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A TEST OF STUDENT PERFORMANCE AND ATTITUDES UNDER VARYING GAME CONDITIONS

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ABSTRACT

The performance of student teams in a simulation competition and student attitudes towards the simulation competition were examined under varying conditions. The variables controlled for in the study were degree of game explanation, grade weighting of the simulation competition, ethnic composition of the student teams, and team size. These study findings may be useful to simulation administrators when organizing simulation competitions.

INTRODUCTION

Past research has examined the relationship between student performance in simulation competitions and a wide range of variables. Personality characteristics such as tolerance for ambiguity, preference for routine, degree of competitiveness, locus of control and achievement motivation have been examined by Rotter (1966); Sims, Butler and Szilagyi (1974); Rue, Slusher and Sims (1974); Butler and Parasuraman (1977); and Brennstuhl and Badgett (1977). Previous academic achievement and simulation performance has been reported on by Dill (1961); McKenney and Dill (1966); Vance and Gray (1967); Gray (1972); Rowland and Gardner (1973); Wolfe (1978); and Roderick (1984). The effects of time pressure were examined by Sampson and Sotiriou (1979) and Walker (1979). Ethnic origin and performance was studied by Loveland, Wall and Whatley (1979) and Moorhead, Brennstuhl and Catalanello (1980) while performance by male and female students was examined by Chisholm, Krishnakuman and Clay (1980).

Team size has been the focus of many studies. Among these are Shaw (1971); Wilson (1974); Remus and Jenner (1977); Gentry (1980); Newgren, Stair and Kuehn (1980); and Wolfe (1982). Other characteristics of the simulation participants such as previous business experience (Trinkauss, 1980); nature of the course offering (Aplin and Cosier, 1979); team organizational structure (Edge and Remus, 1984); and method of team formation (Hsu, 1984) have also been examined. As such, there is a wide and growing body of research on simulation game participant characteristics and performance.

STUDY METHODOLOGY

The present study examined four variables as they related to performance in a simulation competition as well as students' attitudes towards the competition. The variables examined were: (1) degree of game explanation provided by the instructor, (2) grade weighting of the simulation competition, (3) ethnic background of the participants, and (4) team size.

The research involved 538 students in an undergraduate marketing course. The prerequisite to this course was Principles of Marketing. The study was conducted during the

Fall, 1984 and Winter, 1985 semesters. Simulation game performance was monitored during the semester and a detailed questionnaire was administered to all students at the end of the semester. The course included lectures, readings, cases, several written assignments, and the simulation competition. The simulation used was Compete: A Dynamic Marketing Simulation by Faria, Nulsen and Roussos (1984).

The variables controlled for in this study can be described as follows:

- (1) Degree of Game Explanation: This represented a two-way division between high explanation and low. Seventy student teams were in classes that received detailed game introductions and explanations while 65 teams were in classes that received no game explanation.
- (2) Simulation Grade Weighting: Seventy student teams were in classes where their simulation game performance comprised 40 percent of the final course grade while 65 teams were in classes where the simulation game performance comprised 20 percent of the final course grade.
- (3) Ethnic Origin: In terms of ethnic origin, 90 teams were made up entirely of domestic/home students, 22 entirely of foreign students, and 23 teams included a combination of domestic and foreign students.
- (4) Team Size: The students were divided into groups of three (51 teams), four (35 teams), and five (49 teams).

OVERVIEW OF STUDY FINDINGS

While each of the simulation teams can be identified along several dimensions (i.e., a three member team, all foreign, grade weighting of 40 percent, given detailed game explanation), the study findings will be presented only in terms of the four major study variables. The more detailed (four dimension) team break-down results in only three to six teams conforming to each of the team descriptions. The overall study design resulted in a 36 cell matrix (2 X 2 X 3 X 3) and, hence, a sample in each cell too small to provide stable results.

Overall Team Performance

Company earnings were continuously monitored throughout the simulation competition. When comparing the high earnings teams with the low earnings teams, some interesting results were uncovered. The teams comprised of all foreign students consistently outperformed the domestic teams. Over half (54.5 percent) of the foreign student teams lead their industries in earnings while over three-fourths (77.3 percent) achieved the highest or second highest earnings in their industry. Only *one* foreign student team (4.5 percent of the foreign teams) came in last place.

