

CONSIDERATIONS FOR THE USE OF
COMPUTERIZED BUSINESS SIMULATIONS

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The authors have employed various management simulations to augment student interest and learning in both introductory and upper division courses. During the past year they developed and wrote a management simulation game (ADSIM: Administrative Simulation) with the purpose of (1) improving upon the decision-making aspects of the existing computer games and (ii) reducing certain of the “costs” associated with utilizing business simulations in introductory management courses. It was with special interest, therefore, that the authors read the literature outlining the benefits of the simulation approach to learning. Such evidence, given the state of the art, is necessarily inconclusive. The inconclusive nature of the evidence notwithstanding, previous empirical research has been limited in both scope and direction. Extensive attention has been paid to potential benefits, to the exclusion of pertinent costs. Our purpose is an attempt to regain a balanced perspective. This task requires that attention be paid to both costs and benefits associated with the use of simulations. The contribution of this article lies not with the data, for they are, of necessity, exploratory, but rather with its orientation.

From the use of ADSIM and other simulations, the authors have observed the typically reported instructional benefits. These benefits include:

- (1) The acquisition of threshold levels of understanding of Accounting, Finance, Economics and Management.
- (2) The recognition of and appreciation for the interrelationships of managerial decisions.
- (3) The stimulation of interest and enthusiasm for management as a discipline.

A less obvious benefit is the use of decision-making teams as focal points for lectures, discussions and written assignments on such topics as leadership, organization design and work group dynamics. During the past year the authors have successfully experimented with this dimension. At appropriate times during the semester, students were required to write analyses of group structure, group leadership, and group member roles (e.g. building, blocking, maintenance). In addition, students were expected to develop and analyze a sociogram representing the degree of member interaction. Such detailed assignments are of limited effectiveness within the context of trivial-task ad hoc work groups.

In addition to such alluring benefits, the authors have become aware of a number of “costs” associated with the use

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of simulations. These costs are both explicit and implicit. Explicit costs include the allocation of instructional resources (e.g. computer time, instructor time, student out-of-class time, material costs and course content adjustment). Implicit costs include heightened levels of anxiety and frustration, evidenced on occasion by students withdrawal from the group and, in some instances, from the course. The extent and underlying causes of such implicit costs are of particular interest to the authors and in part prompted this study.

METHODOLOGY

Subjects were one hundred and fifty-two students taking the introductory course in Management at the State University of New York College at Geneseo during the Fall Semester, 1977. These students were drawn from five different sections across four different instructors. All sections actively used one of two management decision-making computer simulations available (ADSIM, The Executive Game) [3,5]. Students were randomly assigned to teams (firms) of five to six people and provided with approximately five hours of lecture instruction on the mechanics of the appropriate simulation. In all sections the simulation comprised a major portion of the course (approximately one third of both class time and final grade).

A questionnaire was administered at the end of the semester. The questionnaire contained a number of 5-point Likert Scales designed to measure the degree of frustration, involvement, and confidence experienced by the student during particular periods of the simulation (i.e. trial period, first and subsequent quarters [25%] of play). In addition, certain simulation-related factors assumed a priori to contribute to participant frustration and confidence were examined. Demographic information was also collected (sex, academic year, group size, academic major, previous business coursework, final team ranking, out of class time commitment).¹ Open-ended questions dealing with possible frustration-instigated behavior were also included.

RESULTS

A summary of some of the most interesting results of the study are presented briefly in this section.

Consistent with a priori assumptions, the mean active involvement increased throughout the simulation. See table 1.

¹ Although this information if not reported in this paper it may be obtained from the first author.

TABLE 1

DEGREE OF ACTIVE INVOLVEMENT IN SIMULATION

Time Periods	Mean Response ^a	Coefficient of Variation (%)	95% Confidence Interval
Trial periods	3.50	33.21	3.31 to 3.69
First 25% of Simulation	3.67	29.29	3.47 to 3.81
Second 25% of Simulation	3.82	25.74	3.67 to 3.98
Third 25% of Simulation	3.93	24.18	3.78 to 4.08
Last 25% of Simulation	3.97	27.62	3.80 to 4.15

^a
1 = No involvement, 5 = Very involved

Table 2 indicates, coincident with a priori expectations, that the degree of confidence in ability to make managerial decisions increased significantly with additional simulation experience.

TABLE 2

DEGREE OF CONFIDENCE IN YOUR ABILITY TO MAKE MANAGEMENT DECISIONS

Time Periods	Mean Response ^a	Coefficient of Variation (%)	95% Confidence Interval
Trial periods	2.35	51.56	2.16 to 2.55
First 25% of Simulation	2.84	37.52	2.67 to 3.01
Second 25% of Simulation	3.32	29.54	3.16 to 3.47
Third 25% of Simulation	3.57	26.36	3.43 to 3.74
Last 25% of Simulation	3.78	25.98	3.63 to 3.94

^a
1 = No confidence, 5 = Very confident

Table 3 summarizes the factors leading to increased confidence in decision-making ability in descending order by response mean.

