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ARE BUSINESS GAMES REALLY DELIVERING WHAT STUDENTS ARE LED TO BELIEVE??

Richard D. Teach
Georgia Institute of Technology
richard.teach@dupree.gatech.edu

Robert G. Schwartz
Eastern Washington State University
rschwartz@ewu.edu

ABSTRACT

This paper reviews the role of expected learning by students who participate in computerized business simulations. This paper suggests methodology that could be used to evaluate simulations as students play them, not by the authors' of the games. It used the game CAPSTONE and the specific findings should not be generalized to other games. The research found several points that seemed to raise learning expectation too high. Two learning points were found that underestimated the learning that took place. A simple but important finding was that the expectations of learning, are strongly related to the amount of learning that takes place.

INTRODUCTION

This paper reports on a study .of student learning expectations measured prior to participating in a business simulation and comparing these learning expectations to measures of learning outcomes reported at the end of term after the students had completed the business game. The measures were recorded on a student-by-student basis, and thus the pre and post measures can be matched. The primary hypothesis was that the use of business simulations in a collegiate classroom environment results in student learning that exceeds their expectations.

This paper reports on data collected from undergraduate students who participated in a business simulation called CAPSTONE® as a part of a senior level business-to-business marketing course. The students' performances in the game were evaluated on both the individual level and at the team level. These performance measures were then used, in part, to determine each student's final grade in the course.

BACKGROUND

This paper does not attempt to deal with the efficacy of the use of business simulations in the teaching of an undergraduate capstone course, but rather with the expectations of students as they relate to the learning that takes place while participating in a simulation. A note of caution in the evaluation comes from a 1980 paper where the authors suggest that different discipline types will expect and evaluate differently (Catalanello, 1980). In the middle 1980's it was suggested that business courses should be taught in a fashion similar to the natural sciences, i.e. experiential learning (Dutton, 1985, p. 45). Today students are asking professors to take things a step further and train rather than educate, as it is the students' view that the academic world is not "real" enough p (Malik and Morse, 2000, p 29).

A recent paper suggest that there were three measures of learning that need to be accounted for: what the student learns relative to professor expectations (what the professors expected that the students would learn better by using a game or simulation); what the student learns relative to his/her expectations (the purpose of this study); and what the students actually learns compared to what the instructor measures (the grade assigned in the course (Gentry and Burns, 1997).

THE EXPERIMENT

Early in the semester, each student was provided with a copy of the CAPSTONE® booklet, introducing the game. This booklet described the conditions of the industry being simulated, and explained the rules of the marketplace, the nature of the competition and how the decisions should be made and uploaded to the server running the game. CAPSTONE® provides a two period trial in order that the students get to know how to enter their decisions and retrieve the results and for the students to get a *feel for the industry*, before the competition rounds begin. The practice rounds are an attempt to reduce the likelihood that a simple mistake made early in the game by a student misunderstanding would not cause an unrecoverable situation for a student team.

After the students had completed two "practice" rounds, and after substantial interaction with the instructor, both in and out of the classroom, it was assumed that the student learning expectations had been formed. At this point in time a questionnaire was distributed to the students to record their specific learning expectations. Table 1 is a copy of that questionnaire.

Table 1: The initial data collection questionnaire

	Highly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Highly Agree
I believe that by using the business simulation CAPSTONE in class I expect to:						
learn how to apply marketing principles.						
learn how to develop marketing strategies.						
learn how to apply principles of finance						
l*earn how to* set prices in competitive situations						
learn how to develop finance strategies.						
learn how to apply production principles.						
learn how to position products for particular market segments						
learn how to develop production strategies.						
learn how to apply TQM principles.						
learn how to use perceptual maps in a marketing contexts						
learn how to develop TQM strategies.						
learn how to forecast the outcomes of my various business decisions						
In addition, I expect to acquire a better understanding of:.						
R&D principles.						
R&D strategies						
Accounting principles.						
I expect to be able to analyze spreadsheets better than I could before playing CAPSTONE						
I expect that by participating in the simulation CAPSTONE, I will better understand:						
how a business actually works."						
actual business problems."						
how to solve real business problems						

In addition to these learning points in the questionnaire, the students were also ask to respond using a six-point Likert-like scale, to the following questions regarding each students level of knowledge of underlying technology used in business schools and a question with regard to expectations of using a simulation or business game as a learning tool. These statements are shown in Table 2.

