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The Impact of an Accounting Simulation on Performance and Perception in Accounting Courses

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The accounting profession has given ever-increasing focus and attention to the effectiveness and nature of accounting education. Executive education struggles with how to make accounting understandable and applicable to those responsible for other functions. Graduates of Executive MBA programs often have a negative perception of the accounting field before entering the EMBA. Adult education literature clearly touts the value of simulation, gaming theory, and modeling. This empirical study was designed to investigate the effect of integrating an accounting simulation, *The Accounting Game*, into an accounting course, on students' self-reported perceptions and on course performance. Additionally, the simulation was instituted as a preparation course for applicants entering an Executive MBA program.

Introduction

One of the many reasons that prospective students say drives them to investigate Executive MBA (EMBA) programs is their need to understand concepts across the organization or outside of their normal functional area. As they progress in their careers, they are asked to think more globally or cross-functionally. Many are working outside of the accounting function and looking to gain that expertise from an EMBA. However, because their undergraduate degrees may not be in a business discipline, and their work experience is outside of accounting, they have some fears or concerns about this part of the EMBA program. EMBA academic directors wrestle with how to provide accounting basics to this large subset of their classes.

Additionally, the accounting profession has given ever-increasing focus and attention to the effectiveness and nature of accounting education since 1990. At that time, four prestigious professional groups, the Accounting Education Change Commission (AECC), the American Institute of Certified Public Accountants (AICPA), the Big Eight/Five International accounting firms, and the American Accounting Association (AAA), began sounding the warning that the accounting profession was no longer attracting the "best and brightest." The AECC was a committee established by the AAA, a professional association representing accounting educators and representatives from the accounting profession. Earlier Coe (1987) had concluded that this would "necessitate major changes in accounting education" (p. 2). As a result, a collaborative effort between the AAA and the AICPA has been underway to identify approaches to modify current accounting educational practices.

As the literature review section of this study will show, a great deal of research regarding the educational effectiveness of gaming, a type of educational simulation, has occurred over the course of many years in an effort to improve educational pedagogy. However, few conclusive studies have been conducted regarding the effectiveness of games in the accounting curriculum as compared to other teaching pedagogy. Of those studies that have been conducted and described in the literature, most have had limitations such as small sample sizes, the lack of appropriate controls and measurements, inadequate statistical evidence to support the hypotheses, or findings that were assumed or only anecdotal in nature.

This study was conducted to gather empirical evidence to support anecdotal impressions that the incorporation of a specific simulation into accounting pedagogy would positively impact accounting higher education. The study was designed to further determine if the use of a simulation is a more effective method of teaching accounting principles than traditional teaching methodology. The purpose of this study was to determine whether the inclusion of a particular accounting simulation into an undergraduate accounting course would improve student performance (i.e., course examination grades) and perceptions about accounting (e.g,. as a major, teacher quality, classroom interactions, and overall satisfaction with the introductory course).

The objectives of this study were formulated through interviews with Executive MBA students who had experienced *The Accounting Game* (1983). This simulation was included as part of a boot camp for all EMBA students in three successive intakes. Interviews with these students helped determine the positive impact of the game on their understanding and perception of accounting. Additionally, their positive attitudes regarding accounting entering the course modules in accounting was very different than the fears or concerns of previous students with no exposure to *The Accounting Game*. The increased understanding and the positive perceptions and attitudes led us to believe that *The Accounting Game* or other simulations should be incorporated in all executive

format programs. However, little or no empirical evidence was found to support this theory.

The objectives of this empirical study were accomplished by incorporating *The Accounting Game* (1983) financial literacy simulation into the curriculum of an undergraduate financial accounting principles course. Most students in this course were of the non-traditional student population. These students were selected because experimental and control groups were needed for comparative purposes, and trying to select these two groups from an EMBA program with one cohort group would have been problematic. Appropriate procedural steps were taken to insure the validity of the comparisons. Students in the experimental group participated in the accounting simulation, while students in the control group did not. Student performance data were collected from each group to determine the effectiveness of the simulation as a supplement to the accounting principles course in accordance with the objectives of the study. Both groups of students were also asked at the conclusion of the term to anonymously complete two survey questionnaires regarding their experience.

Methodology

The use of simulations and games in business schools throughout the United States is widespread. Faria (1987) conducted a survey of U.S. universities and corporations. The study found that 95% of the members of the AACSB (formerly American Assembly of Collegiate Schools of Business) deans surveyed utilized simulations in their curricula, and they expected simulation usage to increase over the next five years. The respondents also indicated that they were inclined to believe that simulations were more effective than lectures and textbooks as a teaching methodology. However, as DeJoy (1998) points out, there is a lack of empirical research to support the claim that simulations are effective when incorporated into a business curriculum, much less an accounting curriculum.

