

Knowledge Area Module VI:
Game-Based Learning for Teaching Business

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Abstract

A research study was undertaken at DeVry University in Washington D.C. to examine the effectiveness of adding a simulation game as a supplement to an Introduction to Business and Technology course. Approximately one-fifth of students participated in the game playing, drawn randomly across courses and instructors. This group of students produced scores significantly higher than the scores produced by the control group, indicating they developed a more thorough knowledge and understanding of the introductory business facts, practices, and concepts covered in the class and textbook. The use of the simulation game Industry Giant II can therefore be considered an appropriate and effective learning tool as a supplement for beginning business instruction, supporting the initial hypothesis that such games would be effective for introductory supplementation.

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CONTENTS

Abstract.....	2
List of Tables	5
INTRODUCTION	6
Hypothesis	7
EVALUATION AND SELECTION OF THE GAME	8
RESEARCH METHOD.....	11
Methodology.....	11
STATISTICAL ANALYSIS	12
Descriptive Statistics	13
Chi-Squared Test.....	13
ANOVA.....	14
RESULTS	16
SUMMARY, CONCLUSION, AND RECOMMENDATIONS.....	18
References.....	20
APPENDIX ONE – RAW TEST SCORE DATA SETS	21

List of Tables

Table 1 Industry Giant II Evaluation to Teach BUSN 115.....	10
Table 2 Grade Comparison Between Game and Without Game	12
Table 3 Description Statistics	13
Table 4 Chi-Squared Test	13
Table 5 ANOVA Test of Homogeneity of Variance	14

INTRODUCTION

Business and management 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).

This study examines the use of one such game, Industry Giant II, in the freshman business curriculum at DeVry University in Washington, D.C. Some classes at the university received game time with Industry Giant II (produced by JoWood Productions, www.ig2.jowood.com) as a supplemental reinforcement to traditional classroom instruction, while classes not participating in the game playing served as a control group. Students were tested at the end of their initial business course, Introduction to Business and Technology (BUSN115). Test questions were taken from the test bank that accompanies the textbook used in all classes, Understanding Business (Nickels, McHugh

& McHugh, 2004) so as to ensure all students had an opportunity to be exposed to test materials during their regular classroom experience.

Hypothesis

The researcher hypothesized that the use of the game will result in higher test scores among students who play as compared with students who do not receive such supplemental opportunity.

The Null Hypothesis (H_0) states: There is no difference between the average test scores among students who did and did not receive supplemental play with the Industry Giant II video game. $H_0 \mu_1 \geq \mu_2$ 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.

The Research Hypothesis (H_1) states: The test average test scores among students who did receive supplemental play with the Industry Giant II video game is higher than the average of the students who did not receive supplemental play with the Industry Giant II video game. $H_1 \mu_1 < \mu_2$ 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.

EVALUATION AND SELECTION OF THE GAME

BUSN 115 provides an introduction to business and the environments in which businesses operate. Students are introduced to the roles of the major functional areas of business and to the interrelationships among them. Organizational theories and techniques are examined, and economic, cultural, political, and technological factors affecting business organizations are evaluated.

Students become knowledgeable about the major features of our economic system, particularly as they are related to business. The roles of capitalism, free enterprise, and profit are essential to understanding business. Various motivations for being engaged in business, in addition to the wealth maximization incentive, also provide students with the ability to evaluate the decision making of those in business.

Students also become aware of the major functional areas of business, including, but not limited to, those represented as major programs at DeVry University. Students learn the concerns of each function, what decision making is like in each function, and what career paths are common in each. Students become aware of factors that constrain managers, such as the business environment, organizational culture, and lack of appropriate information for decision making. As the introductory business course in the Accounting, Business Administration (Business Information Systems and Business Operations), Computer Information Systems, and Telecommunications Management programs, BUSN 115 serves a triple role. The first is to provide students with the basic business skills and knowledge that they will need in later courses and in careers. The second is to enhance the development of the students' critical thinking skills, especially











within a business context. The third is to help them form appropriate connections to their peers, their program, their school, and the business community.