After the simulation had completed eight rounds, simulating eight years of operations, CAPSTONE® was stopped. This game was designed to run for eight or fewer iterations. After the results were all downloaded, analyzed and the reports were written, another questionnaire was distributed. This second instrument was phrased in the past tense and everywhere the first questionnaire used the phrase "I expect to learn" the phrase "I learned" was substituted. Additional grammatical changes were made to reinforce the concept of actual learning taking place rather than expectations of learning.

Table 2. Additional statements

1. I Expect Simulations Will Assist My Learning	4. I Know About Computer Technology
2. I am Able to use Spreadsheet Very Well	5. I Know How to use Computer Technology
3. I Know Accounting Principles	6. I Utilize the Internet for Info Purposes

It was assumed that students would not remember their precise answers of the first questionnaire, when they completed the second set of questions, twelve weeks later. This post game information was also obtained via Likert-like responses. A learning objective was stated and the student responded by indicating the extent to which he or she agreed with the statement.

THE PROPOSITIONS AND HYPOTHESES

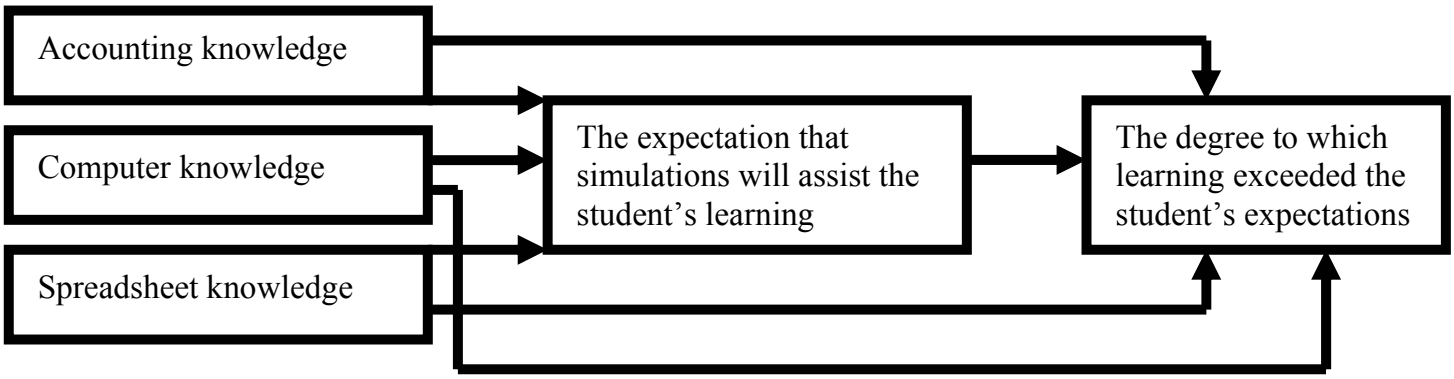
Most students tend to be excited about simulation participation. It is an active, not a passive form of learning. In addition, it brings out the competitive drive, believed by the US culture to be important to success. Does prior knowledge and abilities affect this belief that business games or simulations will enhance or assist the learning process? Hypothesis one was developed to test this theory. Hypothesis one was: **Prior knowledge of accounting and computers along with skills in using computers, spreadsheets and the Internet will positively affect the belief that simulations will assist students' learning.**

Since CAPSTONE® was a computerized total enterprise simulation that utilized detailed accounting statements, spreadsheets, and on line interaction it was expected that prior knowledge of these topics would lead to enhanced expectations of learning. In addition, would the belief that playing a computer game would increase learning, increase expectations as well? The second hypothesis of the study stated**: Level of prior knowledge of accounting, and computer technology along with an ability to utilize computers, spreadsheets, and the Internet in conjunction with the strength of belief that playing a business game would increase learning would result in increased learning expectations among participants in the CAPSTONE® game.**

Hypotheses three follows directly from the second hypothesis.. Will prior knowledge and skills increase actual learning and does anticipation that the simulation will assist the learning process lead to increased learning as well. Thus hypothesis three states: **Prior knowledge of accounting, and computer technology along with an ability to utilize computers, spreadsheets, and the internet in conjunction with the strength of belief that playing a business game would increase learning would in fact, result in increased learning among participants in the CAPSTONE® game.**

Figure 1 provides a schematic drawing or a model of these expectations.