This empirical study has been designed and conducted to test the effectiveness of employing an accounting simulation, *The Accounting Game* (1983), in the beginning undergraduate financial accounting principles course. *The Accounting Game* was designed by Educational Discoveries, Inc. (EDI), a Boulder, Colorado firm. It is a basic financial accounting literacy simulation that incorporates a game metaphor and the fundamentals of accelerative learning techniques into the presentation process.

This simulation teaches participants how to define basic accounting terminology, what financial numbers mean and where they come from, how to read and understand financial statements, why cash (not profit) runs a business, how to speak the language of business, and how to communicate more effectively with others.

Also, this simulation gives participants the opportunity to pretend to run a fictitious lemonade stand business. A “scorecard” game board and game piece is

used to account for transactions that occur throughout the simulation. Students build on the experiences encountered early in the game to advance their knowledge and understanding of the structure, purpose, and relationships of financial statements. Accounting terminology is illustrated in the simplest of examples with props and musical fanfare. As the simulation progresses through the day, the concepts build and become more complex, but the stochastic approach employed in the game gives participants all of the necessary knowledge to successfully assimilate the information and solve the questions and problems posed by the facilitator.

Research Hypotheses

Student Performance:

H1: Student participation in *The Accounting Game* will result in students in the experimental group achieving higher accounting principles course performance than students in the control group.

Student Perceptions:

H2a: Student participation in *The Accounting Game* will result in more students in the experimental group changing to accounting as an undergraduate major than students in the control group.

H2b: Student participation in *The Accounting Game* will result in students in the experimental group having more positive perceptions about instructional quality in the accounting principles course than students in the control group.

H2c: Student participation in *The Accounting Game* will result in students in the experimental group having more positive perceptions about overall satisfaction with the accounting principles course than students in the control group.

H2d: Student participation in *The Accounting Game* will result in students in the experimental group having more positive perceptions about faculty-student classroom interactions than students in the control group.

Independent and Dependent Variables

The primary independent variable of interest in this study was the nominal variable that indicates whether a student-participant in the study had been exposed to *The Accounting Game* or not. Students in sections of the accounting principles course exposed to the game simulation were coded Y and those not

attending the game, i.e., those enrolled in the control sections, were coded N.

Other independent variable data were collected and included for analysis based on the prior research of others and also anecdotal interest (Hill 1998; DeJoy 1998; Hermanson 1994; and DeCoster and Prater 1973). The independent variables included in this study in addition to exposure to the simulation and how they are classified are: Academic Major—nominal, Gender—nominal, Race—nominal, Age—continuous, Grade Point Average—continuous, Prior Total Credit Hours Earned—continuous, SAT-Math Score—continuous, SAT-Verbal Score—continuous, Pretest Score—continuous, Credit Hours Currently Enrolled—continuous, Average Hours Employed Per Week—continuous, and Average Hours Studied Per Week—continuous.

The primary dependent variable of interest in this empirical study was student performance. Prior researchers have identified several alternatives for measuring and evaluating this particular variable of interest. This study utilizes the Sum of All Tests administered during the term as the primary dependent variable measure of student performance. Other possible measures of student performance, Test #1 Score, Test #2 Score, and Cumulative Final Exam score were also collected and analyzed as part of this study. These dependent variables were used to test hypothesis H1. Data relevant to these variables were collected through the administration of two different questionnaires. Analysis of these variables led to conclusions regarding hypothesis H2a through H2d.

Research Design

This empirical study was conducted in four undergraduate financial accounting principles classes taught over two academic terms. Two courses were randomly designated as the experimental group (one per academic term) and the other two designated as the control group (again, one per academic term). In an effort to remove bias and to insure that the two groups were as homogeneous as possible given the limitations of the university setting, all sections were taught by the same tenured accounting faculty member. This particular faculty member regularly taught accounting principles courses, and the contents and topical coverage of the experimental intervention were not specifically made known to her.

The authors administered the simulation intervention during the second week of each of the two academic terms from which the experimental sections had been selected. Attendance was mandatory for students in the experimental group. The eight-hour simulation was conducted in the same classroom on non-class days for both sections being exposed to the game. A pretest of basic accounting knowledge was given to participants in all sections before the administration of the accounting simulation to ascertain the degree of homogeneity between the experimental and control groups.

At the end of the academic term students were asked to complete the regular accounting department student evaluation and a supplemental student questionnaire

to collect data not available through other sources. These two instruments were completed anonymously.

Data Collection

The pretest consisted of multiple choice questions that represented an overview of the accounting concepts and principles covered during the academic term that were also part of the accounting simulation. The pretest was completed during a regularly scheduled class meeting.

