

Developments In Business Simulation & Experiential Exercises, Volume 17, 1990

AN EMPIRICAL EVALUATION OF THE PEDAGOGICAL VALUE OF PLAYING A SIMULATION GAME TN A PRINCIPLES OF MARKETING COURSE

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ABSTRACT

The present study, using a controlled setting based on three game-status groups (2-member teams, single players, and nonplayers), sought to determine whether incorporating a business simulation game in a principles of marketing course improves the acquisition of marketing knowledge. The results suggest that simulation games are an effective means by which to improve quantitative skills in the 2- member team versus the nonplayer condition and the acquisition of theoretical knowledge in the single player versus the nonplayer condition. No differences in the acquisition of applied knowledge across game-status groups were identified.

INTRODUCTION

Since their first appearance over thrifty years agog the number, variety, and usage of business games have grown enormously (Horn and Cleaves 1980). At the present time, over 200 business games are being used at more than 95 percent of the AACSB member schools (Faria 1987). Empirical research on business gaming has also been extensive. Comprehensive reviews can be found in Greenlaw and Wyman (1973), Keys (1976), Wolfe (1985), and Miles, Biggs, and Schubert (1986).

Despite the proliferation and widespread usage of business games in business programs, a review of the literature reveals that the pedagogical value of such games still remains unclear. Are such games a needless time-consuming activity for both students and instructors, or are they an effective vehicle for the achievement of specific educational objectives? In particular, can the use of such a game in a principles of marketing course improve the acquisition of marketing knowledge?

There is no question that in an introductory marketing course a student faces the task of trying to learn a great deal of new material in a limited time. Lectures and readings generally form the foundation of such a course. Often, however, the instructor will add cases, a simulation game, reports, or various other types of assignments to the requirements of a course with the intent of accomplishing some specific pedagogical objective. Rut do any of these supplemental approaches improve the student the acquisition of the basic material of the course?

The present study specifically sought to determine whether incorporating a business simulation game in a principles of marketing course improves the students performance on the final exam of the course. Other potential benefits of game playing, such as engaging in interpersonal interaction or developing analytical skills, were not investigated.

PAST RESEARCH

A great deal of research activity has accompanied the development of business games and their increased usage. Such research has generally been concerned with (1) identifying the factors that affect the simulation environment [e.g., see Edge and Remus 1984; Faria 1986; Remus and Jenner 1977; Rotter 1966; Rowland and Gardner 1973; and Wolfe 1978], (2) the learning aspects of this form of instruction [e.g., see Cangelosi and Dill 1965; Edwards 1987; Greenlaw and Biggs 1974; and Whiteley and Faria 1989], and (3) the relative educational benefits of simulation games versus other approaches to teaching [see reviews of literature by Greenlaw and Wyman 1973; Keys 1976; Miles, Biggs, and Schubert 1986; and Wolfe 1985].

The analyses presented in the four cited reviews lead to the conclusion that the evidence as to whether business simulation games are a more effective teaching tool than other instructional approaches is inconclusive. Greenlaw and Wyman (1973) concluded that there existed little clear evidence to indicate what was learned from business games or whether business games were a superior, or even adequate, method of instruction. Wolfe (1985) updated the Greenlaw and Wyman (1973) study and concluded that, because of the wide variety of study conditions utilized. (e.g., simple versus complex games, different methods of end-of-course evaluations employed), definitive conclusions about gaming effectiveness could not be reached. Miles, Biggs, and Schubert (1986) concluded that, while students believe that they learn as much or more from business games as from cases, the results are mixed and nearly difficult to interpret and compare because of the wide variety of study environments employed.

Keys (1976) reviewed fifteen studies that compared simulation game sections of a class with sections using some other form of instructional approach. The review was limited to studies that employed a rigorous or controlled design and used some form of end-of- course examination as the focus of comparison. Six of the comparisons involved end-of-course case analyses; six involved end-of-course essay exams; two used a true-false final exam; and one used a multiple-choice final exam.