Inserting the Terminal Course Objectives from the BUSN 115 learning objectives into the Game-Based Learning Taxonomy developed in KAM V yields the game type most appropriate to choose for a learning environment. Since Industry Giant II fits the role-playing and simulation genres metered out by the taxonomy, the next step is to “play” the game to see all the learning nouns and verbs can be taught. Table 1 (on the next page) provides a summary evaluation. 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:

● Green for success ● Yellow for mixed results ● Red for unsatisfactory

Given the results shown in Table 1, Industry Giant II covers eight of the 10 Terminal Course Objectives during game play. Industry Giant II starts out in the year 1900 and introduces historically significant business happening as the game progresses such as new technology and new product discoveries or inventions. Information Technology and e-Commerce can be covered by the game, but it usually takes longer than the course semester to reach the 1990s where it comes into play. However, given that restraint, it is still a dynamic and engaging way to keep students learning.

Table 1
Industry Giant II Evaluation to Teach BUSN 115

Terminal Course Objectives	Evaluation
1. Given a description of a typical business, demonstrate how that business acts within our economic system to achieve its goals as well as those of society, along with an understanding of how the future may impact these goals.	
2. Given the importance of ethics in business, be able to understand and address ethical dilemmas that may occur in workplace activities and offer suggestions to prevent their recurrence.	
3. Given the need to increase profits through cost reductions, describe the use of globalization strategies to accomplish this initiative, along with a discussion of the pros and cons of this approach.	
4. Given understanding of entrepreneurship, be able to describe the major elements necessary for success, along with an understanding of the potential risks associated with starting a business venture.	
5. Given a need to identify additional sources of revenue, be able to discuss the importance of the Internet to achieve this goal and the overall value of e-Commerce.	
6. Given the need to improve human resource performance, describe a managerial approach to teamwork, empowerment, and effective communication to accomplish this objective.	
7. Given a need to understand how products are produced, describe the work performed by various departments in the production of a good to a final customer.	
8. Given a need to understand the power of consumers, describe the role that Marketing can play to identify customer needs and desires that can be translated into better products.	
9. Given a need for timely and accurate data for decision making, discuss the use of technology and ways in which the management of information can facilitate this goal.	
10. Given a need to understand a firm's financial performance, be able to identify and explain the major elements contained within financial and accounting statements.	

RESEARCH METHOD

Methodology

This research examined the test scores, 1028 in all, of first-year (freshman) business students enrolled in the same introductory business course at DeVry University in Washington, D.C. A business simulation game, Industry Giant II, was added to approximately one-fifth of students' curriculum as a supplement to the standard classroom and textbook-based instruction. The remaining four-fifths of students experienced only the classroom and textbook-based instruction typical of the normal presentation of the class. Students participating in the game supplement were drawn from a variety of professors to minimize any skewing caused by differences in instructor method or effectiveness. Students participating 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. This further reduced the possibility of skewing of findings due to differences in previous business experience among student participants.

Standardized testing assessments were prepared from a bank of test questions provided to instructors with the text used in all classes, *Understanding Business* by Nickels, McHugh & McHugh. Identical testing situations and test materials were provided to all students, with a similar time-limit, position of testing in the semester, and directions also provided to all students. This allowed the researcher to effectively, quantitatively, and with minimized bias compare the scores of students participating in the game supplement with students who did not participate.

STATISTICAL ANALYSIS

To test the effectiveness of the game supplement, Means, t-Tests, ANOVA, and Chi-squared tests were performed on data resulting from the students' standardized tests. Such results were obtained using SPSS (Statistical Package for Social Science) version 13.0 software analysis. 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).

The first data set, students without game experience, had a sample of 801 scores, ranging from a high score of 100 to a low score of 15. As shown in Table 2 below, 259 student scores (32.33% of the total without game sample) were an "A" grade on their assessment. 222 student scores (27.72% of the total without game sample) were a "B", 127 student scores (15.86% of the total without game sample) were a "C", 90 student scores (11.24% of the total without game sample) were a "D", and 103 student scores (12.86% of the total without game sample) were an "F". The average test score without game experience was 79.18%.