The accounting department student course evaluation and the supplemental student questionnaire were completed anonymously at the end of the term. The supplemental questionnaire included a separate section of questions specifically for the experimental group regarding their perceptions about the accounting simulation.

Students in all sections completed the same three examinations during the term; two mid-term examinations each worth 200 points and a cumulative departmental final examination worth 250 points. The exams were made up of a combination of multiple choice, matching, short answer, and problem type questions. The accounting faculty member's grade book was the source for ascertaining student performance on the examinations administered during the academic term.

Analysis

Each hypothesis, H1 and H2a through H2d, was tested by statistically analyzing data collected from the sources identified in the previous section. Analysis of covariance and chi-square contingency testing were employed in testing the research hypotheses. Analysis of covariance (ANCOVA) was used to test the continuous dependent variables, and the chi-square contingency test was used to test nominal dependent variables. ANCOVA combines the advantages of regression analysis with that of analysis of variance.

Chi-square contingency testing was used to statistically evaluate the nominal data collected from the two survey instruments regarding hypothesis H2a through H2d. This statistical procedure was used to determine if the nominal dependent variables were related to the nominal independent variable, game participation. The dependent variables were student interest in accounting as a major, perceptions about instructional quality, perceptions about faculty-student classroom interactions, and perceptions about overall course satisfaction. The inability to match the respondents of the survey instruments (because of anonymity) to other data collected, e.g., student performance data, also led to the use of the chi-square statistical model.

Descriptive Demographic Statistics

One hundred fifty-five undergraduate students participated in this empirical study over two academic quarters. The student participants enrolled in one of the four accounting principles course sections offered over the two academic terms. One section each term was randomly selected to become part of the experimental group and the other by default became part of the control group. Eighty students participated in the sections incorporating the simulation while seventy-five students enrolled in sections designated as the control group. Independent and dependent variables were tabulated and analyzed on a between group comparative basis. This analysis was performed to assess whether the groups were essentially homogeneous even though individual participants were not randomly assigned but self-selected each section through the university registration process.

For the nominal independent variables academic major, gender, and race, counts are provided for each variable category along with the probability results from the chi-square analysis. The nominal variable academic major was classified into accounting, other business, or non-business. Analysis reveals that there is no statistical difference between the two groups, i.e., they are homogeneous as to major, based on a chi-square probability of .9140. Similar results are obtained for the other nominal variables of gender and race, with chi-square probability values of .7224 and .9745, respectively, indicating homogeneity between the control and experimental groups for these variables.

The remainder of the independent variables, specifically Age, GPA, Total Credit Hours Earned, SAT-Math, SAT-Verbal, Pretest Score, Hours Currently Enrolled, Average Hours Employed per Week, and Average Hours Studied per Week, are continuous variables.

Analysis of the continuous independent variables reveals some relationships of interest to this study. There is a statistically significant difference between Game and No Game on the Pretest Score variable. No Game had a mean Pretest Score of 47.297 out of 100 while Game had a mean Pretest Score of 38.169 out of 100. This difference indicates that the No Game group had a better understanding of the accounting concepts and principles to be addressed in the accounting course and the game at the beginning of the term than did the Game group. Had the Game group recorded higher Pretest Scores, the results of this study may have been confounded by this lack of homogeneity between the two groups. However, because this study was designed to test the effectiveness of incorporating the game into the accounting principles course and hypothesized that the game would improve student performance, statistical acceptance of that hypothesis would provide stronger evidence of effectiveness given this initial disparity between the experimental and control groups.

Table 1 presents the results of the initial analysis of the performance of the students in the two groups. These data summarize the relationship of each performance dependent variable to the independent variable, exposure to the game, without controlling for or explaining any of the possible differences. Analysis of these descriptive statistics reveals that the experimental group had higher scores for each dependent variable than did the control group. However, without controlling for the impact that other relevant independent variables might have on the variation, only the difference in the Cumulative Final Exam is statistically significant ($p < .05$). No explanation is made at this point as to the reasons behind why the game group scored higher than the control group because there was no attempt made in this particular analysis to control for or explain the variation. It should be noted however, that the direction of the difference between Game and No Game is consistent with Research Hypothesis H1.