In the studies using a case final examination, the results showed no performance difference between simulation and nonsimulation sections in four of the studies while the simulation section outperformed the nonsimulation section in two of the studies. In the six studies involving an essay final examination, the simulation section students scored higher in four instances, case section students scored higher in one instance, and there was no difference between the simulation and nonsimulation sections in the other. In the true-false final examination studies, the simulation sections outscored the case sections in both studies. The case group, however, outscored the simulation group to the one study using a multiple-choice final exam.

Developments In Business Simulation & Experiential Exercises, Volume 17, 1990

Using a slightly different group-comparison approach, Whiteley and Faria (1989) found that playing a simulation game in an undergraduate, introductory marketing course is at least in one way better than not playing. Students who played the game on three- or four-member teams scored significantly higher on the quantitative questions on the multiple-choice final exam than those who did not play the same (game participation was optional). There were no differences between the two game-status groups on the applied and theoretical exam questions.

One of the uncertainties associated with the interpretation of the results of the Whiteley and Faria (1989) study had to do with the assessment of the quantitative skills of the respondents prior to the running of the same. While an analysis of the midterm exam scores revealed no differences in performance between the same and non-same groups on the applied and theoretical questions (participation in the game started after the midterm exam), no parallel analysis could be carried out with respect to the quantitative area because no questions of this type were included in the exam. Nonetheless, it was concluded that it was unlikely that those who had better quantitative skills but comparable applied and theoretical knowledge had chosen to play the game versus not play the same. The need for further research to clarify this latter issue was stressed.

STATEMENT OF PURPOSE

Overall, the findings from the four review studies and the Whiteley and Faria (1989) study lead to the conclusion that the evidence as to whether business simulation games are a more effective teaching tool than other approaches is inconclusive. The purpose of the present study is essentially to attempt to clarify, from a learning point-of-view, the appropriateness of using this instructional approach to a principles of marketing course.

The study is, in part, a replication of the Whiteley and Faria (1989) study. In the present study, however, the student's applied, theoretical and quantitative skills were measured prior to the start of the simulation competition. This more comprehensive pretest control allowed for a better assessment of the contribution to learning brought about by simulation game participation.

METHODOLOGY

Subjects

Seventy-three students from the same section of an undergraduate principles of marketing course served as the respondent base for the study. Prior to the midterm exam, the students in the class were given the opportunity to sign up to play a simulation game entitled **LAPTOP: A MARKETING SIMULATION** (Faria and Dickinson 1987). Seventeen students decided to play the game alone; 38 decided to play in two-member teams; and 18 students chose not to play at all.

In order to encourage participation, each student had the opportunity to earn a 5 percent bonus grade. This grade was to be based on individual and team (where appropriate) results. The bonus grade was eventually added to the student final grade in the course (i.e., the grade based on the midterm and final exams). Offsetting the potential for bonus points was the time required by the student to read and understand the same, to make decisions, to

analyze the period-to-period results.
Procedure

The students who chose to play the LAPTOP game were randomly assigned to specific industries/companies. The players for the two-member teams were randomly assigned to teams if they did not want to select their own partners.

Participation in the same required the submission of five weekly decisions. The first decision served as the trial period. The actual competition was based on the remaining four decisions. The first decision was not due until after the midterm exam.

The specific decision required in the game relate to the areas of price, advertising, sales promotion, production level, research and development, and marketing research. The players in the game manufacture two models of laptop computers which are, in turn, sold to retailers in two geographical markets.

Design

Independent variables. A 3 x 3 factorial design was used to analyze the data, with the first variable being a between subjects variable and the second variable being a within subjects variable.

The between subjects variable, Game Status (GS), has three levels no play, play alone, and team play. As previously indicated, 18 students were in the no play condition, 17 students were in the play alone condition, and 38 students were in the team play condition.

Question-Type (QT) on the final exam served as the within subjects variable. The question-types on the final exam were applied (20 questions), theoretical (23 questions), and quantitative (15 questions). [The description of each question-type and the means of classification are described later.]

