ho		

The mean score was significantly higher for those female students who played the game, approximately 96 compared to 76, and significance level is substantially less than five percent (.05). This caused the null hypothesis to be rejected, and the alternate to be accepted. The average test scores among female students who did play were greater than the average test scores among the female students who did not play the game.

6. Grade Analysis

Grade analysis revealed similar significant percentage variation between game players and non-game players. For the purposes of such analysis, grade levels were divided using a 10-point scale, with an "A" grade ranging from 90 to 100, a "B" grade ranging from 80 to 89, a "C" grade ranging from 70 to 79, a "D" grade ranging from 60 to 69, and an "F" grade being any grades falling below 60 (0 to 59). Results of analysis are located in Table 10:

Table 8
Grade Analysis

Grade	w/o Game	Percent	w/Game	Percent
A	103	43.6%	268	82.7%
B	64	27.1%	32	9.9%
C	31	13.1%	22	6.8%
D	10	4.2%	1	0.3%
F	28	11.9%	1	0.3%
	236	100%	324	100%

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). Results of analysis are located in Table 11:

Table 9
Chi-Squared Test

	Expected Counts		Chi-squared calculations	
	Without Game	*With Game*	*Without Game*	*With Game*
A (90-100)	156.35	214.65	18.20417333	13.25982996
B (80-89)	40.45714	55.54286	13.70008071	9.979071135
C (70-79)	22.33571	30.66429	3.360978117	2.448119863
D (60-69)	4.635714	6.364286	6.207362976	4.521412538
F (0-59)	12.22143	16.77857	20.37104868	14.83817126

Calculated chi-squared = 106.89025
p-value = 3.34994E-22
degrees of freedom = (5-1) (2-1) = 4
Critical value at alpha = .01 is 13.2767
Critical value at alpha = .05 is 9.48773

1. Hypothesis:
   H_0 = The two groups are homogeneous
   H_1 = The groupings are different
2. $\alpha = .05$
3. Test statistic: Chi-Squared for Homogeneity
4. Decision criteria: Reject H_0 and accept H_1 if p-value < .05
5. Calculation: p-value = 3.34994E-22
6. Conclusion: The null hypothesis was that the "with" and "without" groups were distributed the same across the grade groupings. The alternative hypothesis was the groupings were different. Since the *Sig.* value is so very small, the null hypothesis was rejected.

There were several significant results revealed during research analysis. First, the overall hypothesis that using the economic simulation video game *Zapitalism* in the Principles of Economics curriculum at DeVry University would lead to significant improvement in standard test scores was borne out by research data. This proved true in consideration of scores in general, as well as when factoring in gender considerations. General analysis revealed a 17-percentage point improvement in mean scores for students who participated in the supplemental game. Breaking down data by gender, male students recorded a similar improvement, an increase in mean score of 15 percentage

points. Female students recorded an even greater improvement, with and increase in mean score of 20 percentage points. This translated into a 39 percent increase in "A" scores for students participating in the supplemental game, a 22 percent increase in "A" and "B" scores for students who played the game, and a 12 percent increase in overall passing scores (A, B, C, or D) for game participants. Table 10 is graphically represented in Figure 1 as another way to understand this analysis.