Table 1. Descriptive Statistics of Dependent Variables Measuring Performance

	Game	No Game	Total	Prob>|t|
Test #1 - 200 points max.				0.2612
Mean	174.013	170.938	172.4258	
Standard Deviation	17.7608	16.1914	16.9835	
Median	179	172	174	
Minimum	96	127	96	
Maximum	200	197	200	
Test # 2 - 200 points max.				0.5258
Mean	173.173	171.100	172.1032	
Standard Deviation	20.7028	19.8849	20.24530	
Median	177.0	174.5	176.0	
Minimum	111	126	111	
Maximum	200	200	200	
Cumulative Final Exam - 250 points max.				0.0119
Mean	201.640	191.550	196.4323	
Standard Deviation	22.4684	26.5744	25.1086	
Median	204	193	199	
Minimum	149	137	137	
Maximum	237	250	250	
Sum of All Tests - 650 points max.				0.0569
Mean	548.827	533.59	540.961	
Standard Deviation	46.9711	51.602	49.8449	
Median	557	537	547	
Minimum	431	442	431	
Maximum	627	636	636	

Hypothesis 1: Student Performance

The response to research question number one regarding improved student performance and its corresponding experimental hypothesis H1 is the primary question of interest in this empirical study. The appropriate statistical analysis for this hypothesis is the analysis of covariance (ANCOVA). ANCOVA is used when an independent variable of interest is nominal, and it is known that there are other independent continuous variables that have a simultaneous impact on the dependent variable. ANCOVA is an appropriate statistical procedure that improves the precision of the research design by employing in the determination of the statistic an existing independent variable that is correlated with the dependent variable of interest, e.g. teaching method and exam scores (Ary, et al., 1985, 255). Reliance on the outcomes from this main model appears justified in that it reflects a relatively high explanatory value of the variables, i.e., R-square of .556813. R-square estimates the proportion of the variation in the dependent variable around the mean that can be attributed to the independent variables in the model rather than to some other random error. An R-square of 1 means that the model is a perfect fit, and that 100% of the variation around the mean of the dependent variable is accounted for by the independent variables included in the model. Likewise, an R-square of zero indicates that no variation is explained by the independent variables in the model. The relatively high R-square of this model provides further support for the inclusion of the specific independent variables identified by previous research into the main model of this study.

The main ANCOVA regression model forms the basis for testing hypothesis H1 regarding improved student performance between the experimental and control groups. The analysis of the model indicates that the differences in the dependent variable Sum of All Tests, between the experimental and control groups attributable to the inclusion of *The Accounting Game*, were not random (Prob > |t| = 0.0002). In other words, the higher scores earned by students in the experimental group over the control group can be attributed directly to the incorporation of this supplemental learning activity. The model also identifies GPA (Prob > |t| <0.0001) as being a statistically significant independent variable in explaining the differences in the Sum of All Tests between the two groups.

This experiment and hypothesis H1 have been designed to test improved test scores between the two groups, i.e. a one-direction test. Since Prob > |t|, included in Table 2, is a two tailed test used in determining statistical significance in each direction, Prob > |t| can be divided by 2, to test only for the increase in test scores. This adjustment also makes the independent variable Pretest Score statistically significant in accounting for differences in the dependent variable Sum of All Tests.

Table 3 illustrates the impact of the incorporation of additional independent variables on the main ANCOVA regression model. The other independent variables not included in the Main ANCOVA regression model were added to the

main model on an iterative basis. This process was performed to determine the potential effect the added independent variable might have on the stability of the model and to determine if the variation of these variables affects the statistical significance of the independent variable of interest, game participation. Table 3 initially includes the main ANCOVA regression model as reflected in Table 2. Subsequent iterations include the main model plus one additional independent variable identified at the bottom of the model in italic print. Additional independent variables were added one variable at a time because ANCOVA is most appropriate when a small number of independent variables is used in the model (Tabachnick and Fidell, 1996).

Table 2. Main ANCOVA Regression Model
*Sum of All Tests = f(The Accounting Game, Gender, GPA, Academic Major, Age, Pretest)

Variable	Estimate	Standard Error	t Ratio	Prob > |t|
Game - (N - Y)	-11.17259	2.883977	-3.87	0.0002
Gender - (F - M)	1.6502628	3.107925	0.53	0.5963
GPA	55.921612	5.109171	10.95	<.0001
Major - (Accounting - Non-business)	4.3960097	6.55807	0.67	0.5038
Major - (Business - Non-business)	-0.085417	4.376662	-0.02	0.9845
Age	-0.118059	0.546385	-0.22	0.8293
Pretest Score - 100 pts. max.	0.2765294	0.142483	1.94	0.0543
*** The R Square for this model is .556813.**				

The sensitivity analysis presented in Table 3 indicates that each iterative model possesses a relatively high explanatory value of the variables in that no R-square is less than .556813. Importantly, in each iteration of the model plus one new independent variable, the game variable continues to be statistically significant. Prob > |t| for the independent variable Game does vary iteration by iteration, between a range of 0.0167 to 0.0002, indicating that the level of significance does fluctuate, but in every case the inclusion of the Game is statistically significant in explaining the increased student performance achieved by the experimental group. Likewise, the GPA variable remains statistically significant throughout all iterations. The independent variable Pretest, although significant in the main regression model on a one-tailed basis, becomes insignificant on some of the iterations, because of statistically insignificant correlations between Pretest and the variables being added.

