Developments in Business Simulation and Experiential Learning, Volume 28, 2001

SEX COMPOSITION, COHESION, CONSENSUS, POTENCY AND PERFORMANCE OF SIMULATION TEAMS

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ABSTRACT

The findings of this study suggest simulation teams of different sex compositions show no differences in group cohesion, consensus or potency. Performance differences did appear. All male teams produced higher simulation scores, but lower grades on plans and reports related to the simulation. All male teams also had lower GPAs and lower course grades. This study points to an important research opportunity by using a simulation to explore differences in performance between males and females, in teams and as individuals.

INTRODUCTION

The relationship between group attitudes and the performance of simulation teams in the classroom has been the subject of several studies [McKenney & Dill, 1966; Deep *et al.,* 1966]. Most of the studies have focused on team cohesiveness [Norris & Niebuhr, 1980; Wolfe and Box, 1988]. Wolfe *et al.* [1989] summarized the literature dealing with cohesion and simulation performance:

(1) Highly cohesive simulation teams produce better economic performance.

(2) Neither previous association nor self-selection is correlated with high team cohesion.

(3) Simulation teams develop cohesion over the course of the simulation.

(4) Team building efforts do not produce superior performance although team members feel better about themselves and their teams.

Hornaday and Ensley [2000], in a study of team cohesion, added consensus and potency measures. They found positive correlations between team performance and team cohesion and potency. One of the team consensus scales (agreement) correlated positively with performance, but the other cohesion scale (understanding) showed a negative correlation.

Although analysis of team sex composition was not the objective of the Hornaday and Ensley [2000] study, they found that males scored significantly higher on the potency scale. Simulation performance also differed between the sexes. Although not statistically significant, males did better on simulation score while females ultimately got higher course grades. By contrast, Johnson *et. al* [1997] found no difference in self-reported simulation performance between male and female teams, but females had less cohesive group structures.

The Hornaday and Ensley [2000] study suffered from limitations of a small sample size and the intermingling of team with individual measures. The present study directly addresses the issue of team sex composition using a larger and more tightly controlled sample to examine the relationship between team sex composition, cohesion, consensus, potency and performance.

METHODOLOGY

The Multinational Management Game (MMG) simulates a computer manufacturing firm operating in North America (U.S.A.). During the competition teams can establish subsidiaries in Asia (Malaysia) and Europe (Germany) [Keyes & Wells, 1997]. Manufacturing and marketing are possible in all three countries, but shares of stock can be sold and dividends paid only in the U.S. The firm manufactures two products: Product A, a microcomputer, and Product B, a CD-ROM drive sold to other end-item manufacturers. Products manufactured by the firm can be freely shipped between all three countries. To complete a decision MMG participants consider 24 entries for each subsidiary.

The simulation cycle covered 12 calendar weeks. Teams entered their decisions on diskettes which were turned into the MMG administrator who "ran" the simulation. Printed results were available to the students three hours after they turned in their decisions. The conduct of the simulation followed the sequence described by Hornaday and Curran [1996]. During the first three weeks, students submitted three practice decisions for familiarization. After the practice decisions, students spent two weeks preparing a written strategic plan for the eight graded decisions. The plan included detailed marketing and production plans as well as pro forma income and cash flow statements for the first five decisions (each MMG decision simulates one year). Student teams then made one decision per week for eight weeks. At the completion of the competition, student teams prepared an MMG report to shareholders, describing their performance during the eight graded decisions.

MMG activities counted for 25% of each student's course grade – 7.5% for the plan, 10% for competition score and 7.5% for the report. A composite rank order of all teams on nine accounting measures determined the percentage of 20 course points awarded to each team based on the following allocation scheme. The scoring forced teams to expand to Europe and Asia.

Senior business students enrolled in six sections of Business Policy during the Fall 1999 and Spring 2000 semesters at a mid-sized Southeastern AACSB-accredited business school participated in the simulation. All students had completed six required business core courses with a grade

of "C" or better. Organized into 70 MMG teams, 212 students took part.

The administrator grouped students into three-member MMG teams the first day of class. The literature suggests that this is an appropriate simulation team size in terms of team performance [Wolfe and Chacko, 1983; Gentry, 1980] and in striking a balance between the need for group skills and the avoidance of group dynamics problems inherent in larger teams [Knotts & Keys, 1997]. Because of late registrations and course withdrawals, seven teams ended the competition with four members and four teams had two members. The remaining 59 teams had three members.

