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AN EMPIRICAL INVESTIGATION OF THE INTERNAL VALIDITY
OF A MARKETING SIMULATION GAME

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ABSTRACT

Computer-based simulation games have been a popular teaching tool in business schools for over 30 year. Instructors at the more than 95 percent of the AACSB member schools which make use of such games (Faria, 1987) can choose from approximately 228 published games available in the marketplace (porn & Cleaves, 1980). Interest in researching business gaming has also been extensive comprehensive reviews of such research can he found in Greenlaw and Wyman (1973), Keys (1976), Wolfe (l985, and Miles, Biggs and Schubert (1986).

Notwithstanding the extensive use being made of business simulation games in academic, a number of researchers have questioned the pedagogical value and/or the validity of such games (see Newgren, 1981; Norris, 1981; Whiteley & Faria, 1989; and Wolfe, 1985, 1986). The present study, using a controlled experiment, was designed to investigate the internal validity issue.

PAST RESEARCH

While a great deal of research in the area of simulation gaming has focused on the factors affecting the simulation environment, the learning aspects of simulation gaming, and the relative merit of simulation games versus other teaching methods, the internal and external validity of business games have also been areas of concern (see Dickenson, Faria, & Whiteley, 1988, 1989; Hand & Sims, 1975; Reichel, Reichel, & Olami, 1987; Norris & Snyder, 1982; Wolfe, 1976; and Wolfe & Roberts, 1986').

External Validity

The measurement of the external validity of business games has followed two approaches. One approach has involved the examination of the correlation between a business executive's game-playing performance and his/her real-world business performance (see Bahb, Leslie, & Van Slyke, 1966; McKinney & Dill, 1966; Vance & Gray, 1967; and Wolfe, 1976). In general, these studies provide support for the external validity of business game: externally successful business executives tend to outperform their less successful counterparts in a simulation competition.

The second approach has involved the use of a longitudinal research design, where business game performance is compared with some measure of subsequent business career performance (see Norris & Snyder, 1982, and Wolfe & Roberts, l986. In the study by Norris and Snyder (1982), no significant relationships between business genie performance (as measured by ROl) and three measures of career success (number of promotions received, proximity to the firm's chief executive officer, and percentage of salary change since graduation) were identified. The use of a team-level game performance measure instead of an (individual-level game performance measure may be the reason for these results. Wolfe and Roberts (1986) did compare individual game performance with business career performance. In this case, a significant correlation between business game success (as measured by ROl') and salary level five years after graduation was found (p < .0.5) At the p < .10 level of significance, business game success was also found to be significantly correlated with percentage salary increase, the number of promotions, and overall lob satisfaction. Overall, the results of this study seem to confirm the external validity of the simulation game used in the investigation.

Internal Validity

There are a number of studies, which claim to provide results, which are supportive of the internal validity of a simulation exercise. For example, several researchers suggest that, since the student participant learned certain concepts by participating in a game (e.g., sales forecasting, goal-setting, or how to analyze a financial statement), the game investigated possessed internal validity (gee Edwards, 1987; Hall, 1987; Neuhauser, 1976; and Snow, 1976). Other researchers state that the internal validity of the game used was supported by the fact that better students (as measure! by CPA') outperformed poorer students in the competition (see Gray, 1972; Vance & Grays 1972; and Wolfe, l987).

The major concern, with previous research in this area is the absence of any attempt to operaionalize, measure, and statistically test the internal validity of a game based on the characteristic of the game itself. Evidence of the internal validity of a game has been based solely on game performance characteristic of the participants. The failure to adopt a consistent definition of internal validity appears to be the cause of the focus taken.

While many definitions of internal validity exist, most are very similar to that found in Parasuraman C1986): The extent to which results observed in an experiment are solely due to the experimental manipulation (p. 814). In each of the studies cited, experimental manipulation did not take place; there was simply game participation followed by an examination of some factor at the conclusion of the competition.