Figure 1. The proposed relationships between skills, expectations and the degree that learning expectations will be exceeded.



THE DATA

The data were keyed on an individual student basis, that is, a student record was produced that contained the data from the expectations questionnaire and the data from the post game questionnaire on what the student reported as his/her actual learning outcomes. Since the questionnaires matched, the differences between each student's responses could be produced question by question. Taking a post-game response and subtracting the pre-game response of the same question provided a positive value when expectations were exceeded and a negative value whenever expectations were not met. This data provides the basis of this research and a summary of this data is shown in Table 3. Because the questionnaire used a six-point response from highly agree to highly disagree, the difference data may be constrained. For example, if a student had very high expectations, the possibility that the actual learning being evaluated as greater than the expectation was essentially impossible. The same phenomenon could occur when the expectations were also very low.

Table 3 displays the distributions of the differences between student expectations questions and their responses of what they felt they had learned and the mean of the differences, question by question. If a mean were positive it indicated that, on the average, the outcome exceeded the students' expectations. Note that there were no negative mean values.

THE FINDINGS

How does one measure the degree that expectations are exceeded, in an overall sense? In this research, the sum of the 19 differences between what was reported using the end-of-term questions (the degree of what was learned) minus the beginning-

of-term questions (the degree of what was expect to be learned) was used. The19 variables were displayed in Table 1.

EXPECTATIONS OF SIMULATIONS IN GENERAL

Why do differences in what students expect to learn exist when they are in the same class using the same simulation? It was hypothesized that competence and knowledge of computing and accounting would affect the degree of expectations. This was hypothesis one. To test this hypothesis, a regression analysis was performed using the responses to the question, "*I expect that simulations will assist my learning*." as the dependent variable and the five other variables defined in Table 2 that represent prior knowledge and skills as dependent variables. The result showed very little support for this proposition. There might be a case for the variable *I know how to use computers*, but the evidence is very scant with a "p" value of only 0.104. Table 4 displays the significance of the regression and the "p" values of each independent variable along with the standardized beta coefficients..

Table 3. The Distribution Of The Differences
N=60

	Mean of the distribution	A lot less than I expected to. (-3)	Less than I expected to (-2)	A little Less than I expected to (-1)	About what I expected to (0)	A little more than I expected to (+1)	More than I expected to (+2)	A lot more than I expected to (+3)	Number of Missing Values
Appling marketing principles.	0.67	0		7	14	21	7	3	9
*D*eveloping marketing strategies.	0.51	1	1	9	15	13	9	3	9
*A*ppling principles of finance	0.73	0	2	5	13	19	9	3	9
Setting prices in competitive situations	0.02	0	2	13	22	11	3	0	10
*D*eveloping finance strategies.	0.39	0	1	12	13	17	7	1	9
*A*ppling production principles.	-0.04	0	3	15	20	7	3	2	10
Position products for particular market segments	-0.08	2	5	11	13	16	2	1	10
*D*eveloping production strategies.	0.18	1	3	12	13	15	6	1	9
*A*ppling TQM principles.	1.16	0	3	3	9	14	12	7	10[1]
Using perceptual maps in a marketing contexts	0.30	1	1	9	21	10	5	3	10
*D*eveloping TQM strategies.	1.00	1	2	4	10	15	10	8	10[2]
*F*orecasting the out-comes of my various business decisions	0.37	0	1	7	24	14	3	1	9[3]
*U*nderstanding R&D Principles 15	016	1	3	10	17	14	5	1	9
*D*eveloping R&D Strategies	0.12	1	4	9	19	11	6	1	9
Understanding Accounting Principles	0.76	1	1	6	9	21	10	3	9
Utilize Spreadsheets better	1.06	0	1	5	11	16	10	4	10[4]
How a business actually works	0.02	0	3	11	23	12	1	0	9[5]
Understand *A*ctual business problems."	0.20	1	1	10	20	13	24	0	10[6]
How to solve real business problems	0.39	0	2	4	25	13	6	1	9