Covariates. Each question-type on the midterm exam served as a covariant for the corresponding question-type on the final exam in order to reduce the level of experimental error. The expectation of a high correlation between the midterm and final exam grades, the structural consistency between the two exams, and the inability to randomly assign students to the various game-status groups indicated the need for this additional control.

The midterm exam contained 17 applied questions, 16 theoretical questions, and 5 quantitative questions. In order to give equal weighting to each question-type, the student's percentage grade for each question-type was calculated. These scores were converted to z-scores before being used as covariant values.

Question classification. In order to determine the question-type classification of each of the multiple-choice questions on the midterm and final exams, five faculty members, all of whom have taught principles of marketing, were asked to classify each question. The faculty members were asked to classify the question as quantitative if they felt that it requires a knowledge of or use of a computational approach to arrive at the correct answer, to classify the question as applied if they felt that marketing knowledge is required to understand the scenario (or situation) described, or to classify the question as theoretical if they felt that it focuses on one's

Developments In Business Simulation & Experiential Exercises, Volume 17, 1990

knowledge of a particular theory or concept (but excludes computations and applied scenarios).

Dependent variable. The grade on the final exam served as the dependent variable. More specifically, the students normalized percentage grade (i.e., z-score) for each question-type was used instead of the raw score in order to give equal weighting to each question-type and to remove any question-type performance differences for the sample as a whole (i.e. the question-type main effect was eliminated). The latter adjustment was deemed appropriate since within-group differences of this nature were not of interest in the present study.

RESULTS

The data were analyzed using the analysis of covariance option in the BMDP2V computer program package. When significant differences were uncovered in the analysis of covariance, each pairwise contrast was investigated using the FOLUP program developed by Yancey et al. (1979).

Assumptions of the Analysis of Covariance Model

The transformed data (i.e., z-scores) met all of the assumptions of the analysis of covariance model. The p-values were greater than .05 for (1) Bartlett's test for the homogeneity of the mean squared errors that are pooled for the within error terms; (2) the chi-square 1, 2, and 3 values; and (3) Bartlett's test for the homogeneity of variance across groups. The analysis of variance of regression coefficients across groups based on the relationship between the covariant and the dependent variable indicated the presence of a common slope for each question-type and the total grade [applied questions $F(4, 67) = 0.69, p > .05$; theoretical questions: $F(4, 67) = 1.54, p > .05$; quantitative questions: $F(4, 67) = 2.40, p > .05$; total grade: $F(4, 67) = 1.08, p > .05$]. Further, the existence of a linear relationship between the covariant and the dependent variable across all respondents was supported in all cases [Regression analysis for applied questions, $F(1, 71) = 46.81, p < .001, R^2 = .40$; for theoretical questions, $F(1, 71) = 78.78, p < .001, R^2 = .53$; for quantitative questions, $F(1, 71) = 25.09, p < .001, R^2 = .26$; for total grade, $F(1, 71) = 99.03, p < .001, R^2 = .58$]. This latter conclusion was also supported by a visual analysis of the corresponding normalized probability plots of the residuals and a test of polynomials which indicated that a first-degree equation was the most appropriate in each case.

Analysis of Covariance of Final Exam Scores

The results of the analysis of covariance carried out on the final exam scores are presented in Table 1.

The significant F-values for the covariates indicate that the performance levels across the game-status groups were not the same on the midterm exam and that the performance level on the midterm exam is related to the performance level on the final exam (see Tables 2 and 3). Using the midterm exam as a covariate was therefore an effective means by which to achieve greater pre-game equality across groups and thereby reduce the level of experimental error.

The failure to obtain significant results for the Game Status (GS) main effect means that playing the game, either along or on a team, versus not playing the game did not help or hinder a student's overall performance on the final exam.

The nonsignificant result for the Question-Type (QT) main effect was expected because of the nature of the transformations performed on the data.