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The domestic and mixed teams were relatively evenly distributed from top to bottom in their industries. Loveland, Wall and Whatley (1979) found no difference in performance between Mexican (foreign) and American (domestic) students in a simulation competition. The current study found that foreign (primarily Chinese) teams consistently outperformed domestic (Canadian) teams. The indication would be that foreign students are not at a disadvantage in simulation competitions.

Teams of three students consistently outperformed teams of four and five students. This is consistent with findings reported by Gentry (1980). Interestingly, teams of five students tended to outperform teams of four students. As such, small teams are not necessarily preferable to larger teams but, odd sized teams would seem to be preferable to even sized teams. As all teams subjected to either a high or low grade weighting or high versus low level of game explanation were in the same classes, company earnings performance along these dimensions could not be compared.

In addition to monitoring earnings performance by the major study variables, additional information was gathered through questionnaires administered to the students at the completion of their courses. From responses to the questionnaires, it was discovered that there was a direct relationship between earnings and team member game participation. Those groups indicating that all team members participated equally tended to achieve higher company earnings.

As might be expected, the higher their team's earnings, the more the students felt that the simulation competition was a good measure of their course knowledge and understanding. The higher earnings teams changed objectives and strategies less often. This may reflect the fact that the poorer performing teams were constantly searching for the right approach to the competition. There was no relationship found between time spent on the simulation decisions and company performance.

Overall student attitude towards the simulation competition was directly related to company performance. The higher the earnings of the team, the higher the rating of the simulation competition in relation to course readings, lectures and cases. In addition, the higher the team earnings, the more perceived benefit attributed to the simulation competition and the higher the level of enjoyment from the competition.

Degree of Game Explanation

This variable involved the degree of game introduction and explanation. Seventy student teams were in classes given detailed (over two class periods) introductions and explanations of the simulation. The remaining teams were in classes given no explanations. The no explanation teams were told to read the simulation manual and be prepared to make their first decision.

As all high explanation and no explanation teams were in the same classes and, hence, the same industries, no competitive comparison is possible. As such, only attitude feedback from the questionnaires will be presented here. The first interesting finding was that the high explanation teams worked together more cohesively. That is, there was a greater likelihood that members of these teams would indicate that there was an equal sharing of responsibility, that all members attended all team meetings, etc.

Very interestingly, the no explanation students expected to receive a higher grade for the simulation competition and a higher grade in the course. The high explanation teams tended to change objectives and strategies during the

competition more frequently than the no explanation teams.

There was no difference in the amount of time devoted to each set of decisions between the high and no explanation groups. This is contrary to findings reported by Faria and Nulsen (1974)

Simulation Grade Weighting

Once again, 70 student teams were in classes where the simulation competition comprised 40 percent of the team's final course grade while the remaining teams were in classes in which the simulation competition represented 20 percent of the final course grade. The questionnaire responses showed that students in the 40 percent classes tended to more equally share decision-making responsibilities while students in the 20 percent sections expressed a preference for smaller team sizes. Perhaps students in the 40 percent sections participated more and desired the input of more team members because of the greater significance of the simulation grade for them.

The students in the 20 percent sections were more likely to indicate that their performance in the simulation competition was a good reflection of their course knowledge and understanding. Whether in a high explanation or no explanation class, students in 20 percent sections expressed greater satisfaction with the assistance of their instructor than students in 40 percent sections. These responses would seem to be consistent with the higher stake that the 40 percent students have in the competition.

The 20 percent students tended to change objectives and strategies slightly more frequently. Very surprising, there was little difference in time devoted to each round of decisions between the two groups. It would be expected that the 40 percent students would devote more time given their higher stake.

Students in the 20 percent sections expressed greater enjoyment and perceived benefit from the simulation competition. This may reflect the fact that the significance of the grade in the 40 percent sections caused anxiety and worry, thus taking some fun out of the competition for these students.

Finally, as might be expected, when asked what percentage of their final grade the simulation game should contribute, the responses were as shown in Table 1. The 40 percent students felt the simulation should have been weighted a little lighter while the 20 percent students felt the simulation should be weighted a little heavier.

Ethnic Composition of Teams

There were three categories of teams by ethnic origin: (1) teams of all Canadian students; (2) teams of all foreign students; and (3) teams of Canadian and foreign students. Ninety-three percent of the foreign students were Oriental,

Team cohesiveness was highest among the all foreign student teams and lowest among the mixed teams. As well, preference for existing team size was highest among the foreign student teams and lowest on the mixed teams. The mixed teams, as well, expressed a preference to have smaller size teams.