Table 2
Grade Comparison Between Game and Without Game

	<i>Without Game</i>		<i>With Game</i>	
A (90-100)	259	32.33%	163	71.81%
B (80-89)	222	27.72%	31	13.66%
C (70-79)	127	15.86%	19	8.37%
D (60-69)	90	11.24%	13	5.73%
F (0-59)	103	12.86%	1	0.44%
TOTALS	801	100.00%	227	100.00%

The average test score of the game-playing group appears to be notably higher than the non game-playing group by more than 12 percentage points. As measured from the game-playing group, this is more than one standard deviation (or more than 15 standard error) higher than the no game-playing group. This is meaningful because the differences are in more than one full letter grade difference. Table 3 provides the standard descriptive statistics.

Descriptive Statistics

Table 3
Description Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Grade w/o Game	801	15	100	79.18	16.163
Grade w/Game	227	58	100	91.50	11.740
Combined Sample	1028	15	100	81.90	16.124

Chi-Squared Test

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, Table 4. One of the advantages of chi-square is that it is appropriate for almost any kind of data. (Archambault, 2000; SPSS, 2005).

Table 4
Chi-Squared Test

	Expected Counts		Chi-squared calculations	
	<i>Without Game</i>	<i>With Game</i>	<i>Without Game</i>	<i>With Game</i>
A (90-100)	328.8152	93.18482	14.8234	52.30636
B (80-89)	197.1333	55.86673	3.136733	11.06838
C (70-79)	113.7607	32.2393	1.54077	5.436813
D (60-69)	80.25584	22.74416	1.183076	4.174641
F (0-59)	81.03502	22.96498	5.953727	21.00853

Calculated chi-squared = 120.6324	5.63944E-26
degrees of freedom = (4-1) (2-1) = 3	Critical value at alpha = .05 = 7.815
Critical value at alpha = .01 = 11.345	p-value = 5.64E-26

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 = 5.64E-26
6. Conclusion: The null hypothesis is that the "with" and "without" groups are distributed the same across the grade groupings. The alternative hypothesis is that the groupings are different. Since the p-value is so very small, we reject the null hypothesis.

ANOVA

If the Levene's Test is significant (the value under "Sig." is less than .05), the two variances are significantly different. If it is not significant (Sig. is greater than .05), the two variances are not significantly different; that is, the two variances are approximately equal. If the Levene's test is not significant, the two groups have approximately equal variance on the dependent variable. Here, note in Table 5 that the significance of the Levene Test is .000, which is less than .05. Therefore the variances are significantly different.

Table 5
ANOVA Test of Homogeneity of Variance

Descriptive Statistics

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
					w/o Game	801		
w/Game	227	91.50	11.740	.779	89.97	93.04	58	100
Total	1028	81.90	16.124	.503	80.91	82.89	15	100

Levene Test

Levene Statistic	df1	df2	Sig.
22.951	1	1026	.000

1. Hypothesis:
 $H_0 \mu_1 = \mu_2$
 $H_1 \mu_1 \neq \mu_2$
2. $\alpha = .05$
3. Test statistic: ANOVA
4. Decision criteria: Reject H_0 and accept H_1 if Sig > .05
5. Calculation: Sig = .000
6. Conclusion: Based on the results of this sample and analysis, there appears to be a significant difference between the two means. Adopt the research hypothesis.

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).

Hoffjan said that simulation games are a proven means of active learning, where students can experiment with various business methods and construct their own understandings and conclusions about the business world (2005, p. 63). The use of a business game turned out statistically significant result and affected the overall result of students.

RESULTS

The most pronounced result of this research is that the Null Hypothesis is rejected and the Research Hypothesis is accepted.

$H_0 \mu_1 \geq \mu_2$ is rejected.

$H_1 \mu_1 < \mu_2$ is accepted.