There are two preliminary studies which did incorporate the experimental manipulation feature in a test of the internal validity of a simulation game, but in each study the analysis was based solely on an analysis of the trends in the data; no statistical analysis was carried out (see Dickinson, Faria, & Whiteley, 1988, 1989). In both cases, it wag concluded that evidence for the internal validity of the simulation game was limited. The conclusion drawn in these studies, of course, are speculative at heat.

The present study therefore represents the first attempt to statistically investigate the internal validity of a business gaming situation through the manipulation of variables in a simulated competition. Participant reaction to each of the manipulated variables will serve as the dependent variables.

PURPOSE AND HYPOTHESES

It is the position of the present study that participation in a simulation game is an internally valid experience to the participant make decisions which are consistent with the environment with which they must contend. While the actual decisions made will be influenced by the dynamics of the game used, the actions of competing companies, the objectives of the game, and the capabilities of the participants, the simulated environment must also be considered as an important uncontrollable variable to which the decision makers must respond. If this latter type of decision making does occur, then the simulated environment can be said to possess internal validity.

This premise (is investigated by means of a controlled experiment using a popular marketing management simulation game in an introductory marketing course. The game, <u>LAPTOP: A Marketing Simulation</u> (Faria & Dickinson, 1987), can he parameterized in such a way so as to define two theoretically meaningful and distinctly different environments.

Experimental Environments

Strategy decisions in LAPTOP are made at the product-market level C4 levels), at the territorial level C2 levels), and at the company level. A total of 32 specific, demand-affecting, types of decisions must be made. Twelve different marketing research reports can also be ordered.

When initializing a new LAPTOP competition, the game administrator can specify the weights of the demand affecting strategy elements, each of which can be weighed using an index ranging from I (low importance) to 10 (high importance). For the purposes of the present experiment, the parameter-weighting feature of the game was used to define two district environments. One environment resulted in a situation that would reward the use of a "pull" strategy. The second environment resulted in a situation that would reward the use of a "push" strategy.

Push and pull strategies are well known and discussed in all basic marketing tests. Schewe (1987) states that "In a pull approach, the manufacturer spends heavily to create consumer awareness and demand for the product…. In a push strategy, the emphasis shifts to aggressive personal selling and promotion aimed at gaining the cooperation of distributors and retailers". (p. 404. McDaniel and Darden (1987) state that the use of aggressive personal selling and trade advertising by a manufacturer to convince a wholesaler and/or retailer to carry its merchandise is a pushing strategy... .At the other extreme is a pulling strategy, which stimulates consumer demand and focuses its promotional efforts on the final customer" (p. 530)

The strategy decision areas that were deemed to be "pull" variables in the study were final household price, broadcast and print advertising, and premiums. Weighted average price and exact competitive price research information were also considered to he pertinent to the decision-making process under such an environment. Trade advertising, co-operative advertising allowances, sales force size, trade show participation, and point-of-purchase sales promotion materials were deemed to be push variables. Co-operative advertising allowance, sales force size, and sales force compensation research information were also considered to be pertinent to the decision-making process under this latter environment.

In order to create an industry which would reward the use of a pull strategy, all of the identified pull variables were initialized with a weighting of 10 ft one of the experimental conditions (i.e., the pull environment). The push variables in this environment were given a weighing of 1. The decision variables, which did not fall within either a push or pull environment, were given a middle weighting of 5.

Similarly, in order to create an industry which would reward the use of a push strategy, all of the identified push variables were initialized with a weighting of 10 in the other experimental condition (i.e., the push environment). The pull variables in this environment were given a weighting of 1. The decision variables, which did not fall within either a push or pull environment, were given a middle weighting of 5.

In total, the manipulation of the variable weights (i.e., assigning a weight of 1 or 10) involved 20 of the 32 decision areas of the LAPTOP simulation. The default value of 5 was assigned to the remaining 12 decision area. Furthermore, the parameter weights for each company were the same across product-markets and between territories.