As stated in an earlier section, the foreign teams exhibited the best performance in the simulation competition. In light of this, it is not surprising that the foreign student teams were the most likely to

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express a desire that the simulation be more heavily weighted in the grading scheme. The Canadian students tended to express a desire for a lighter grade weighting. The foreign students were most likely to indicate that the simulation competition was a good reflection of their course knowledge and expressed, as well, a higher grade expectation from the competition.

TABLE 1
DESIRE FOR SIMULATION GRADE WEIGHTING

	<u>40% Classes</u>		<u>20% Classes</u>	
	<u>Number</u>	<u>Percent</u>	<u>Number</u>	<u>Percent</u>
Less	102	37.7%	34	12.7%
Same	136	50.4	76	28.3
More	<u>32</u>	<u>11.9</u>	<u>158</u>	<u>59.0</u>
	270	100.0%	268	100.0%

The foreign students, on average, devoted more time to the simulation decision-making. Not surprisingly given the foregoing, the foreign students expressed greater enjoyment and perceived benefit from the simulation as well as greater satisfaction with the assistance of their instructor.

team Size

Team sizes of three, four and five were formed for the simulation competition. As the following discussion will show, a team size of three is preferable to sizes of either four or five. As game performance information is presented elsewhere, the discussion in this section of the paper will focus on team member attitudes toward team size, harmony on the team, and attitudes toward the simulation competition.

On a scale of one to seven, with one representing disagreement and seven representing agreement, the students were asked to respond to the statement, "The members of my simulation team participated equally in the game." The mean response rate for teams of three, four and five was as follows:

<u>Team Size</u>	<u>Mean Response</u>
Three	5.8
Four	3.7
Five	5.4

As can be seen, the greatest degree of agreement was among teams of three, followed by teams of five with the lowest level of agreement among teams of four members. These findings would support the results by Gentry (1980) in which he found that teams of three exhibited greater harmony than teams of four.

As a further indication of group harmony or preference, when asked to indicate what would be their preferred group size, 82.6 percent of the students in groups of three indicated that their current group size was the ideal. On the other hand, approximately half of all members of groups of four and five indicated that they would prefer smaller groups if they were to participate in another simulation competition.

In terms of grading of the simulation competition, only 20 percent of the members of teams of three and five desired to have their simulation performance count for a smaller part of their total grade. On the other hand, slightly over 42 percent of the members of groups of four would have liked their simulation performance to be a smaller part of their course grade. Along these same lines, groups of three expressed the

strongest agreement with the statement, "My simulation performance is a good reflection of my knowledge and understanding of the game". Groups of four expressed the strongest disagreement to the statement. Furthermore, groups of three anticipated the highest grades from the simulation competition while groups of four anticipated the lowest grades.

As part of their period-by-period decision-making process, teams of four and five spent, on average, 25 percent more time analyzing their previous period's output and making a new set of decisions. This would support findings reported by Newgren, Stair and Kuehn (1980). Larger groups require more input of time due to more opinions expressed and more preferences to be accommodated.

When asked to rate the educational benefits of a simulation game as well as their overall enjoyment of the game on a one (low) to seven (high) scale, the results were as follows:

<u>Team Size</u>	<u>Benefit</u>	<u>Enjoyment</u>
Three	5.3	5.5
Four	4.3	4.5
Five	4.7	4.9

As can be seen, highest perceived benefit and greatest enjoyment were expressed by groups of three. Lowest benefit and lowest enjoyment were expressed by groups of four. Finally, when asked to compare the learning from a simulation game to that derived from lectures, readings and cases, groups of three gave the simulation game the highest comparative scores followed by groups of five and then groups of four.

DISCUSSION AND SUMMARY

Past research has examined a wide range of variables as they relate to simulation performance. This study has replicated some past studies and pioneered some new ground. Overall, students preferred a team size of three, and this team size exhibited the best game performance. As well, the students preferred the simulation competition to lectures, cases and/or readings. The majority of students would like to see the simulation competition comprise a larger portion of the class activities and final grade. Most teams made three major strategy changes during the simulation competition.

There was little difference in team performance or student attitudes between the course sections which were provided with thorough game explanations and those provided with no explanation. This contradicts results reported by Faria and Nulsen (1974) in which it was found that the degree of the professor's input into the competition did exert an influence on the students' performance and outlook on the competition. A possible reason for this would be that the students in the no explanation classes were able to ask questions before the competition began. Perhaps the question and answer *session*, coupled with their reading of the simulation manual, represented all the explanation the students required.

