

# Developments in Business Simulation & Experiential Exercises, Volume 9, 1982

## A PEDAGOGICAL APPROACH TO BUSINESS GAMING FOR THE COMMUTER STUDENT

C. Richard Huston, Louisiana Tech University  
Edmond L. d'Ouille, Indiana University Northwest  
T. Hillman Willis, California State University, Fresno

### ABSTRACT

Administering a computer-based simulation to nonresidential students presents a number of problems that are unique to the commuter campus setting. This paper shares the authors' experiences in dealing with these problems and presents the approaches they have developed to organize teams and evaluate performance.

### INTRODUCTION

The typical commuter campus environment is one in which a high percentage of students are employed on a full-time basis, taking coursework primarily in the evening and spreading their degree programs over longer periods than four years.

In these circumstances, the administration on a business game presents a number of novel problems, and the significance of the course in the curriculum takes on new dimensions. The principal problems which we propose to discuss in this paper are those associated with the selection of student teams and the evaluation of student performance. Before describing the specific details of our approaches and our experience with them, however, it seems appropriate to outline the course in general and to mention the role which it appears to play on "commuter" campus.

The game we have used most often in the simulation is INTOP (International Operations Simulation). This is a highly complex game that affords the administrator a great deal of flexibility in its application. There are twelve possible product/market combinations and numerous opportunities for intercompany transactions between the student teams. Each company has the opportunity to purchase a wide range of marketing research services and is also required to join the "World Federation on Appliance Manufacturers." Membership in the organization carries with it a subscription to the "Gazette," which is the Federation's newspaper, published by administrators for each of the twelve decision periods over which the game is played. This is the principal vehicle through which the students obtain a variety of information from the administrators about the simulated economic environment of the game.

At the "commuter" campus, we have found that it is both necessary and desirable to place a heavy emphasis on the managerial accounting aspects of the game. The typical student takes his required accounting coursework early in his program along with his general education courses and arrives in the simulation courses after an intervening period of several years with only faint recollection of accounting principles. This course requires the student to reestablish his understanding of accounting. For each decision period, the student team is required to prepare and submit a detailed cash budget for the following period. The preparation of this budget required not only a forecast of sales revenue in conjunction with the pricing of his products, but also an understanding of the behavior of manufacturing costs. Additionally, a detailed budgeted income statement is

prepared, emphasizing the difference between net profit and cash flow for a period. Considering that these requirements are imposed for each of twelve accounting periods and that a concluding aspect of the game is an "audit" of the operations of each team by another team, the course becomes almost an applied course in managerial accounting. However, the traditional values of a business game, group decision making, negotiation, dealing with uncertainty and behavioral interactions between teams and its members are not lost, but rather enhanced by the emphasis.

### TEAM ORGANIZATION

The first problem a game administrator faces is that of organizing teams in such a way that the talent is equitably distributed and the students are satisfied with the composition of their groups. The emphasis upon accounting knowledge and the presence of accounting majors in the student group accentuates this problem in our case. Several methods have been tried and found to be inappropriate for one or more reasons. If the students are allowed to organize their own teams, the talent is very seldom fairly distributed; some teams get all exceptional students, some teams have no accountants, and so forth. If the administrator randomly selects the teams the same types of problems arise.

An obvious solution would appear to be for the administrator to stratify the students by major and grade average and then assign or randomly select teams. This approach has been tried and found to suffer from one serious problem that may be unique to a commuter campus--namely, the student's class and work schedules conflict to the extent that it is impossible for the team members to meet outside of class.

In order to overcome these problems, we have adopted the following technique of organizing the teams. The first two weeks of class are devoted to discussion of the rules of the game. A rules test is given the following week. If, for example, there are to be nine teams in the class, then the nine students scoring the highest grades on the rules test are designated as team organizers. All students in the class fill out questionnaires which provide information on grade point, major, preference for meeting times, and career objectives. The questionnaires are coded so that the student's name is not disclosed. The team organizers are then given \$100,000 each to bid for team members using the information from the questionnaires as a basis for their selections.