The marketing research information available to companies under either environment did not require the assignment of weights. In this case, the company either requests or does not request the pertinent information.

Hypotheses

The nature of the dependent variables used in the study vary as a function of the decision area under consideration (e.g., actual price, advertising expenditure, percentage of companies requesting a particular type of research. Nonetheless, the general hypothesis is that, if marketing strategy formulation in a simulation environment is an internally valid experience, then the nature of the decisions should gravitate toward the more heavily weighted and more pertinent strategy element. The nature of the decisions should therefore vary as a function of the environment in which a company operates. Specifically, the following outcomes are expected to occur:

H1: For each product market, the average price in the Pull environment will be lower than the average price in the Push environment.

H2: For each product market, the average broadcast advertising expenditure in the Pull environment will be higher than the corresponding average expenditure in the push environment.

H3: For each product market, the average trade advertising expenditure in the Pull environment will be higher than the corresponding average expenditure in the Push environment.

H4: For each product market, the average trade advertising expenditure In the Pull environment will be lower than the corresponding average expenditure in the Push environment.

H5: For each territory, the average co-operative advertising allowance percent in the Pull environment will be lower than the corresponding average percent in the Push environment.

H6: For each territory, the average sales force size in the Pull environment will be smaller than the corresponding average in the Push environment.

H7: For each product market, the percentage of companies using the sales promotion approach of point-of-purchase materials in the Pull environment will be lower than the corresponding percentage in the Push environment.

H8: For each product market, the percentage of companies using the sales promotion approach of trade shows in the Pull environment will be lower than the corresponding percentage in the Push environment.

H9: For each product market, the percentage of companies using the sales promotion approach of premiums in the Pull environment will be higher than the corresponding percentage in the Push environment.

H10: The percentage of companies requesting each of average price and exact price research information in the Pull environment will be higher than the corresponding percentage in the Push environment.

H11: The percentage of companies requesting each of co-operative advertising allowance, sales force size, and sales force compensation research information in the Pull environment will be lower than the corresponding percentage in he Push environment.

The investigation of the general hypothesis reflecting the preceding 11 specific hypotheses requires a total of 37 between-environment comparisons. The actual values to he used are company-wide values, territorial values, or product-market values, as is appropriate.

METHODOLOGY

The simulation competition executed in the study involved approximately 700 undergraduate students who were enrolled in the seven sections of a one-semester introductory marketing course taught during the academic year. The players were advised that the game was worth 20% of the course grade and that the performance objective of the game was to maximize the company's earnings per share relative to the competition in the same industry (versus producer or territorial performance).

The students were assigned to teams (companies) of up to four players on the basis of self-selection or, when necessary, on a random basis. In all but one case, each team was assigned to an industry consisting of 5 companies. One industry had 6 companies. While 35 industries were established during the year, two industries, consisting of 11 companies in total, were used to handle administrative problems encountered during the course (e.g., 1ate enrollees).

Each of the 165 companies in the remaining 33 industries was randomly assigned to one of three environments. Thirteen industries (i.e., 65 companies) were assigned to the "push" environment; thirteen industries (i.e., 65 companies) were assigned to the "pull environment; arid seven industries (i.e. 35 companies) were assigned to the "default environment. (All parameter weights were set equal to five in this latter environment.) Only the companies in the push and pull environments were included in the analysis. And at no time during the game did the game administrator inform the players about the nature of the environment which they faced or that an experiment was being run.

The first weekly decision of the game was made during the third week of the course. This decision and the subsequent one served as trial decisions, thereby providing the players with the opportunity to become familiar with the technical aspects of the game and to try various strategies without risk.

At the end of the trial period, a new game was started, bur the environment and the competition faced by each company during the trial period remained the game. The knowledge which the teams acquired during this period therefore had the potential of being relevant to the new game.