Table 4. The significance of the regression model using the expressed level of expectation that simulations assist the students learning and the "p" values of the independent variables

The dependent variable:	expectation that simulations will assist the student's learning	The adjusted $R^2 = 0.150$
The independent variables:	"p" value	Beta Coefficients
I am able to use spreadsheets very well	0.350	0.172
I know accounting principles	0.705	0.078
I know about computer technology	0.181	-0.416
I know how to use computers	0.104	0.381
I utilize the Internet for info purposes	0.139	0.375
Significance of the regression Equation:	> 0.193	

The missing values resulted when students were absent during one of the two periods that the data were collected. Note that on each and every question or learning point, some students' expectations were not met.

Table footnotes: The differences were generally plus or minus 3, but footnotes 1and 2 reported two +4s for their questions. Footnote 3 reported one +5 for its questions. Footnote 4 reported three +4s for its questions. Footnote 5 and 6 reported one +4 for their questions.

Thus, hypothesis one was not supported.

THE DEGREE OF ACTUAL LEARNING

How does one measure the degree of expected learning, in an overall sense, that took place by participating in the simulation? In this research, the sum of the 19 responses d to the pre simulation questionnaire was used. These 19 variables were displayed in Table 1.

TESTING HYPOTHESIS TWO

Hypothesis two was: Prior knowledge of accounting, and computer technology along with an ability to utilize computers, spreadsheets, and the internet in conjunction with the belief that playing a business game would increase learning would result in increased learning expectations among participants in the CAPSTONE® game. Thus, the variable of interest was the sum of each student's expectations of the learning before the game was played. This sum was used as the dependent variable in a regression analysis and using all the variables displayed in Table 2. as dependent variables. The results of this regression are shown in Table 5.

The belief that simulations, in general, will increase learning expectations was very strongly related to the level of expected learning from participating in games in general Prior knowledge of accounting was marginally supportive of the same thing. Neither computer nor spreadsheet, nor Internet skills were related. Thus Hypothesis two was supported only to the extent that two of the six dependent variables was important in establishing learning expectation.

TESTING HYPOTHESIS TWO

Using the same logic used in measuring the expected learning, actual learning was defined as the sum of the 19 variables in the post-game questionnaire. In this actual learning case, again all six variables displayed in Table 2 were used as independent variables. Hypothesis three was: **Prior knowledge of accounting, and computer technology along with an ability to utilize computers, spreadsheets, and the internet in conjunction with the belief that playing a business game would increase learning would in fact, result in increased learning among participants in the CAPSTONE® game.**

These results of this regression analysis indicated that the expectation that the game would assist learning was highly related to the reported actual learning that took place. In

Table 5. The significance of the regression model using the sum of expressed level of the students expected learning as the dependent variable and the "p" values of the independent variables

The dependent variable:	expectation that simulations will assist the student's learning	The adjusted $R^2 = 0.279$
The independent variables:	"p" value	Beta Coefficients
I am able to use spreadsheets very well	0.336	0.438
I know accounting principles	0.067	0.165
I know about computer technology	0.783	-0.363
I know how to use computers	0.429	0.080
I utilize the Internet for info purposes	0.693	0.178
I expect simulations will assist my learining	0.003	0.092
Significance of the regression Equation:	< 0.003	

Table 6. The significance of the regression model using the sum of expressed level of the students learning as the dependent variable and the "p" values of the independent variables

The dependent variable: expectation that simulations will assist the student's learning		The adjusted $R^2 = 0.267$
The independent variables:	"p" value	Beta Coefficients
I am able to use spreadsheets very well	0.404	0.523
I know accounting principles	0.010	0.141
I know about computer technology	0.169	-0.454
I know how to use computers	0.904	0.407
I utilize the Internet for info purposes	0.261	-0.026
I expect simulations will assist my learining	< 0.0005	-0.270
Significance of the regression Equation: < 0.004		

addition, reported accounting knowledge was also strongly associated with the reported level of learning that took place in the game. The expectation variable had a "p" value less than 0.0005. The reported level of accounting knowledge had a "p" value equal to 0.010. Table 6 displays the results of the third regression analysis.