Once the teams are selected, they formally organize by voting for a president and establishing job responsibilities for each member of the team. Each member of the team has a number of voting shares of stock in the corporation equal to his score on the first test. After the first organizational meeting, teams may trade member and/or buy members from other teams. The cash involved in the transaction is subtracted from and added to the original capitalization of each company.

After the fourth decision period, the president has

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the authority to fire any members of his team whose performance ~s not satisfactory. By die same token, any member of a team including the president can be discharged by a vote of team members holding a majority of stock in the company. A second test is given approximately half-way through the semester and the voting stock in the company is adjusted after this test. That is, each member's shares of stock will equal the total of his scores on both tests.

This approach has been followed in organizing teams with excellent results. There are far fewer complaints from the students inasmuch as they have some control over the composition of their teams. The schedule conflicts have been eliminated, and most teams spend a considerable amount of time in meetings outside of class. Surprisingly, we experienced a minimal amount of trading of team members after the initial auction. No one was fired, although the threat of firing proved to be an excellent motivational device. Several students' performance has improved considerably after their teammates threatened to fire them; also more than one president has been demoted by a majority vote of his stockholders.

For the most part, the talent is evenly distributed although the bidding process has produced some unexpected results--a bargain hunting organizer ending up with a five-man team while the other eight teams in the class had only two or three members. The one problem that has arisen involved an outstanding student falsifying his grade point average on the placement questionnaires so that his friends could purchase him with a relatively low bid. This gave us the opportunity to hold a trial early in the semester, and the outcome discouraged future students from attempting the same ruse.

### PERFORMANCE EVALUATION

Assigning grades to students in a situation where the simulation comprises all or a large part of the content of the course poses another problem for the instructor. It is difficult to evaluate the performance of the individual teams inasmuch as there is a certain amount of luck involved in the playing of any game, and simulation is no different from football in that respect, as the random number generator most certainly does not dole out the good bounces on an equitable basis. Some teams seem to make all the right decisions for the wrong reasons while other teams make bad decisions early in the game or disastrous mistakes in filling out on their forms which put them in a position where they spend the entire course trying to overcome the effects of their early mistakes. In order to eliminate these types of problems, we have developed an evaluation system that goes a long way toward minimizing the effect of luck upon the evaluation of team performance.

#### Forecasting Accuracy

The formalized forecasting procedure incorporated into the simulation wherein, as previously mentioned, each team is required to complete a forecast of demand and production costs as well as prepare a cash flow and proforma income statement for each period of the simulation, proves of great value in this context. The forecasting and budgeting process imposes a disciplined framework within which the student engages in decision making.

This highly structured decision-making process offers several advantages. It eliminates any doubts as to which teams are thoroughly planning their decisions, and which teams are merely lucky. The forecasting results also provide a convenient input for an evaluation measure that ranks team performance each decision period. We have used evaluation techniques that combine measures of forecasting accuracy, operating efficiency, and profitability. For example, each decision period, a computation is made of the percentage

error in the team forecasts of:

1. Variable Manufacturing Costs;
2. Net cash flow by location;
3. Net income from operations;
4. Return on investment; and
5. Sales by product and territory.

The teams are then given an overall ranking based upon their forecasting accuracy. They are also ranked upon the results achieved by their decisions in such areas as selling expenses, short-term investment of excess cash, asset turnover or utilization of capacity, inventory management and profitability. The forecasting and performance measures are then combined into a single ranking index for each team which is published in the Gazette every decision period. A computer program is used For the computation of the individual performance measure so that both the administrator and the students receive these results along with the ordinary output from the game.

The one problem encountered in the use of these ordinal measures is that they do not provide a relative measure of team performance, and the ranking system can produce inequities where there are either very great or small differentials in individual performance of near ranked teams.

#### Dimensional Analysis Performance Index

Consequently, we have experimented with the use of dimensional analysis as a technique for the development of a single measure of team performance. Dimensional analysis is a mathematical technique that provides a means of combining several criteria of different dimensions and varying relative importance into a single dimensionless entity [1,2]. This technique has been used extensively in engineering and physics but has had limited application in the administrative sciences.