TABLE 3

FACTORS AFFECTING CONFIDENCE

Factors	Mean Response ^a	95% Confidence Interval
Ability to work with team members	3.83	3.65 to 4.00
Team discussions	3.71	3.53 to 3.89
Team performance - ranking	3.59	3.40 to 3.78
Worksheets ^b	3.56	3.36 to 3.77
Trial periods	3.20	3.00 to 3.40
Course content other than simulation	2.93	2.74 to 3.12
Relationship with other courses	2.81	2.58 to 3.03
Workbook or "blue book" ^c	2.51	2.28 to 2.74

^a
1 = Did not contribute at all, 5 = Contributed very significantly

^b
In both simulations forecasting worksheets are provided and are an integral component of the decision-making process.

^c
Workbooks (or "blue books") were employed by two instructors to facilitate ex post analysis. Missing values for the other instructors' courses were excluded from analysis.

Table 4 summarizes the students' reported mean frustration, over time. While there is weak evidence suggesting a decline in frustration, it is clear that there is a substantial degree of variability in subject response.

TABLE 4

DEGREE OF FRUSTRATION WITH THE SIMULATION

Time Periods	Mean Response ^a	Coefficient of Variation (%)	95% Confidence Interval
Trial periods	3.04	51.48	2.79 to 3.29
First 25% of Simulation	3.09	39.80	2.90 to 3.29
Second 25% of Simulation	2.87	37.71	2.69 to 3.04
Third 25% of Simulation	2.82	45.04	2.61 to 3.02
Last 25% of Simulation	2.73	53.48	2.50 to 2.96

^a 1 = No frustration, 5 = Very frustrated

Figure 1 summarizes the trends throughout the simulation for the degree of involvement, frustration and confidence associated with the decision-making experience.

FIGURE 1

TRENDS OF INVOLVEMENT, FRUSTRATION AND CONFIDENCE THROUGHOUT SIMULATION

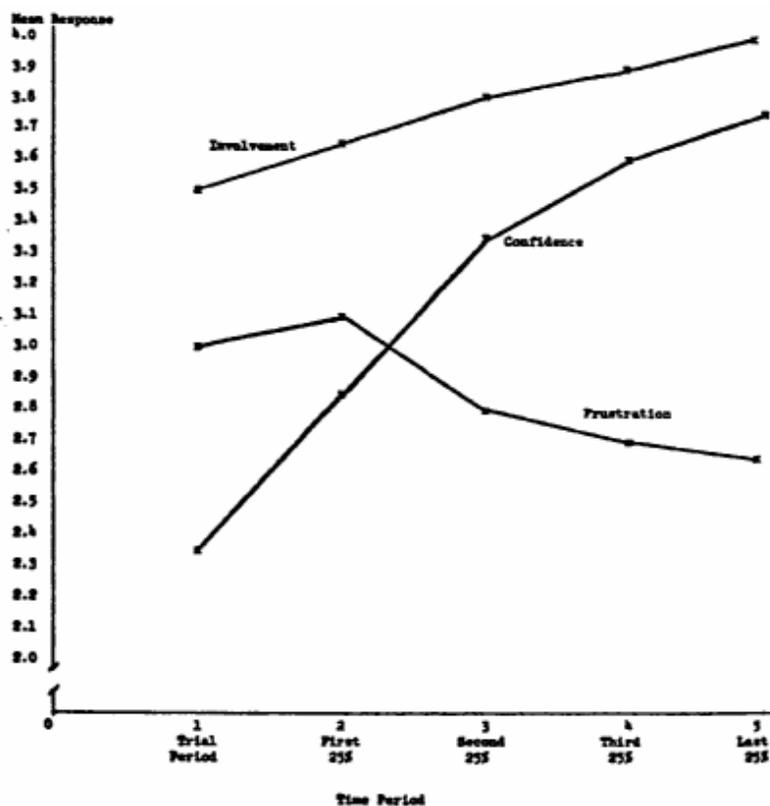


Table 5 presents in descending order of importance the various components of frustration.

TABLE 5
COMPONENTS OF FRUSTRATION

Factors	Mean Response ^a	95% Confidence Interval
Understanding reasons for performance	3.29	3.07 to 3.50
Understand decision interrelationships	3.22	3.02 to 3.42
Team performance - ranking	3.05	2.82 to 3.28
Worksheets ^b	2.94	2.72 to 3.16
Team discussions	2.72	2.49 to 2.95
Workbook or "blue book" ^c	2.56	2.32 to 2.81
Economic skills required	2.45	2.26 to 2.63
Accounting skills required	2.19	1.99 to 2.40
Relationship to other courses	2.00	1.79 to 2.21
Computer skills required	1.67	1.49 to 1.84

^a 1 = Did not contribute at all, 5 = Contributed very significantly

^b In both simulations forecasting worksheets are provided and are an integral component of the decision-making process.