The new game consisted of eight weekly decisions. For all but one of the decision variables the decisions for the final (i.e., the 10th) period of play were utilized for hypothesis testing, thereby allowing time for the companies to adapt their strategies to the simulated environment. The research requests for the next to the last period of play had to be utilized since, in light of the objective of the game, companies would not order research information in the final period.

RESULTS

Statistical Analysis Approach

Each of the 37 decisions that the participating in the game were required to make can be considered to involve theoretically unrelated variable, even though some may be statistically correlated. For example, a price decision in one product market is conceptually unrelated to a price decision in another product market. Similarly, a request for one type of research is conceptually unrelated to a request for another type of research. In an experiment of this nature, it is appropriate to analyze each dependent variable separately (see Biskin, 1980, 1983). Furthermore, since all of the hypotheses in the study are directional in nature, analyzing each dependent variable separately prevents the possibility of an unacceptable loss of power, which could otherwise occur under a multivariate type of analysis (Tabachnick & Fidell, 1983). For these reasons, the data collected in the present study were analyzed using independent, one-tailed t-tests.

Test of Hypotheses

The results of the data analysis are presented in Tables 1 and 2. These results indicate that, while 13 of the 37 between-environment comparisons are significant, only 9 of the comparisons are in the direction hypothesized. Furthermore, these latter results only pertain to 4 of the 11 specific hypotheses investigated.

Only in the area of co-operative advertising allowances (Hypothesis 5) are the results completely consistent with expectations: in both territories, the co-operative advertising allowance percent in the pull environment is lower than it is in the push environment. Partial support for expectations exists in the areas of price (Hypothesis 1) and trade advertising (hypothesis 4). In three of the four product markets in each of these decision areas, the prices and the level of trade advertising in the pull environment are lower than they are in the push environment. Finally, there is limited support for Hypothesis 11. Only with respect to the request for co-operative advertising allowance research information (Other research) are the results significantly different between environments. As

expected, the percentage of companies in the pull environment requesting such research is lower than it is in the push environment.