This empirical study was designed to assess whether student performance would be improved by the inclusion of *The Accounting Game* as a component of the course curriculum. The main analysis has utilized the Sum of All Tests as the dependent variable and measure of student performance. Analysis of these results supports acceptance of H1, i.e., the incorporation of this simulation improves student performance in the accounting principles course.

Table 3. Sensitivity Analysis of Other Independent Variables

Main ANCOVA Regression Model *	**Estimate**	**Standard Error**	**t Ratio**	**Prob > |t|**
Game - (N - Y)	-11.17259	2.883977	-3.87	0.0002
Gender - (F - M)	1.6502628	3.107925	0.53	0.5963
GPA	55.921612	5.109171	10.95	<.0001
Major - (Accounting - Non-business)	4.3960097	6.55807	0.67	0.5038
Major - (Business - Non-business)	-0.085417	4.376662	-0.02	0.9845
Age	-0.118059	0.546385	-0.22	0.8293
Pretest Score - 100 pts. max.	0.2765294	0.142483	1.94	0.0543

* R - square .556813
Note: These are the same data presented in Table 2.

Main Model plus Credit Hours *	**Estimate**	**Standard Error**	**t Ratio**	**Prob > |t|**
Game - (N - Y)	-11.20714	2.886919	-3.88	0.0002
Gender - (F - M)	1.4739964	3.117475	0.47	0.6371
GPA	56.04322	5.115829	10.95	<.0001
Major - (Accounting - Non-business)	5.3842304	6.662961	0.81	0.4205
Major - (Business - Non-business)	-0.776012	4.452976	-0.17	0.8619
Age	-0.100056	0.547287	-0.18	0.8552
Pretest Score - 100 pts. max.	0.2726714	0.142684	1.91	0.0581
Credit Hours Earned	*0.0633812*	*0.07333*	*0.86*	*0.3889*

* R-square .559235

Main Model plus Race *	**Estimate**	**Standard Error**	**t Ratio**	**Prob > |t|**
Game - (N - Y)	-11.05647	2.892899	-3.82	0.0002
Gender - (F - M)	1.4042889	3.150476	0.45	0.6565
GPA	53.717011	5.336585	10.07	<.0001
Major - (Accounting - Non-business)	5.2753099	6.714332	0.79	0.4334
Major - (Business - Non-business)	-1.118075	4.453617	-0.25	0.8022
Age	0.1462028	0.572482	0.26	0.7988
Pretest Score - 100 pts. max.	0.2687353	0.144242	1.86	0.0646
Race (A - W)	*2.3602493*	*11.51045*	*0.21*	*0.8378*
Race (B - W)	*-17.55958*	*11.35853*	*-1.55*	*0.1245*
Race (O - W)	*16.06957*	*19.10038*	*0.84*	*0.4017*

* R-square .564913

Main Model plus SAT *	**Estimate**	**Standard Error**	**t Ratio**	**Prob > |t|**
Game - (N - Y)	-8.354894	3.371654	-2.48	0.0151
Gender - (F - M)	0.6237177	3.689702	0.17	0.8662
GPA	55.962881	6.707144	8.34	<.0001
Major - (Accounting - Non-business)	6.4361052	7.846285	0.82	0.4143
Major - (Business - Non-business)	-3.709086	5.209862	-0.71	0.4784
Age	1.0853247	1.107778	0.98	0.3299
Pretest Score - 100 pts. max.	0.1986381	0.159231	1.25	0.2155
SAT - Math	*0.1323005*	*0.05809*	*2.28*	*0.0252*
SAT - Verbal	*0.0092833*	*0.04479*	*0.21*	*0.8363*

* R-square .637370

Main Model plus Term *	Estimate	Standard Error	t Ratio	Prob > |t|
Game - (N - Y)	-11.17936	2.906677	-3.85	0.0002
Gender - (F - M)	1.6572911	3.131426	0.53	0.5975
GPA	55.922169	5.127954	10.91	<.0001
Major - (Accounting - Non-business)	4.3695485	6.663087	0.66	0.5131
Major - (Business - Non-business)	-0.070028	4.43381	-0.02	0.9874
Age	-0.120382	0.555872	-0.22	0.8289
Pretest Score - 100 pts. max.	0.2792166	0.17751	1.57	0.1181
Term	*0.0911449*	*3.567001*	*0.03*	*0.9797*