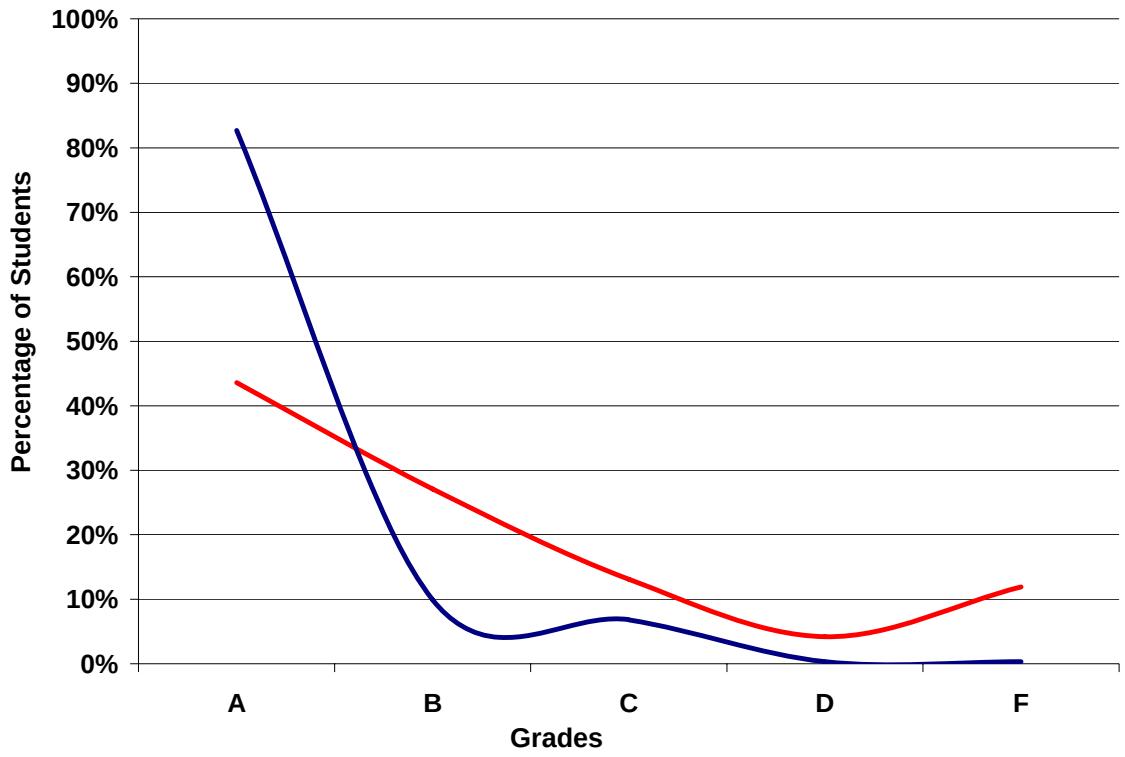


Figure 1: Grade Distribution

Additionally, there was a slight but not statistically relevant difference in scores related to gender. However, it was initially anticipated that since males have a higher propensity for engagement in video game playing, they would have greater benefit from the game supplement, as they would exhibit greater commitment and be more likely to be comfortable with typical video game semiotic domains. This did not prove to be the case when data was analyzed; instead, the opposite result was recorded. While this still

caused rejection of the null hypothesis, it was not for reasons anticipated in research planning. Although male students who did not participate in the game outscored female students who did not participate in the game by a mean score of two and a half points, with the game addition the pattern reversed. Of students who participated in *Zapitalism*, female students outscored male students by a mean score of just under two points. Comparing the two differences still did not reach the boundary of a statistically significant variance, but was still worthy of note.

STATEMENT OF SALIENT AND SIGNIFICANT ELEMENTS

The overall hypothesis of this case study, that using the economic simulation video game *Zapitalism*, by Lavamind, as a supplement to the ECON 312 Principles of Economics class at DeVry University in Washington, D.C., will increase standard test scores, is supported by analysis of research data. The following conclusions are accepted:

1. The average test scores among students who did play were greater than the average test scores among the students who did not play. (from Hypothesis 1)
2. The average test scores among male students who did play were greater than the average test scores among the male students who did not play. (from Hypothesis 4)
3. The average test scores among female students who did play were greater than the average test scores among the female students who did not play. (from Hypothesis 5)

Two secondary hypotheses were not supported by research data. First, there was no significant difference between the average test scores of male and female students who received supplemental play. Female students outscored male students with the addition of game playing activity. In addition, there was no significant difference between the average test scores of male and female students who did not receive supplemental play. Male students outscored female students with the addition of game playing activity. The following conclusions are accepted:

1. There was no significant difference between the average test scores of male and female students who received supplemental play. (from Hypothesis 2)
2. There was no significant difference between the average test scores of male and female students who did not receive supplemental play. (from Hypothesis 3)

Game participation was found to be by far the most significant element in score improvement.

Gender was found to be a minor and secondary element in score improvement, although not of statistical significance.

REVIEW OF OUTCOMES

Implementation of the outcomes of findings such as supported in this research has the potential to lead to a positive social change in higher education. The goal of education should be that students learn. When a supplement can dramatically increase recorded student learning with only four to eight hours of implementation, this is an important addition to the classroom.

Applying cultural web, change kaleidoscope, and forcefield analysis to incorporation of video games such as *Zapitalism* into the college economics curriculum at DeVry University, however, raised a number of professional issues and problems. Culturally, there are a number of tenured professors who are comfortable with their current instructional practices. They and less enthusiastic about video game playing, despite empirical evidence to support its benefits to student learning. In addition, some students are less receptive to game playing during class time when they have "paid money" to be instructed. This is another cultural issue to consider. Positive social and cultural contexts include the range of innovation allowed to individual instructors, and general support from administration for changes that can be documented to improve student success. The addition of *Zapitalism* as a required supplement to the economics curriculum must take faculty and student preferences into consideration.