This result again only partially supported the hypothesis. Only two of the six variables supported the hypothesis. As a result of performing the above regression analyses, the interaction model expressed in Figure 1. needed to be restated and redrawn and is shown in Figures 2 and 3.

What was discovered were the factors affecting the degree of expectations and learning, but not the factors leading to missed expectations.

MISSING THE EXPECTATIONS OF LEARNING

The data collection process matched each student's pre-game and post-game questionnaires. Using the same logic of measuring actual learning and expected learning, a value was calculated to measure the degree that the expectations were missed. That measure was the sum of the 19 differences between the expressions of was expected to be learned the expression of what was learned.

Figure 2. The relationships among variables leading to learning expectations and actual learning

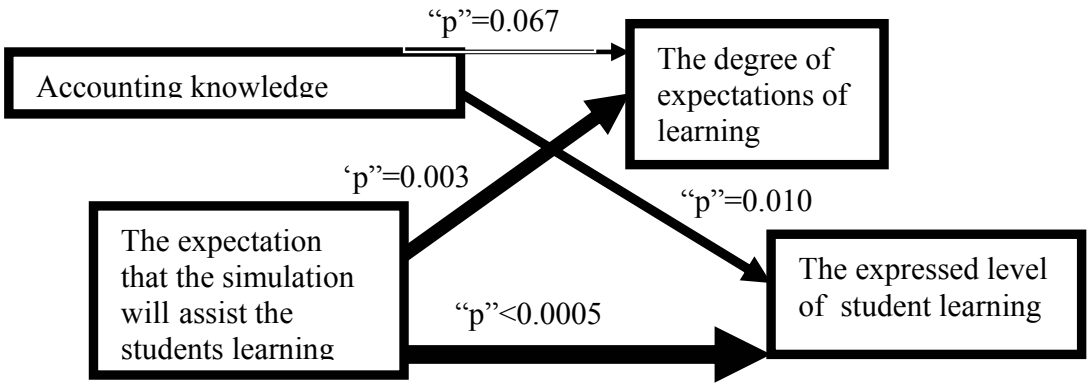


Figure 3. The driving forces related to the degree to which learning exceeds (or does not meet) expectations are still unknown

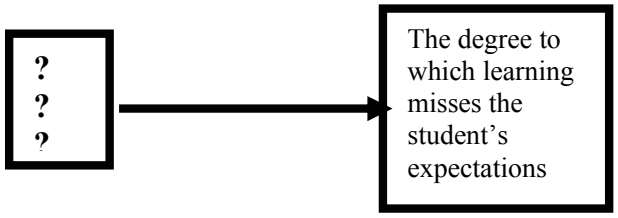


Table 7. The distribution of the sums of the differences between the student's learning evaluations minus his or her learning expectations.

41	35	31	23	23	22	21	20	20	19	17
17	16	16	15	15	15	14	13	13	12	12
11	11	11	10	10	9	9	9	8	7	6
5	5	4	4	3	3	3	2	1	0	-2
-2	-2	-3	-4	-5	-5	-7	-12	-25		

The distribution of the values indicated that most, but not all, of the students believed that the experience exceeded their expectations. Based upon the sum of the difference between expectations and learning outcomes, 42 students out of 53 students who completed both questionnaires, had their expectations exceeded by the gaming experience. One student's sum equaled zero, the vales of learning objectives not met exactly equaled the value by which his or her learning objectives exceeded his or her expectations. Ten students had negative sums. Table 7 displays the sum of the differences.

The most negative student (the student with the –25 score) was one who had earned the lowest grade in the class. But, the second most negative student (-12) earned one of the highest grades in the class.