* R-square .556815

Main Model plus Hours Enrolled *	Estimate	Standard Error	t Ratio	Prob > |t|
Game - (N - Y)	-7.788762	3.190466	-2.44	0.0167
Gender - (F - M)	1.637849	3.422299	0.48	0.6334
GPA	69.82264	6.45258	10.82	<.0001
Major - (Accounting - Non-business)	-0.782652	6.76285	-0.12	0.9081
Major - (Business - Non-business)	5.1719046	4.724343	1.09	0.2767
Age	-0.011186	0.541367	-0.02	0.9836
Pretest Score - 100 pts. max.	0.1673285	0.153426	1.09	0.2785
Hours Enrolled	*-0.11023*	*1.106319*	*-0.10*	*0.9209*

* R-square .661163

Main Model plus Hours Employed *	Estimate	Standard Error	t Ratio	Prob > |t|
Game - (N - Y)	-8.3677092	3.136132	-2.77	0.0069
Gender - (F - M)	0.8313025	3.493444	0.24	0.8125
GPA	69.611695	6.566837	10.60	<.0001
Major - (Accounting - Non-business)	1.9449325	6.580617	0.30	0.7683
Major - (Business - Non-business)	2.988061	4.665708	0.64	0.5235
Age	-0.068862	0.534123	-0.13	0.8977
Pretest Score - 100 pts. max.	0.1766719	0.153454	1.15	0.2527
Average Hours Employed per Week	*0.0487049*	*0.239904*	*0.20*	*0.8396*

* R-square .659569

Main Model plus Hours Studied *	**Estimate**	**Standard Error**	**t Ratio**	**Prob > |t|**
Game - (N - Y)	-8.656218	3.219267	-2.69	0.0086
Gender - (F - M)	1.1784799	3.49795	0.34	0.7370
GPA	68.958869	6.425187	10.73	<.0001
Major - (Accounting - Non-business)	1.7851712	6.608826	0.27	0.7877
Major - (Business - Non-business)	3.5800517	4.695791	0.76	0.4479
Age	-0.055856	0.55259	-0.10	0.9197
Pretest Score - 100 pts. max.	0.1614708	0.158466	1.02	0.3110
Average Hours Studied per Week	*-0.256404*	*1.067414*	*-0.24*	*0.8107*

* R-square .652157

Main Model plus Previous Acctg. *	**Estimate**	**Standard Error**	**t Ratio**	**Prob > |t|**
Game - (N - Y)	-8.461439	3.126546	-2.71	0.0081
Gender - (F - M)	1.3654531	3.479504	0.39	0.6957
GPA	68.67847	6.294	10.91	<.0001
Major - (Accounting - Non-business)	1.798068	6.531876	0.28	0.7837
Major - (Business - Non-business)	2.9936558	4.595481	0.65	0.5164
Age	-0.069469	0.531977	-0.13	0.8964
Pretest Score - 100 pts. max.	0.1762618	0.152759	1.15	0.2516
Previous Accounting Class – (N - Y)	*-1.671817*	*5.729968*	*-0.29*	*0.7711*

* R-square .661109

Table 4 includes the ANCOVA models and analysis of each new dependent variable in the same format as Tables 2 and 3. All independent variables found in the Main ANCOVA Regression Model are included as covariates in each of the iterations in the dependent variable sensitivity analysis. The inclusion of the Game in the curriculum of the accounting course of the experimental group remains a statistically significant explanation for improved student performance over the control group when that performance is measured by Test #1 or by the Cumulative Final Exam. When the dependent variable is designated as Test #2, the Game is not a statistically significant independent variable affecting improved student performance of the experimental group over the control group. This is not surprising because the topical coverage of Test #2 and the simulation are dissimilar.

Table 4. Sensitivity Analysis of Dependent Variables

Main Model: DV=Sum all Tests *	**Estimate**	**Standard Error**	**t Ratio**	**Prob > |t|**
Game - (N - Y)	-11.17259	2.883977	-3.87	0.0002
Gender - (F - M)	1.6502628	3.107925	0.53	0.5963
GPA	55.921612	5.109171	10.95	<.0001
Major - (Accounting - Non-business)	4.3960097	6.55807	0.67	0.5038
Major - (Business - Non-business)	-0.085417	4.376662	-0.02	0.9845
Age	-0.118059	0.546385	-0.22	0.8293
Pretest Score - 100 pts. max.	0.2765294	0.142483	1.94	0.0543

* R-square .556813

Note: These are the same data presented in Table 2.