Social Change

Further defining contexts through change kaleidoscope, the scope of the change does not need to be substantial. This research documents dramatic results with an addition of only four to eight 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. Leadership power and capability are certainly sufficient for this curriculum change, but a respect for preferences of tenured faculty and potential student complaints are again issues in this analysis. The University has the capacity to implement the change. The video game costs less than 10 dollars and a number of licenses have already been purchased. There was a time when this game was included with textbooks, but never used. If included again with the student purchased textbooks, widespread adoption would be easier after the results of this study are presented to administration leadership. 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.

Readiness is a more substantial area of consideration. Even with findings such as those from this research, there is not uniform awareness of the need to implement change either from a faculty or student perspective, and therefore commitment to change may be a concern. Uniformity does not raise concern; as if the change were adopted, it would be included in departmental guidelines for the course. Some faculty and students, however, may view traditional classroom instructional methods as a preservation issue, making them less supportive of the supplemental game.

This leads to context categorization through forcefield analysis. Pushing factors include strong documentation that *Zapitalism* improves student understanding of the material presented in their textbook. The relative inexpensiveness of the program 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 DeVry 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. Analysis strongly indicates, therefore, that resisting factors all center on the game being used during class, not its general addition to the curriculum. It will therefore be more effective to plan adding *Zapitalism* to the required course curriculum as an activity undertaken outside of class, with individual instructors given some latitude in how they will hold students accountable in game use, similar to the latitude they currently enjoy regarding homework and other activities that take place outside classroom time.

Based on this research, a suggestion has been made to make *Zapitalism* a regular part of the ECON 312 curriculum at DeVry University. 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 purchase the game to play at home, or use the game at one of the University's computer labs and save the cost of the game. This also frees faculty from any substantial changes to their course preparation.

Alternatively, implementation of the game as part of classroom activity could have been mandated by the department. However, moving from the perspective of the

Theory to Practice Continuum and given the cultural and readiness considerations identified above, this was deemed less effective.

It is the hope of this researcher that this study and its findings and outcomes will encourage other instructors to implement change within their own courses, leading to greater incorporation of experiential learning opportunities such as video game supplements throughout college-level education.

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APPENDIX A: RAW DATA

Independent Variables:

Group 1 = Game Played
2 = No Game Played

Gender 1 = Male
2 = Female

Grade 1 = A
2 = B
3 = C
4 = D
5 = F

Score	Group	Grade	Gender	w/o Game	w/Game	Male w/o Game	Female w/o Game	Male w/Game	Female w/Game
100	1	1	1	100	100	100	100	100	100
100	1	1	1	100	100	100	100	100	100
100	1	1	1	100	100	100	100	100	100
100	1	1	1	100	100	100	99	100	100
100	1	1	1	100	100	100	98	100	100
100	1	1	2	100	100	99	98	100	100
100	1	1	2	100	100	99	96	100	100
100	1	1	2	100	100	99	96	100	100
99	1	1	1	99	100	99	96	100	100
99	1	1	1	99	100	98	96	100	100
99	1	1	1	99	100	98	96	100	100
99	1	1	1	99	100	98	94	100	100
99	1	1	2	99	100	98	94	100	100
98	1	1	1	98	100	97	94	100	100
98	1	1	1	98	100	97	93	100	100
98	1	1	1	98	100	97	92	100	100
98	1	1	1	98	100	97	92	100	100
98	1	1	2	98	100	97	92	100	100
98	1	1	2	98	100	96	92	100	100
97	1	1	1	97	100	96	92	100	100
97	1	1	1	97	100	96	92	100	100
97	1	1	1	97	100	96	92	100	100
97	1	1	1	97	100	96	92	100	100
97	1	1	1	97	100	96	92	100	100
96	1	1	1	96	100	96	92	100	100
96	1	1	1	96	100	96	91	100	100
96	1	1	1	96	100	96	90	100	100