All teams contained a mixture of majors creating functional diversity. Insofar as possible each team had a finance or accounting major and a marketing major. Otherwise team assignments were random, resulting in 10 all-female, 27 majority female, 21 majority male, seven all-male teams and five teams with equal sex composition (Exhibit 3). Only rarely did friends or students with high grades end up on the same team. Constrained by an MMG technical limit of no more than eight teams competing directly with each other in "industries," two "industries" ended up with seven teams while the other seven "industries" had eight teams.

Teams competed across class sections. For example, in the Fall 1999 semester, each of three class sections contained teams from each of four industries. The same in Spring 2000 where five industries had teams spread across three class sections.

At the beginning of the semester each student provided background information. These data contained four continuous variables - overall grade point average (GPA), age, years of full-time employment and years of part time employment (See Exhibit 2). Teams were also classified by five nominal categories: two semesters, nine industries, three team sizes, five sex distributions and two levels of ethnic/racial diversity (See Exhibit 3). Course grade was added as a continuous variable at the end of the semester.

Students completed questionnaires measuring three attitudes important to successful teamwork (cohesion, consensus and potency). Each response item utilized a five-point Likert scale. The sum of response items constituted the score for each attribute. Two scales modified from those developed by Bollen and Hoyle [1990] measured perceived c*ohesion,* defined as "an individual's sense of belonging to a particular group and his or her feelings of morale associated with membership in the group." *Consensus* was measured with two scales of two items each adapted from Jehn's [1984] Interpersonal Conflict Scale (ICS).

Team *potency* is a measure of the degree to which team members feel their team can accomplish its goals and how its capabilities compare to other teams [Guzzo *et al.,* 1993]. The present study used seven items based on Shea & Guzzo [1987]. Potency is similar to "team spirit" and group efficacy [Campion *et al.,* 1993]. Statements on the potency scale are extremely positive. For example: "This team feels it can solve any problems it encounters."

To summarize, the Team Cohesion scales measured the extent to which participants felt they were accepted fully as team members (Belonging) and their opinions concerning the quality of the team compared to other teams (Morale). The level of understanding and agreement during team decision-making measured processes associated with Team Consensus. The Team Potency scale included seven statements measuring team self-confidence.

In general, simulation scores are good measures of team performance for several reasons. First, students interact over a series of decisions, in this case three practice decisions and eight graded decisions. In addition, the decisions are clear-cut. Each team must enter one decision, no minority opinions. Finally, most students get into the competitive spirit of the simulation. They are self-motivated. Doing well in the simulation score becomes an important goal, over and above its effect on course grade.

This analysis considered three team performance measures. MMG stock price measured team simulation performance. The other two measures were team writing projects - the MMG Plan and the MMG Report.

Exhibit 1 shows the sequence of data collection. Demographic characteristics were collected at the beginning of the semester. The attitudinal instrument was administered three times:

(1) After completion of three practice decisions and the MMG plan

(2) Midway through the MMG competition (Decision 4)

(3) At the completion of the MMG competition (Decision 8)

Students knew all their MMG scores when they turned in peer evaluations during the last week of class.

HYPOTHESES

Four hypotheses were tested:

H1: Team cohesion does not differ across teams with different sex composition.

H2: Team consensus does not differ across teams with different sex composition.

H3: Team potency does not differ across teams with different sex composition.

H4: Team performance does not differ across teams with different sex composition.

H5: In multivariate testing, sex composition scores on three attitudinal measures (team cohesion, consensus, and potency) are not significant predictors of simulation performance.

TESTING

Statistical testing measured differences across five types of team sex composition: All Female, Majority Female, Equal, Majority Male and All Male. To facilitate bivariate correlation and analysis of variance (ANOVA) testing of continuous variables, the average of member individual scores constituted the team score. All of the continuous variables tested are team averages. Cross tabulation measured team sex composition

across discrete nominal categories. The categories in Exhibit 3 are self-explanatory except for ethnic/racial mix and free riders. Of the 70 teams, 47 had at least one, but not more than two non-white members. Twenty three teams were homogeneous – 22 all white and one all black. Each student submitted a peer evaluation at the end of the semester. If any student in the team complained in the comments section of the peer evaluation that one or more members of the team had not done their share, that team was classified as a "free rider" team. Nineteen of the 70 teams had free riders (27%).

Bivariate testing (not shown) confirmed, as would be expected, that all the attitudinal scale scores showed positive and significant correlations both sequentially and across scales. For example, the Morale 1 Scale (Questionnaire 1) was significantly correlated with the Belonging 2 Scale (Questionnaire 2) and the Morale 3 Scale (Questionnaire 3). As the simulation progressed, the correlation between team performance and the Morale and Potency Scales was positive and became stronger. The correlation between Decision 4 Stock Price and the Potency 2 Scale score was .499, increasing to .602 between Decision 8 Stock Price and the Potency 3 Scale score. The same relationship held with the Morale 2 and the Morale 3 Scale scores. None of the other three scales showed significant or sequential correlations with team performance.