DV = Test #1 *	**Estimate**	**Standard Error**	**t Ratio**	**Prob > |t|**
Game - (N - Y)	-2.903588	1.190561	-2.44	0.0160
Gender - (F - M)	-0.975669	1.283011	-0.76	0.4483
GPA	16.570697	2.109164	7.86	<.0001
Major - (Accounting - Non-business)	0.7407762	2.707298	0.27	0.7848
Major - (Business - Non-business)	1.06864	1.806771	0.59	0.5552
Age	-0.22316	0.225558	-0.99	0.3242
Pretest Score - 100 pts. max.	0.1014737	0.05882	1.73	0.0868

* R-square .358969

DV = Test #2 *	Estimate	Standard Error	t Ratio	Prob > |t|
Game - (N - Y)	-1.984193	1.480056	-1.34	0.1823
Gender - (F - M)	1.7628163	1.594986	1.11	0.2710
GPA	15.978138	2.622025	6.09	<.0001
Major - (Accounting - Non-business)	0.7020251	3.3656	0.21	0.8351
Major - (Business - Non-business)	-0.084179	2.246102	-0.04	0.9702
Age	-0.157287	0.280405	-0.56	0.5758
Pretest Score - 100 pts. max.	0.0933694	0.073122	1.28	0.2038

* R-square .289937

DV = Cumulative Final Exam *	Estimate	Standard Error	t Ratio	Prob > |t|
Game - (N - Y)	-6.284806	1.684214	-3.73	0.0003
Gender - (F - M)	0.8631156	1.814998	0.48	0.6352
GPA	23.372776	2.983706	7.83	<.0001
Major - (Accounting - Non-business)	2.9532084	3.82985	0.77	0.442
Major - (Business - Non-business)	-1.069879	2.555929	-0.42	0.6762
Age	0.2623879	0.319084	0.82	0.4123
Pretest Score - 100 pts. max.	0.0816864	0.083208	0.98	0.328

* R-square .423685

In summary, the ANCOVA regression model has been employed to analyze the student performance of the experimental group and the control group. Additionally, in response to a survey question asked specifically of the game group regarding the game's influence on the students' overall understanding of accounting, 93.9% indicated that the game had improved their understanding, with 44.9% indicating a great improvement from the exposure. These analyses provide evidence to accept hypothesis H1; higher student performance by the experimental group over the control group is at least in part attributable to the inclusion of the pedagogical supplement, *The Accounting Game*, in the accounting principles course.

Hypothesis 2a through 2d: Student Perceptions

Research hypotheses H2a through H2d, regarding the expected improvement of student interest in accounting as a major and student perceptions of instructional quality, overall course satisfaction, and faculty/student classroom interactions as a result of the use of *The Accounting Game*, were evaluated via chi-square contingency testing. Statistical analysis resulted in each research hypothesis, H2a through H2d, unexpectedly being rejected. Study results surprisingly revealed that incorporation of the accounting simulation, *The Accounting Game*, into the accounting principles course did not increase the number of students who selected accounting as a major or increase student perceptions about instructional quality, overall course satisfaction, and faculty-student classroom interactions. Initial expectations were that the incorporation of the game would improve student performance and student perceptions. Improvement in student performance without corresponding improvements in student perceptions appears to be inconsistent.

Although inclusion of the accounting simulation did not improve student perceptions identified and tested in research hypotheses H2a through H2d, students in the Game group responded positively to questions regarding their individual perceptions about the impact of the incorporation of *The Accounting Game* into the accounting principles course that they attended. In spite of the rejection of research hypotheses H2a through H2d, the positive responses elicited from students in the experimental group about the incorporation of the accounting simulation in their accounting principles course cannot be ignored in the final analysis. Therefore, *The Accounting Game* should be incorporated into accounting principles courses as a means of improving student performance. Also, adding this simulation as a pedagogical supplement produces no negative perception side effects either toward the instructor or the course.

Conclusions

In spite of the popularity of simulations in business schools and corporations across the country, there have been only a few research studies that investigate the effectiveness of accounting simulations for improving student performance or the effects of simulations on student perceptions toward the accounting profession. The purpose of this study was to add to the literature in this area and to determine whether the inclusion of a particular accounting simulation, *The Accounting Game*, in an undergraduate accounting principles course would improve student performance and student perceptions about the accounting principles course.

This empirical study found that the incorporation of the accounting simulation, *The Accounting Game*, into an undergraduate accounting principles course was effective at improving student performance. Research hypothesis H1 was

accepted, i.e., the students in the experimental group earned higher grades than the students in the control group. An analysis of covariance (ANCOVA) regression was employed. This testing revealed that improvements in experimental group student grades were statistically significant. The ANACOVA model was designed and covariates selected to control for confounding of results associated with covariate correlation and non-homogeneity between the experimental and control groups. Different measures of student performance, i.e., alternate dependent variables, were tested to assess the sensitivity of the model and to measure the statistical impact the simulation had on each exam.