The test average test scores among students who did receive supplemental play with the Industry Giant II video game is higher than the average of the students who did not receive supplemental play with the Industry Giant II video game. The researcher anticipated that use of Industry Giant II as a supplement to classroom instruction would cause higher assessment scores for students receiving such supplementation as opposed to students who did not receive such additional reinforcement. This was indeed the case, with nearly twenty percent more student scores of grades “C” or above in the supplemented group (93.84% of student scores compared to 75.91% of student scores in the group without game supplement).

In total, 128 students’ scores of the game-playing group were 100, of a total score sample of 227, or a total of 53.39%. The scores from students who did not benefit from playing Industry Giant II numbered only 47 at the 100, or perfect score, mark. Given the total sample of this score set was 801, 5.87% of student scores were 100, the highest level of mastery. This shows a tremendous improvement in extremely high mastery in the group who participated in playing Industry Giant II. The difference between the two percentages, 50.52 percentage points, is considerable and certainly great enough to make definite conclusions regarding the outcomes of this research.

On the other end, the number of failing scores in the two groups is also a relevant comparison. There was only one student score from the group that played Industry Giant in the “F” range, and it was a 58, only two points away from being a “D”. Given the sample of this data set of 227, this results in a failing percentage, indicating students who had little or no understanding of the materials presented in the classroom or textbook, of 0.44%. In stark contrast, 12.86% of the students that did not participate in playing Industry Giant II recorded “F” grades, indicating a much larger portion of this group had little or not understanding of the materials presented in the classroom or textbook. The average “F” grade of the failing grade data set for students not playing the game was 48, with 50 students receiving a grade of 50 or below. The “F” grades in this data set of students scores ranged from a low of 15 to 59, and comprised a total of 12.86% of the total 801 score sample. This indicates strongly that students who did not participate in playing Industry Giant II as a supplement to classroom instruction and textbook materials were highly less likely to attain even a basic proficiency in the course content.

Overall, results from this research indicate that playing Industry Giant II as a supplement to the classroom instruction and textbook materials available to freshmen business students significantly improved their mastery of the subject matter of a beginning business curriculum.

SUMMARY, CONCLUSION, AND RECOMMENDATIONS

In summary, a research study was undertaken at DeVry University in Washington D.C. to examine the effectiveness of adding a simulation game as a supplement to an Introduction to Business and Technology course. This is important because such simulations are typically used at a later point in students' business study.

Approximately one-fifth of students participated in the game playing, drawn randomly across courses and instructors. This group of students produced scores significantly higher than the scores produced by the control group, indicating they developed a more thorough knowledge and understanding of the introductory business facts, practices, and concepts covered in the class and textbook. The use of the simulation game Industry Giant II can therefore be considered an appropriate and effective learning tool as a supplement for beginning business instruction, supporting the initial hypothesis that such games would be effective for introductory supplementation, as they have been shown to be for more advanced instruction.

Conclusions and recommendations based on this research are first, that business simulation games are effective learning tools for college students, particularly when used to augment traditional business instruction. Such games assist students in applying, practicing, and ultimately developing greater understanding of the business environment. In addition, conclusions from this research include that such games can be used effectively at the introductory level of business instruction, when many students have little prior business knowledge, experience, or context.

Obviously, such a dramatic increase in student understanding of introductory business materials as is concluded from this research lends itself to the recommendation

that simulation games such as Industry Giant II should be included as supplementation learning and teaching tools in most areas of business curriculum, beginning with introductory business instruction. It is also recommended that publishers and educators consider the creation of such business simulations as a needed component of textbook and curriculum development, with more publishers providing game simulations as accompaniments to college course texts. It is further recommended that college professors consider adding a simulation game to their course material requirements and syllabus to greater enhance student learning and grasp of course information and concepts. In courses where no such provision is made, it is recommended students seek out such game supplement on their own.

Truly effective learning tools, that both educate and engage the students such as was demonstrated by the use of Industry Giant II in this research study, should be employed by more educators in their course structures. Students, professors, universities, and ultimately businesses would all benefit from a better-trained and educated graduate.

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