TABLE 1
ANALYSIS OF COVARIANCE OF FINAL EXAM SCORES WITH
MIDTERM EXAM SCORES BY QUESTION-TYPE
AS THE COVARIATE

| Source of variation | df | MS | F |
|-----------------------------------|-----|-------|---------|
| Between groups of subjects | | | |
| Covariate | 1 | 63.63 | 70.78** |
| Game status (GS) | 2 | 0.84 | 0.93 |
| Error | 69 | 0.90 | |
| Within subjects (groups) | | | |
| Covariate | 1 | 4.60 | 12.07** |
| Question-type (QT) | 2 | 0.30 | 0.80 |
| GS x QT | 4 | 4.87 | 3.19* |
| Error | 139 | 0.38 | |

* $p < .05$. ** $p < .001$.

TABLE 2
MEAN STANDARDIZED (Z-SCORES) MIDTERM EXAM SCORES

| Question-type | Game status | | |
|----------------|--------------------------|-----------------------|---------------------|
| | Played alone (n = 17) | Team play (n = 38) | No play (n = 18) |
| Applied | 0.62 (0.80) | -0.06 (0.96) | -0.46 (1.00) |
| Theoretical | 0.54 (0.92) | -0.08 (1.00) | -0.35 (0.90) |
| Quantitative | 0.56 (0.37) | 0.05 (0.92) | -0.64 (1.23) |
| [Overall mean] | 0.57 (0.60) | -0.03 (0.75) | -0.48 (0.88) |

Note: Standard deviations are shown in parentheses.

TABLE 3
PEARSON PRODUCT-MOMENT CORRELATIONS BETWEEN
MIDTERM AND FINAL EXAM SCORES

| Question-type | Game status | | |
|---------------|--------------------------|-----------------------|---------------------|
| | Played alone (n = 17) | Team play (n = 38) | No play (n = 18) |
| Applied | .33 | .59** | .74** |
| Theoretical | .57* | .72** | .73** |
| Quantitative | .08 | .37* | .62* |
| [Overall] | .41 | .77** | .83** |

* $p < .01$, one-tailed. ** $p < .001$, one-tailed.

The significant result for the Game Status (GS) x Question-Type (QT) first-order interaction indicates that the performance level on each question-type was not the same across the three game-status groups. In particular, the follow-up analysis indicates that, with respect to the applied questions, all groups

Developments In Business Simulation & Experiential Exercises, Volume 17, 1990

performed equally well (see Table 4). However, with respect to the theoretical questions, the analysts indicates that those who played the game alone performed better on these questions than those who did not play the game (see Table 4). There were no other significant between-group differences for this question-type. For the quantitative questions, those who played the game in teams performed better than those who did not play the same (see Table

TABLE 4
MULTIPLE COMPARISONS (VIA TUKEY WSD TECHNIQUE) OF
FINAL EXAM SCORES OF THE GAME STATUS (GS) X
QUESTION-TYPE (QT) INTERACTION EFFECT

| Question-type | GS pairwise contrast | Means compared | Obtained t-value |
|---------------|--------------------------|-----------------|------------------|
| Applied | Played alone - No play | 0.32 - (-0.20) | 2.08 |
| | Played alone - Team play | 0.32 - (-0.05) | 1.70 |
| | Team play - No play | -0.05 - (-0.20) | 0.73 |
| Theoretical | Played alone - No play | 0.38 - (-0.23) | 2.40* |
| | Played alone - Team play | 0.38 - (-0.06) | 2.02 |
| | Team play - No play | -0.06 - (-0.23) | 0.77 |
| Quantitative | Team play - No play | 0.22 - (-0.45) | 3.16* |
| | Team play - Play alone | 0.22 - (-0.03) | 1.15 |
| | Play alone - No play | -0.03 - (-0.45) | 1.68 |

Notes: $df = 174$, critical t -value = 2.36, and $FWI = .05$.
 $MS_{\text{error, cells}} = 0.55$ was used as the error term. "*" indicates pairwise contrast is significant.

4). There were no other significant between-group differences for this question-type.