There were some minor performance differences and several significant attitude differences between students in the high simulation weighting and low simulation weighting classes. Surprisingly, teams in the high weighting classes spent less time making their decisions and expressed less positive attitudes toward the simulation competition. A possible explanation for the less positive attitudes would be the fear brought about by the simulation being such a significant part of the final course grade. The students in the lower grade

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weighting classes, on the other hand, having less of a grade concern, could enjoy the competition with less fear of the consequences of a bad decision on performance. An explanation for the difference in time devoted to the decisions cannot be offered at this point. It would seem, from this study, that weighting the simulation competition at approximately 30 percent of the final course grade would be in line with the desires of the sample group used here.

In terms of ethnic composition of the teams, the all foreign student teams performed better in the simulation competition, participated more equally, expected a higher grade, devoted more time to the simulation, expressed a desire to have it weighted more heavily in their final course grade, and perceived more benefit to be derived from the competition than either the all Canadian or mixed student teams. While the mixed teams seemed to have some group problems (i.e., lack of equal participation), the all-Canadian teams expressed the greatest desire to have the simulation game weighted less heavily, spent the least time on the competition, and expressed the lowest overall opinions of the simulation competition.

Under all measures, whether game performance or attitude, groups of three turned out to be the preferred size. The students themselves expressed a desire for groups of three. The interesting finding, however, was that groups of five were preferred to groups of four. A possible explanation for this is that even numbered groups result in many standoffs in the decision-making process and, hence, much team disharmony.

To summarize, the findings from this study would seem to indicate the following for the simulation administrator; (1) teams of three should form the base group size; (2) simulation teams should not be ethnically mixed; (3) a higher degree of simulation game explanation would be preferred; and (4) the simulation grade should not be more than 30 percent of the overall course grade. These conclusions, however, are tentative and further research is necessary to support or refute them.

REFERENCES

- [1] Aplin, John C. and Richard A. Cosier. The Use of Intensive Simulation in Executive Development and Academic Settings, Proceedings of the Sixth Annual ABSEL Conference, 1979, pp. 161-163.
- [2] Basuray, Toni and S. E. Blythe. 'Experiential Learning in a Cross Cultural Setting-The Practice of Simulation Approach to Business Education in Japanese Universities,' Proceedings of Eight Annual ABSEL Conference, 1981, pp. 165-167.
- [3] Brenenstuh, Daniel C. and Ralph F. Catalanello. "An Analysis of the Relationship between Personality Characteristics and Preferred Styles of Learning," Proceedings of the Fourth Annual Meeting of the Association for Business Simulation and Experiential Learning, 1977, pp. 82-89.
- [4] Brenenstuh, D. C. and T. F. Badgett. "Prediction of Academic Achievement in a Simulation Mode via Personality Constructs." Proceedings of the Fourth Annual ABSEL Conference, 1977, pp. 223-229.
- [5] Butler, Richard J. and A. Parasuraman. "Degree of Uniformity in Achievement Motivation Levels of team Members: Its Effects on Team Performance in a Simulation Game," Proceedings of the Fourth Annual ABSEL Conference, 1977, pp. 118-123.
- [6] Chisholm, T. A., P. Krishnakuman and J. P. Clay. "An Examination of the Perceived Effectiveness of Computer Simulation in a Classroom Setting as Affected by Game, Environmental and Respondent Characteristics," Proceedings of the Sixth Annual ABSEL Conference, 1979, pp. 213-219.
- [7] Chisholm, T. A., P. Krishnakuman and J. P. Clay. "Are Computer Simulations Sexist?," Proceedings of Seventh Annual ABSEL Conference, 1980, pp. 160-164.
- [8] Dill, William R. "The Educational Effects of Management Games," in William R. Dill, James R. Jackson and James W. Sweeney (eds.), of the Conference on Business Games, Tulane University, 1961, pp. 153-162.
- [9] Edge, A. G. and W. E. Remus. "The Impact of Hierarchical and Explitarian Organization Structure on Group Decision Making and Attitudes," Developments in Business Simulation and Experiential Learning, Honolulu, Hawaii, 1984, pp. 35-40.
- [10] Faria, A.J. and R.O. Nulsen. "The Use of Internal and External Assignments with a Marketing Simulation Game," Proceedings of the First Annual ABSEL Conference, 1974, pp. 54-61.
- [11] Faria, A.J., R.O. Nulsen and D.S. Roussos, A Dynamic Marketing Simulation Business Publications, Inc., 1984.
- [12] Gentry, James W. "The Effects of Group Size on Attitudes Toward the Simulation," Proceedings of Seventh Annual ABSEL Conference, 1980, pp. 165-168.
- [13] Gray, Clifford F. "Performance as a Criterion Variable in Measuring Business Gaming Success: An Experiment with a Multiple Objective Performance Model," Southeastern AIDS Conference, 1972, pp. 193-199.
- [14] Hsu, Ti. "A Further Test of Group Formation and Its Impacts in a Simulated Business Environment," Developments in Business Simulation and Experiential Learning, Honolulu, Hawaii, 1984, pp. 6-10.
- [15] Loveland, J.P. , L. Wall and A. Whatley. "Group Decision Making in a Computer Game: Analysis of Demographic and Psychosocial Variables," Proceedings of the Sixth Annual ABSEL Conference, 1979, pp. 145-149.
- [16] McKenney, James L., and William R. Dill, "Influences on Learning in Simulation Games," American Behavioral Scientist, Vol. 10, No. 2 (October 1966), pp. 28-32.
- [17] Moorhead, G., D.C. Brenenstuh and R. Catalanello. "Differential Predictors of Academic Performance for White and Non-White Samples," Proceedings of Seventh Annual ABSEL Conference, 1980, pp. 154-156.
- [18] Newgren, K.E., R.M. Stair and R.R. Kuehn. "The Relationship Between Group Size and the Learning Curve Effect in a Gaming Environment," Proceedings of the Seventh Annual ABSEL Conference, 1980, pp. 203-205.