The question, "Why were some expectations exceeded while others remained un-met?" was an obvious one. The degree of missed expectations were regressed on the six variables shown in Table 2. None of the six variables (The variables displayed in Table 2) were strongly related to the degree that learning missed the students' expectations. The best relationship to this dependant variable was *"I know computer technology*" but the "p" value was only 0.251.

It is postulated that overselling the games learning aspects might cause exuberant expectations. Another rational might be that actually learning might have been the factor. Too little learning or greater than expected learning could cause the students' expectations to be missed, but the authors are inclined to believe the first suggestion. Thus, hypothesis five was developed. **Missed expectations would be the result of unrealistic expectations and not the result of either inadequate learning or experiencing a much greater that expected learning outcome.**

DETERMINING THE COVARIATES OF MISSED EXPECTATIONS

Table 7 shows the degree to which expectations were either exceeded or not. The data appeared to be on a continuum, thus regression was an appropriate tool to determine what co-varied with it. These missed expectations were regressed using the original expectation scores as independent variables.. It was postulated that excessive expectations might have been drivers of the missed expectations. Since there were 53 observations and 19 variables, a conventional regression would have too few degrees of freedom, a backwards, stepwise regression was performed. Table 8 shows the results of the regression analysis.

Two variables, the *expectation of learning how to set prices* and the *expectation of learning how to solve business problems h*ave positive coefficients, meaning that they contributed to exceeding the students' expectations. The other five variables, *the expectations of learning how to; 1) apply production principles; 2) developing operations strategies; 3) use perceptual maps; 4) forecast outcomes and; 5) understanding how business actually works* all had negative coefficients and thus contribute to having un-met expectations.

The next step was to regress the same dependent variable using the degree of learning over the points covered in the questionnaire as expressed by the students and collected after the simulation had been completed. The result of this backward stepwise regression indicated that the variables "I learned how to forecast outcomes and I learned how business really works were related to missed expectation. The signs of the Betas were both positive, indication that these two outcomes resulted in expectations being exceeded. The outcome of the regression is shown in Table 9.

Table 8. The results of regressing of the degree of missed expectations upon the expectations data

The dependent variable:	The degree of missed expectations	The adjusted $R^2 = 0.591$
The independent variables:	"p" value	Beta Coefficients
Set prices	0.076	0.243
Apply production principles	0.092	-0.224
Develop operations strategies	0.019	-0.326
Use perceptual maps	0.007	-0.381
Forecast Outcomes	0.013	-0.360
Understand how business actually works	0.009	-0.358
Be able to solve business problems	0.015	0.375
Significance of the regression Equation: < 0.0005	Note that the first two variables have "p" values greatly exceeding the traditional 0.05 level.	

Table 9. The results of regressing of the degree of missed expectations using students' expressions of what they learned as independent variables.

The dependent Variable	The degree of missed expectations	Adjusted $R^2 = 0.383$
The Independent Variable: I learned how:	"p" values	Beta Coefficients
To forecast outcomes	0.014	0.335
Business really works	0.007	0.386
Significance of the regression Equation. < 0.0005		

In testing hypothesis five, the final step was to combine both sets of variables into a single regression. But, when this regression was performed, the two added variables of *I learned how to forecast outcomes* and *I learned how business really works* had low "p" values when combined with the expectation variables. They were highly co-varied with the variables in the *I expected to learn* set. As a result, only variables measuring learning expectations were significantly related to unmet expectations. Table 10 shows the results of this regression analysis.

This results supports hypothesis five that expectations were the causes of missed expectations. The simple expectations of expecting to learn to set prices and how to solve business problems, led to underestimating actual learning and expectations of learning the more sophisticated skills of developing operations strategies, using perceptual maps, forecasting outcomes and understanding how business really works led to unmet expectations.

The last of the model shown in Figure 3 can now be completed and is shown in Figure 4. where the prefix of "*I expect to learn how to*:" should precede each statement in the boxes to the left of the dependent variable, "*The degree to which learning missed the students' expectations*."

Much of the learning that was to take place by participating in the simulation appeared to have been oversold by the simulation or the course instructor, or over estimated by the students. Only the learning points of how to set prices and how to solve business problems were undersold.