Students in the Game group earned statistically significant higher test scores on Test #1 and the Cumulative Departmental Final by a high enough margin to make the Sum of All Tests also higher for the Game group. The experimental group, however, did not score higher on Test #2. This finding is consistent with expectations however, in that much of the material tested on Test #2 is not directly related to the principles and concepts conveyed during the eight-hour accounting simulation.

Limitations

The findings and conclusions of this empirical study are subject to several potential research limitations. Ideally, an experiment should be performed having participants randomly assigned to the experimental and control groups. In the environment of higher education, random assignment to groups was not practical. Students were not assigned to sections but self selected the classes they attended through the normal university registration process. The limitation of non-random samples is present in most experimental research conducted in higher education. This limitation was appropriately managed through research design in an effort to maximize the general usefulness of the study (Jensen, 1995; Shavelson, 1988). The use of a quasi-experimental design does not give the researcher full experimental control. This potential lack of control over sources of possible invalidity must be considered in evaluating the results of the experiment. The more similar the groups are at the initiation of the experiment, as confirmed by similar group means for the pretest and other demographic statistics, the more credible the results of this type of study become. Analysis at the beginning of this empirical study of the two groups, Game and No Game, found that with the exception of the pretest scores being higher for the No Game group by a statistically significant amount, the groups were statistically homogeneous. Statistically higher pretest scores in the No Game group indicates superior background accounting knowledge, adding further credence to the improved performance associated with the incorporation of the game into the course.

The effectiveness of the simulation might differ with other instructors with different basic teaching styles and testing methods. This represents a limitation that will affect the ability to generalize the findings to all undergraduate financial

accounting principles courses taught at all the various types of higher educational institutions. This particular limitation is extremely difficult to eliminate given the desired objective of controlling as many variables as possible. Incorporating other higher education institutions into this study would have had a confounding effect on the study results, in that each university has its own curricula, evaluation methodology, instructional facilities, and student expectations (Hill 1998).

Student perception data collected through the routine accounting department student evaluation questionnaire and the supplemental student survey were anonymous. Providing for student confidentiality in this manner created a limitation through the inability to correlate student perceptions about course satisfaction with other independent variables that have been hypothesized to have an impact, i.e., the Game, or GPA (Marsh, 1984).

The population for this study consisted of undergraduate students at a school with a majority of non-traditional students. Although most of the participants were non-traditional, the application of these results to the Executive MBA population is limited. Although we expect the results to be very similar, any statistical inference would be inaccurate.

Recommendations for Future Research

The findings of this study suggest that the incorporation of *The Accounting Game* into an undergraduate financial accounting principles course will positively affect student performance. The study results did not support the research hypotheses that student perceptions would be more positive with the incorporation of the game. These results are somewhat contrary to anecdotal expectations that games are a preferred pedagogical method of students. Also, one might have anticipated improved student performance yielding greater perceived student satisfaction with the instructor, the course, and its ancillary impact. Future research should explore this potential dichotomy.

Research hypothesis H2a hypothesized that the incorporation of *The Accounting Game* would result in more students in the experimental group changing to accounting as an undergraduate major than students in the control group. Students were specifically asked if they had changed their academic major since the term had begun, and if they had, to what major. Asking these questions in such close time proximity to the experimental intervention, i.e., the administration of the accounting simulation, may have been premature. Future research could investigate the long-term impact *The Accounting Game* has on the choice of academic major by students participating in the simulation.

This experimental study compared the undergraduate accounting instructional pedagogy of two groups. Each group received identical instruction incorporating the same pedagogy throughout the academic term with the exception of the treatment intervention, i.e. *The Accounting Game* accounting literacy simulation at the beginning of the term. Future research could make a comparison

between the inclusion of *The Accounting Game* for the experimental group and some other additional alternative learning activity, e.g., a practice set or CD-ROM tutorial, for the control group.

One further aspect of future research should be to investigate the effect this particular accounting simulation has on long-term retention of accounting concepts as compared to more traditional approaches to conveying these principles. Comparing student performance in higher-level accounting courses may be a mechanism for testing the long-term effectiveness of this particular pedagogy.

Another indication for future research would be to investigate the effect of *The Accounting Game* on executive students in EMBA programs. This would require two different cohort groups, one experimental group and one control group. This would confirm the expected hypothesis that the results of this study would be duplicated in that environment.

This empirical study produced results that both met and failed to meet expectations in terms of the research hypotheses tested. The research nonetheless has provided substantive statistically valid evidence to support the claims put forth by the accounting profession that new and innovative accounting pedagogy could have a positive impact on accounting education and the students attracted to the accounting profession.

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