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- [19] Roderick, Roger D. "Student Background as a factor in Simulation Outcomes," Developments in Business Education and Simulated Exercises, Honolulu, Hawaii, 1984, pp. 76-79.
- [20] Rotter, J.B. Generalized Expectancies for Internal versus External Control for Reinforcement, Psychological Monographs, Vol. 80, No. 69, 1966.
- [21] Rowland, K.M. and D.M. Gardner. The Uses of Business Gaming in Education and Laboratory Research, Decision Sciences, Vol. 4, 1973, pp. 268-283.
- [22] Rue, L., A. Slusher and H.P. Sims. "Achievement Motivation and Performance in a Business Simulation Game," National Gaming Council: 13th Annual Symposium, 1974, Vol. II, pp. 488-492.
- [23] Sampson, Nancy S. and C.E. Sotiriou. "Business Policy Simulation and the Intense Course Structure," Proceedings of the Sixth Annual ABSEL Conference, 1979, pp. 157-160.
- [24] Sampson, Nancy and Constantine Sotiriou. "Student Perceptions: Simulation and the Corporate Policy Course," Proceedings of the Fourth Annual Meeting of the Association for Business Simulation and Experiential Learning, 1977. pp. 110-117.
- [25] Shaw, M.E., Small Group Behavior, McGraw-Hill Book Company, 1971.
- [26] Sims, Henry p., R.J. Butler and A.D. Szilagyi. "Personality Correlates of Business Game Performance and Satisfaction," National Gaming Council: 13th Annual Symposium, Vol. II. 1974, pp. 493-498.
- [27] Trinkaus, John W. "Participant Type Differences in Response to Experiential Methods: An Informal Look," Proceedings of the Eighth Annual ABSEL Conference, 1981, pp. 113-115.
- [28] Vance, Stanley C., and Clifford F. Gray. "Use of a Performance Evaluation Model for Research in Business Gaming," Academy of Management Journal, Vol. 10. No. 1 (March 1967), pp. 27-37.
- [29] Walker, Clayton H. "Comparing Performance During Three Managerial Accounting Simulation Schedules," Proceedings of the Sixth Annual ABSEL Conference, 1979, pp. 153-156.
- [30] Wolfe, Joseph A. "Associations Between Individual Cognitive Processing Variables and Business Game Performance and Play," Proceedings of the Seventh Annual ABSEL Conference, 1980, pp. 169-173.
- [31] Wolfe, Joseph. "Correlations Between Academic Achievement, Aptitude, and Business Game Performance," Proceedings of the Fifth Annual ABSEL Conference. 1978, pp. 316-324.
- [32] Wolfe, Joseph and T.I. Chacko. "The Effects of Different Team Sizes on Business Game Performance," Proceedings of the Ninth Annual ABSEL Conference, 1982, pp. 232-235.