CONCLUSIONS

This paper undertook to explain some of the factors that lead to students having their expectations either being unmet or exceeded. Care needs to be taken when using business simulations in the classroom. Overstating what can be learned from playing a business game is very easy to do. When aggregate measures are used a lot of dissatisfaction may be hidden. In the case analyzed above, the averages all pointed to expectations being exceeded, bu when individual students' data were analyzed, it showed no single learning point without some students feeling they had unmet objectives.

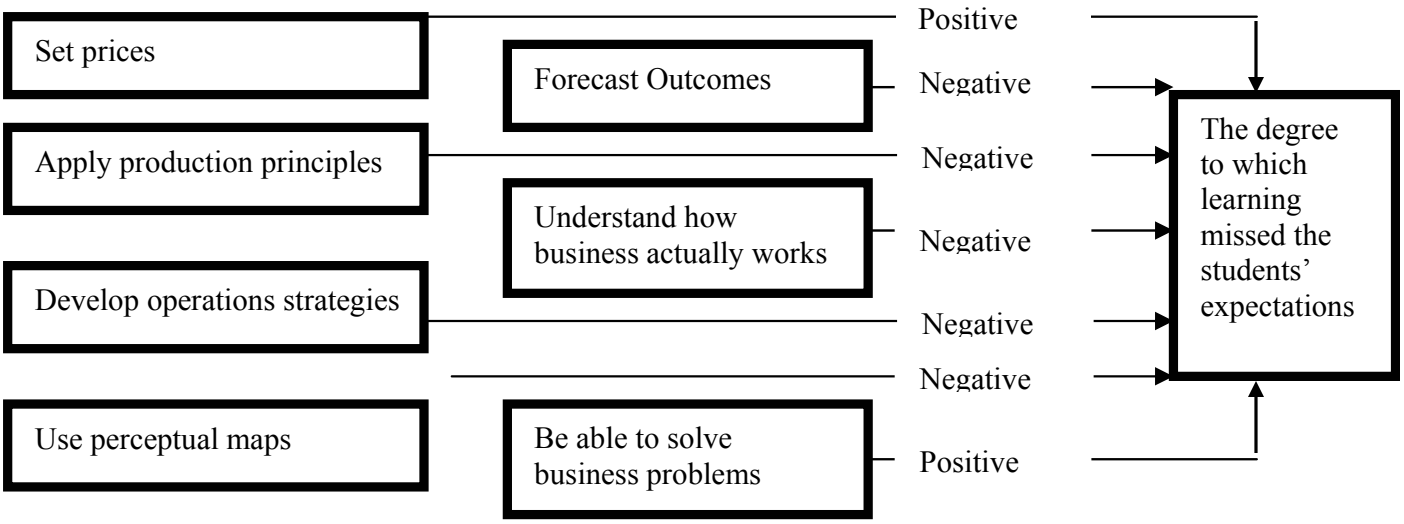
A BIT OF CAUTION WHEN INTERPRETING THE RESULTS

A bit of caution needs to be applied in interpreting the results. There is a confounding factor between the instructor and the game. That is, the degree to which student learning expectations is exceeded or not met is a function of multiple causes. The specific simulation used in the class may cause this mismatch between expectations and outcomes or it could be caused by the quality of the instruction or it could be caused by the nature of the students in the class. There are likely other possible causes as well. In this paper, no attempt will be made to partition the causes of the differences between expectations and outcomes.

Table 10. Relating expected learning and actual learning variable to unmet expectations

The dependent variable:	The degree of missed expectations	The adjusted $R^2 = 0.579$
The independent variables:	"p" value	Beta Coefficients
Set prices	0.076	0.256
Apply production principles	0.143	-0.201
Develop operations strategies	0.022	-0.344
Use perceptual maps	0.016	-0.354
Forecast Outcomes	0.090	-0.292
Understand how business actually works	0.023	-0.362
Be able to solve business problems	0.018	0.369
Understand how business really works	0.966	0.007
Forecast outcomes	0.347	-0.133
Significance of the regression Equation: < 0.0005	Note that the first two variables have "p" values greatly exceeding the traditional 0.05 level.	

Figure 4 The model of missed student expectations.



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