DISCUSSION

The purpose of the present study was to determine if playing a marketing simulation game in a principles of marketing course improves a students acquisition of marketing knowledge as measured by the students final exam performance. The results of the study show that overall performance on the final exams and on the applied questions in particular, did not vary as a function of game status. However, with respect to the theoretical questions, those who played the game alone performed better on this type of question on the final exam than those who did not play the game. As for the quantitative questions, those who played the game in teams performed better than those who did not play the game. There were no other between-group differences.

The results for those who played the game in teams versus those who did not play the game are consistent with the results found in the Whiteley and Faria (1989) study. In both studies, no differences in performance were found for the applied and theoretical questions. In both studies, as well, those who played the game in teams scored higher on the quantitative questions than those who did not play the game.

There are two possible reasons for the lack of exam performance differences between these two groups on the applied and theoretical questions. One is that participation in the game did not require the students to significantly draw on the applied and theoretical material covered in the course. All that was required of the participants was for them to make decisions that were primarily of a quantitative nature (e.g., price, sales force size, shipment

quantities, level of advertising). Further, no strategy or post-game performance reports were required. The preparation of such reports would have made it necessary for the students to refer to the appropriate applied and theoretical course material.

A second possible explanation for the absence of differences on the applied and theoretical questions is the fact that only five weekly decisions were required. Had more decisions been required, the results might have been different. A longer game could have given the students a greater opportunity to draw on the applied and theoretical material in the course.

The findings that those who played the game in teams scored higher on the quantitative questions than those who did not play the same is consistent with the nature of the decisions required in the same. By playing the game, the students had the opportunity to practice and apply techniques such as sales forecasting, return on investment, markups, average cost pricing, and breakeven analysis (most of these techniques were tested on the final exam). Those who chose not to play the game did not have that additional practice.

The failure of those who played the same alone to score higher on the applied questions than those who did not play the game can be explained in the same fashion as for the team game-status group. No parallel, consistent explanation, however, can be given as to why only those who played the game alone scored higher on the theoretical questions than those who did not play the game.

There is one possible explanation, though, for why those who played the game in teams scored higher on the quantitative questions than those who did not play the game while those who played alone did not. In the team situation, each member could use the other member as a resources person in order to determine the appropriate means by which to analyze the data. The single player, however, did not have this opportunity for group interaction.

The failure to find a significant difference across game-status groups with respect to the overall final exam grade is a function of the results for each question-type and the equal weighting given to each type. Since none of the groups showed a dominance in performance for more than one question-type, uncovering an overall difference would be unlikely.

CONCLUSION

The evidence from past research as to whether business simulation games are a more effective teaching tool than other instructional approaches (e.g., cases) is inconclusive. This state of affairs may be due to the nature of the research designs of past studies or to the failure to understand the pedagogical value of such games.

There are a number of instructional methods and techniques that can be used to teach a principles of marketing course. Lectures and reading assignments tend to serve as the foundation of most, if not all, such courses. To supplement this approach, cases and/or a simulation game are often added to the course requirements. However, no matter which of these supplemental approaches is used, it is essential for the instructor to fully understand the pedagogical value of the technique and to appreciate the commitment of time that will be required by both the students and the instructor.

Developments In Business Simulation & Experiential Exercises, Volume 17, 1990

It must also be realized that different components of a course may not be capable of achieving the same instructional objectives. And, given the fact that the present study found that the weakest students chose not to participate in the optional simulation game (see Table 2), the Issue of who is to benefit from any supplemental approach also needs to be addressed.

The results from the present study and the study by Whiteley and Faria (1989) Indicate that only certain types of learning can be improved by participating in a simulation game. Now other instructional approaches perform in each learning context investigated to these studies need to be the subject of further research. Comparative studies based on different types of supplemental learning techniques and studies focusing on the impact of the length of the same on the learning process also need to be conducted.

In total, it is clear that caution must be exercised when looking for supplemental tools or techniques for any type of course. The issues of the pedagogical value of the technique and the required time commitment need to be addressed when considering such an addition. But no matter what approach is being considered, the focus should always be on the marginal benefit of the new approach to a basic lecture/reading type of course.

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