96	1	1	1	96	100	95	90	100	100
96	1	1	1	96	100	95	90	100	100
96	1	1	1	96	100	95	90	100	100
96	1	1	1	96	100	95	89	100	100
96	1	1	1	96	100	95	89	100	100
96	1	1	1	96	100	95	89	100	100
96	1	1	2	96	100	95	87	100	100
96	1	1	2	96	100	95	87	100	100
96	1	1	2	96	100	95	86	100	100
96	1	1	2	96	100	95	86	100	100
96	1	1	2	96	100	94	85	100	100
95	1	1	1	95	100	94	84	100	100
95	1	1	1	95	100	94	84	100	100
95	1	1	1	95	100	94	83	100	100
95	1	1	1	95	100	94	83	100	100
95	1	1	1	95	100	94	80	100	100
95	1	1	1	95	100	93	80	100	100
95	1	1	1	95	100	93	80	100	100
95	1	1	1	95	100	93	80	100	100
95	1	1	1	95	100	93	80	100	100
95	1	1	1	95	100	92	80	100	100
94	1	1	1	94	100	92	78	100	100
94	1	1	1	94	100	92	76	100	100
94	1	1	1	94	100	92	76	100	100
94	1	1	1	94	100	92	76	100	100
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94	1	1	1	94	100	92	75	100	100
94	1	1	2	94	100	92	75	100	100
94	1	1	2	94	100	92	74	100	100
94	1	1	2	94	100	92	73	100	100
93	1	1	1	93	100	92	72	100	100
93	1	1	1	93	100	92	72	100	100
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93	1	1	1	93	100	91	69	100	100
93	1	1	2	93	100	91	60	100	100
92	1	1	1	92	100	90	58	100	100
92	1	1	1	92	100	90	57	100	100
92	1	1	1	92	100	90	46	100	100
92	1	1	1	92	100	90	42	100	100
92	1	1	1	92	100	90	0	100	100
92	1	1	1	92	100	90	0	100	100
92	1	1	1	92	100	90	0	100	100
92	1	1	1	92	100	90	0	100	100
92	1	1	1	92	100	90	0	100	100
92	1	1	1	92	100	89	0	100	100
92	1	1	1	92	100	89	0	100	100

92	1	1	1	92	100	89	100	100
92	1	1	2	92	100	89	100	100
92	1	1	2	92	100	89	100	100
92	1	1	2	92	100	88	100	100
92	1	1	2	92	100	88	100	100
92	1	1	2	92	100	87	100	100
92	1	1	2	92	100	87	100	100
92	1	1	2	92	100	87	100	100
92	1	1	2	92	100	87	100	100
92	1	1	2	92	100	87	100	100
92	1	1	2	92	100	87	100	100
91	1	1	1	91	100	87	100	100
91	1	1	1	91	100	87	100	100
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87	1	2	1	87	100	82	100	90
87	1	2	1	87	100	82	100	90
87	1	2	1	87	100	82	100	90
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87	1	2	1	87	100	78	98	85

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87	1	2	2	87	100	77	98	80
86	1	2	1	86	100	76	97	80
86	1	2	1	86	100	76	96	80
86	1	2	1	86	100	76	95	80
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86	1	2	1	86	100	75	95	70
86	1	2	1	86	100	75	93	70
86	1	2	2	86	100	74	93	70
86	1	2	2	86	100	74	92	70
85	1	2	1	85	100	73	92	70
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84	1	2	2	84	100	68	90	
83	1	2	1	83	100	67	90	
83	1	2	1	83	100	67	90	
83	1	2	1	83	100	66	90	
83	1	2	1	83	100	66	90	
83	1	2	1	83	100	64	90	
83	1	2	2	83	100	64	90	
83	1	2	2	83	100	50	90	
82	1	2	1	82	100	50	90	
82	1	2	1	82	100	13	90	
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82	1	2	1	82	100	0	90	
82	1	2	1	82	100	0	90	
82	1	2	1	82	100	0	88	
82	1	2	1	82	100	0	88	
82	1	2	1	82	100	0	87	
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80	1	2	1	80	100	0	85	
80	1	2	1	80	100	0	85	
80	1	2	1	80	100	0	83	
80	1	2	2	80	100	0	83	
80	1	2	2	80	100	0	81	
80	1	2	2	80	100		80	
80	1	2	2	80	100		80	
80	1	2	2	80	100		80	
80	1	2	2	80	100		80	

78	1	3	1	78	100	80
78	1	3	1	78	100	80
78	1	3	2	78	100	80
77	1	3	1	77	100	80
77	1	3	1	77	100	80
76	1	3	1	76	100	80
76	1	3	1	76	100	80
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