^c Workbooks or "blue books" were employed by two instructors to facilitate ex post analysis. Missing values for the other instructors' courses were excluded from analysis.

Subjects were asked to indicate the time spent outside the classroom on simulation-related activities. The mean time spent per week outside the classroom was approximately 2 hours per student. This time commitment exceeded the *a priori* expectations.

The following comments are excerpted from open-ended questions concerning the benefits and "costs" of the simulation usage. The inclusion of these comments may be a better indication of the true nature of the feelings of selected subjects as opposed to the numerical responses reported above.

Positive Comments

"ADSIM has been a very worthwhile experience for me. In learning more about the management processes, I also learned a lot about myself and other people--how to be more responsible myself and how to trust and depend on others."

"The game taught me a lot about myself, it showed me strengths that I hadn't realized, and, also revealed to me my weaknesses and limitations."

Negative Comments

"I thought I'd never understand enough to make good decisions thus I participated very little." something must be done. I don't want anyone else going through the agony we did."

"...we could not maintain, no matter how hard we tried, a high ranking."

"What a stupid game. I skipped class."

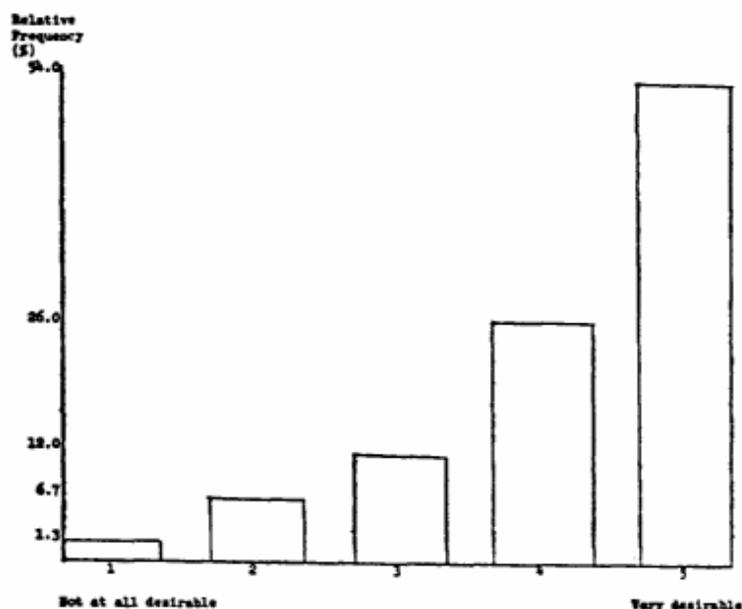
"I thought that our whole objective was ruined because of a keypunching error."

"I considered dropping the course. I would make suggestions and the group would reject them without considering them. I had given these ideas a lot of thought."

Figure 2 presents the overall assessment of the desirability of the simulation. It should be noted that 80% of the respondents classified the simulation as either desirable or very desirable.

FIGURE 2

DESIRABILITY OF SIMULATION



DISCUSSION

The primary purpose of this study was to investigate some of the implicit costs associated with the instructional use of simulations. The reported patterns of confidence, involvement and frustration, although weak, are to some degree comforting. However, the very nature of the aggregation process subordinates the “exception.” As a consequence, such data warrant cautious assessment. This caveat is underscored by the intensity of the negative comments generated by the open-ended questions. It is perhaps the isolated individuals whose confidence and involvement declined, and whose frustration increased, that warrant special consideration. Even the very positive acceptance of the simulations does not excuse the failure to address the problem of frustration at an individual level.

Based on the data there appear to be three underlying sources of frustration. They are:

- (1) Difficulty understanding the economic and managerial interrelationships (e.g. reasons for team performance).
- (2) Interpersonal conflict among group members.
- (3) Administrative and clerical problems (e.g. keypunching errors, distortions in the simulation environment due to unrealistic decisions).

The authors suggest judicious application of the following measures and techniques to minimize frustration:

- (1) Extended trial periods with classroom discussion and full disclosure.
- (2) Special out-of-class sessions and increased instructor

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- availability to aid in game start-up.
- (3) Open class discussion dealing with the inevitability and resolution of interpersonal conflict.
 - (4) The inclusion of an “override option” allowing the administrator to control the number of decision variables and, as a consequence, the number of interrelationships. Such an option has been included in ADSIM for this purpose.
 - (5) Special attention in the development of simulation “software” to limit distortions arising from either keypunching errors or unrealistic decisions.
 - (6) The inclusion of a function designed to minimize the long-, run consequences of an inferior decision made early in the simulation. A variant of this function was incorporated in ADSIM.

It is hoped that this presentation motivates practitioners to be cognizant of frustration as an implicit cost and to investigate measures to limit it. In addition, it is hoped that this exploratory effort generates researcher interest in the area of implicit costs.

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