Cross tabulation testing of the distribution of team sex composition across nominal categories are contained in Exhibit 3. Results showed no significant differences

Exhibit 4 contains the results of the ANOVA testing comparing team average scores on cohesion, consensus and potency scales. Again, no significant differences appeared, supporting Hypotheses 1, 2 and 3.

Results of ANOVA testing for differences in team performance compared to sex composition are shown in Exhibit 5. Hypothesis 4 is supported. Although none of the differences were significant, note that all male teams achieved the highest stock prices but the lowest grades on plans and reports.

Regressing Year Eight Stock price against eight continuous and ten dummy covariates produced a statistically significant model with an adjusted R^2 of .396 (Exhibit 6). Among the covariates only three were significant - the performance of All Male Teams along with team scores on understanding and potency. The same model regressing MMG plan and report scores was not statistically significant. Hypothesis 5 is not supported.

DISCUSSION

The evidence presented here suggests that the demographic backgrounds of teams in the sample did not vary significantly across five different types of sex composition (Exhibit 2). Nor were there differences in the distribution of teams across sex composition and discrete categories (Exhibit 3). Further, team average scores on cohesion, consensus and potency showed no differences between the five types of sex composition (Exhibit 4).

Turning to the univariate testing of performance measures (Exhibit 5), we again find no significant differences related to sex composition. As noted earlier, however, all male teams recorded the highest stock prices in the simulation competition, but the lowest grades on the MMG plans and reports. All male teams also had the lowest overall GPAs, were the youngest, had less full-time work experience, and received the lowest course grades (Exhibit 2).

In multivariate testing using Year Eight Stock Price as the dependent variable, three covariates were significant: all male teams, the potency score and the understanding score of the consensus measures (Exhibit 6). The multiple regression showed that the stock price achieved by the all male teams in the sample was higher when the model controlled for other variables.

The significant relationship between higher stock price and the potency scale is not surprising. The bivariate testing described earlier showed that team potency scores were closely correlated with stock price performance. Why team understanding scale score is significant with a negative sign is unclear. There is no theoretical reason why members of high performing teams would report less understanding of team decisions. This anomaly requires further analysis. Perhaps the reliability of the understanding scale is faulty, although it has been used repeatedly in other studies with no difficulty.

The finding that male teams produced higher stock prices but did not perform well on other performance measures, study may illuminate sex differences in performance discussed by social psychologists.

In a meta-analysis of sex differences in group performance, Wood [1987] concluded that her review provided evidence of "superior performance of men, compared with women, when working individually as well as when working in same-sex groups." The reason for this result, according to Wood, appears to be that "task content or settings favored men's interests and abilities over women's."

Task content and setting does not explain the results in the present study. Here all team members were senior business students who had completed an identical set of core courses. In fact, the females in the sample had a higher average GPA than the males, indicating that they had better mastery of the coursework.

Why then, did the all male teams do so well on the simulation and so poorly in other measures? Perhaps the answer lies in the nature of the task. Making simulation decisions is different than writing papers and taking tests. The team decision process is mostly verbal. Once the decision is made, it is easily entered with no written justification. Once entered decisions are final – no modifications or retractions. Results are quick, objective and public. Decisions are sequential. The results of one decision are used to produce the next decision

Turning back again to the social psychologists might provide some insight. In a study using non sex-typed content found that male groups exhibited more task orientation (generating more solutions to brainstorming tasks) but that female groups displayed a higher level of positive social behavior (producing better quality solutions to discussion problems) [Wood *et al.*, 1985] This may explain the

performance of all male teams in the present study.

Insofar as individual performance is concerned. It may be that males and females select different areas of competition. Cashdan [1998] in study of university students found no differences in overall competitiveness between individual males and females, but the sexes competed in different areas. Predictably, males tended to compete against other males in sports while females competed in "looking good" and "getting my way." Males reported significantly higher use of physical aggression, doing it better and taking possession as competitive tactics than did females. In her concluding comments, Cashdan speculated that these behaviors have their roots in evolutionary psychology. Males value physical attractiveness in a mate, while females are attracted to high-status males.

It is reasonable to speculate that simulation competition offers more opportunity for aggressive behavior. After all, there are clear winners and losers. The scores are public for all to see. Females, on the other may not be interested in the raw competition of the simulation but put their efforts towards writing reports and taking tests where the reward is a good grade from the professor not a score in direct public competition with other students.

This study points to an important research opportunity by using a simulation to explore differences in performance between males and females, in teams and as individuals.

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