In our application here, the dimensional analysis model can be stated as:

$$PI_j = \sqrt[n]{\sum_{i=1}^n \left( \frac{X_{ij}}{\bar{X}_i} \right)^{w_i}} \quad (1)$$

Where  $PI_j$  = performance index for team  $j$

$X_{ij}$  = performance criterion  $i$  for team  $j$

$\bar{X}_i$  = mean value of performance criterion  $i$  for all teams

$w_i$  = weight (relative importance) assigned to criterion  $i$ .

$$w = \sum_{i=1}^n |w_i|$$

The dimensional analysis model requires that the performance criteria ( $X_i$ ) and the weights ( $w_i$ ) reflect

<sup>1</sup> For a more complete discussion of the dimensional analysis model, see Houston (3).

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ratio scale values. If the instructor desires to place more emphasis on certain areas of performance, he may assign greater weights to those criteria. Where the criterion measure is inversely related to performance, e.g. percentage error in forecast, a negative weight is assigned that criterion. The major problem we have encountered in applying this model is that the performance criteria ( $X_i$ ) cannot assume negative values; consequently, it is sometimes necessary to rescale criteria measures such as profits, when negative values occur.

While this brief description of our performance measures may appear somewhat complicated, in practice it is relatively simple to compute manually and offers several advantages over single measures often used such as total profits or stock prices. The impact of luck is substantially reduced, and the teams who are not putting forth adequate effort are exposed in short order. Also, teams that make critical decision errors early in the simulation and can never hope to achieve a significant level of profit in the course of the game are still motivated to put forth the effort as they can achieve high rankings in all measures except profitability.

### Team Reports

In addition to team performance, we also use a combination of team reports, individual tests, and peer evaluation in assigning final grades. Early in the simulation, each team is required to prepare a paper in which they formulate their basic strategy and outline the goals they plan to achieve at specified stages of the simulation. They also are required to present the formal organization of their company and write a job description for each member of the team. Annual reports are prepared for each four-quarter period over which the simulation is conducted. The annual reports are extremely valuable as a self-teaching device inasmuch as they force the students to prepare consolidated financial statements and to analyze their performance relative to that of the previous year. For some teams, the annual reports appear to provide excellent training in creative writing as they produce many ingenious explanations as to why their company failed to meet its stated objectives or failed to keep the promises it made to its stockholders in the previous annual report.

Each team in the simulation also conducts a performance audit of another team in the class. All companies are required to keep detailed records of their financial data as well as an account of all decisions made. After the tenth quarter, the company records are turned over to the auditing team and the audits are conducted the following week. The audits consist of an in-class report and a written summary. Following the oral report, the auditee is permitted to offer a rebuttal. The audits typically are the highlight of the semester. The students are usually much more critical in their analysis than an instructor, and the rebuttal period produces some lively discussion.

### Testing and Assigning Individual Grades

There are a wide variety of testing techniques that we have utilized in teaching the simulation. We typically have given two short objective tests and a lengthy final examination. As explained above, the results of the first two tests are incorporated into the process used to organize teams. These tests also appear to be beneficial as they force the student to learn the operating rules of the game at the outset, and although this extra motivation may be unnecessary in some situations, it most certainly has improved team performances early in the simulation.

Probably, the most difficult problem the game administrator faces is determining how much each member contributes to the team performance. We feel that our final examination provides much of this information.

The student is required to complete a cash flow budget and a pro-forma income statement as well as answer essay questions designed to test his knowledge of the functional relationships of the simulation. Experience has shown that the student who puts a considerable amount of work into the course scores very high on the exam while the student who has let the other members of his team to all of the work cannot begin to complete the cash flow and pro-formas income statements and scores an extremely low mark. We also use peer evaluation by team members for the purpose of distinguishing the relative contributions of team members. However, the peer evaluation approach does not appear to produce very precise results as many students exhibit a reluctance to penalize their colleagues even in instances where such a team member has contributed almost nothing throughout the course.

### REFERENCES

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