TABLE 1
COMPARISON OF MEAN DECISION VARIABLE VALUES

	Environment		
Variable	Push (n = 65)	Pull (n = 65)	t-value
1. Price ($):			
Prod100/Ter1	966.26 (1151.87)	738.11 (735.85)	1.35
Prod200/Ter1	1244.25 (1593.79)	856.00 (868.15)	1.73*
Prod100/Ter2	1599.00 (1120.19)	1264.69 (405.30)	2.26*
Prod200/Ter2	1912.18 (1136.87)	1504.72 (758.59)	2.40**
2. Broadcast advertising ($'000):			
Prod100/Ter1	40.88 (39.26)	31.35 (31.58)	1.52
Prod200/Ter1	55.29 (55.29)	44.80 (54.12)	1.25
Prod100/Ter2	44.62 (37.85)	37.78 (43.04)	0.96
Prod200/Ter2	62.94 (51.17)	58.58 (74.81)	0.39
3. Print advertising ($'000):			
Prod100/Ter1	30.46 (32.38)	19.43 (17.41)	2.42***
Prod200/Ter1	36.00 (29.23)	25.97 (30.44)	1.92*a
Prod100/Ter2	31.12 (36.85)	24.40 (27.04)	2.24*a
Prod200/Ter2	42.15 (35.61)	37.85 (50.51)	0.56
4. Trade advertising($'000):			
Prod100/Ter1	15.46 (14.91)	8.34 (10.88)	3.11***
Prod200/Ter1	18.40 (19.72)	10.35 (17.39)	2.47**
Prod100/Ter2	15.91 (15.66)	9.11 (13.10)	2.68**
Prod200/Ter2	20.55 (24.98)	15.00 (27.47)	1.21
5. Co-operative advertising allowance %:			
Territory1	4.62 (2.82)	2.51 (2.31)	4.66***
Territory2	4.97 (2.83)	2.77 (2.51)	4.69***
6. Sales force size:			
Territory1	8.32 (2.58)	8.11 (2.39)	0.49
Territory2	11.77 (3.78)	12.11 (3.28)	-0.55
7. % of companies using P.O.P. sales promotion:			
Prod100/Ter1	21.54 (41.43)	26.15 (44.29)	-0.61
Prod200/Ter1	21.54 (41.83)	20.00 (40.31)	0.21
Prod100/Ter2	13.85 (34.81)	23.08 (42.46)	-1.36
Prod200/Ter2	15.38 (36.36)	20.00 (40.31)	-0.69
8. % of companies using trade shows:			
Prod100/Ter1	3.08 (17.40)	3.08 (17.40)	0.00
Prod200/Ter1	7.69 (26.85)	3.08 (17.40)	1.16
Prod100/Ter2	3.08 (17.40)	3.08 (17.40)	0.00
Prod200/Ter2	10.77 (31.24)	4.62 (21.15)	1.32
9. % of companies using premiums:			
Prod100/Ter1	41.54 (49.66)	27.69 (45.10)	1.66*a
Prod200/Ter1	27.69 (45.10)	38.46 (49.03)	-1.30
Prod100/Ter2	47.69 (50.34)	36.92 (48.64)	1.24
Prod200/Ter2	32.31 (47.13)	36.92 (48.64)	-0.55
10. % of companies requesting price research:			
Average prices	4.62 (21.15)	4.62 (21.15)	0.00
Exact prices	76.92 (42.46)	67.69 (47.13)	1.17
11. % of companies requesting other research:			
Co-operative allowances	12.31 (33.11)	1.54 (12.40)	2.46**
Sales force size	9.23 (29.17)	3.08 (17.40)	1.46
Sales force compensation	9.23 (29.17)	6.15 (24.22)	0.65

Notes. Prod100 = Product 100; Prod200 = Product 200; Ter1 = Territory 1; Ter2 = Territory 2. Cell values in parentheses are standard deviation values.

*p < .05, one-tailed. **p < .01, one-tailed.
***p < .001, one-tailed.

a t-value is significant but in the direction Opposite to that hypothesized.

TABLE 2
SUMMARY OF TESTS OF HYPOTHESES

Hypothesis	# of comparisons	# of comparisons significant & consistent with hypothesis
1. Price	4	3
2. Broadcast advertising	4	0
3. Print advertising	4	(3)a
4. Trade advertising	4	3
5. Co-op. adv. allowance	2	2
6. Sales force size	2	0
7. P.O.P. sales promotion	4	0
8. Trade shows	4	0
9. Premiums	4	0
10. Price research	2	(1)a
11. Other research	3	1
Total	37	9

a Significant but contrary to hypothesis.

The significant results which are contrary to expectations relate to the areas of print advertising (Hypothesis 3) and the use of the premiums as the selected form of sales promotion (Hypothesis 9). Unexpectedly, the companies in the push environment spent more on print advertising than the companies in the pull environment. This difference occurred in three of the four product markets. Similarly, in one of the four product markets, the percentage of companies in the push environment using the gales promotion approach of premiums was Unexpectedly greater than the corresponding percentage in the pull environment.

With respect to the remaining five hypotheses (Hypotheses 2, 6, 7, 8, and 10), there are no significant differences between environments.

In total, the results show that there is only complete support for one hypothesis (Hypothesis 5), partial support for two hypotheses (Hypotheses 1 and 4), limited support for one hypothesis (Hypothesis 11), and no support for seven hypotheses (Hypotheses 2, 3, 6, 7, 8, 9, 10). In the latter case, some of the comparisons are actually significant but contrary to expectations (see results for hypotheses 3 and 9). The majority of the hypotheses of the study are therefore not supported.

DISCUSSION

The results of the study indicate that by the end of ten periods of play the participants in the pull environment were not making very many operational and strategic decisions that were significantly different from those being made by the participants in the push environment. Furthermore, in some of the areas where there were significant differences, the nature of the differences were contrary to expectations.

It appears that the participants in the game were completely able to determine whether or not a co-operative advertising allowance was an important demand or market share determining variable in the game: as expected, the companies in the pull environment had lower co-operative advertising allowances than the companies in the push environment. For the most part, this level of understanding also applied to the areas of price and trade advertising: as expected, the companies in the pull environment had lower prices and spent less on trade advertising than the companies in the push environment. To a lesser extent, the companies in the two environments realized that the need for certain types of research information was more important to one of the environments than the other. As expected, the percentage of companies in the pull environment requesting co-operative advertising allowance research was lower than the corresponding percentage in the push environment, however, no differences in the percentage of company requests between environments existed for sales force size and sales force compensation research information.

While the preceding results provide some evidence that the companies in the two experimental environments were responding correctly to their environments, the majority of the results are either counter to or non-supportive of this position. In three of the four product markets, the companies in the pull environment were Unexpectedly spending less on print advertising than their push-environment counterparts. A similar result occurred in one of the four product markets with respect to the use of the sales promotion approach of premiums. In the decision areas of

broadcast advertising, sales force size, point-of-purchase promotion, trade show promotion, and the requests for price research, no significant differences between environments were found. Thus, in 7 of the ii decision areas investigated, the companies failed to show any kind of differential response that would indicate that they were correctly responding to the parameters of their respective environments even though the importance of the decisions in each of these areas varied between environments.

In total, the results of the study provide only limited support for the general hypothesis that, if marketing strategy formulation in a simulation environment is an internally valid experience, then the nature of the decisions should gravitate toward the more heavily weighted and more pertinent strategy elements. With respect to this experiment, all that can be concluded is that the decision makers were at least beginning to properly adapt to the simulation environment in which they operated.

Since only some of the results of the study can he attributed to the experimental manipulation carried out in the game, support for the internal validity of the business gaming situation under investigation is limited. The failure of the companies in the game to totally adapt to their respective environments may be due to a number of factors the number of periods for which decisions were required the level of marketing knowledge of the participants, or the competitive focus of the game.

Ten periods of play may not have been enough time for the participants in the game to properly understand the nature of all of the response functions defining their environments. A game of 15 to 20 periods may be required.

It may also be that students in an introductory marketing course lust do not have a sufficient understanding of the marketing planning process to execute effective and appropriate marketing strategies. It may be that simulation games are more effective learning tools when used in more advanced marketing courses.

Finally, since the marketing objective for each company in the game wag to achieve a higher earnings per share than the competition, the participants in the game may have focused their attention more on what the competition was doing rather than on trying to develop more effective marketing strategies based on the nature of the parameters of the game. Had market share, or even marker share and profits, been set as the performance goal, the results might have been different.

CONCLUSION

The present study sought to empirically investigate the internal validity of an experimentally manipulated simulation game environment. Contrary to expectations, the results indicate that, overall, the participants facing a pull environment were not making operational and strategic decisions that were significantly different from those being made by the participants facing a push environment. Only 9 of the 37 between-environment comparisons based on the 11 hypotheses investigated were significant and of the nature expected. Four of the comparisons were significant but in a direction contrary to expectations. No differences in the nature of the decisions between the environments were found in the remaining 24 areas. The results therefore indicate that the companies in the different environments were correctly adapting to the environment in what they operated only to a very limited degree. The positive results of the study relate, completely or partially, to only 4 of study's 11 hypotheses (Hypotheses 1, 4, 5, and 11).

Based on the findings of the present study, future research needs to investigate whether a longer game, the acquisition of greater knowledge about the marketing planning process, or a focus on a different marketing objective would lead to more positive results. Requiring game participant to prepare reports explaining the reasoning for their decisions would also be helpful.

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