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# FOUR FACTORS AFFECTING GROUP PERFORMANCE IN BUSINESS POLICY SIMULATIONS

Robert W. Hornaday, University of North Carolina - Charlotte
Walter J. Wheatley, University of West Florida

## ABSTRACT

This paper examines the effects of scholastic achievement (GPA), gender, academic major, and personality orientation (marginality) of business policy students on their group performance in a complex management simulation. Results of testing a large sample of student teams indicated that GPA bore no relationship to group performance, but that all-female teams, teams with accounting majors, and non-marginal teams all outperformed their corresponding opposites in the team simulation competition.

## INTRODUCTION

### Overview

The utilization of games as a pedagogical tool in the instruction of business policy courses has been evident since Von Neumann and Morgenstern first related the concept of strategy to business with their theory of games in the early 1940's [18]. Since this time the number of reports offering evidence as to the value of gaming as a vehicle for teaching business policy is rivaled only by the number of reports questioning its effectiveness. The purpose of this paper is to present both sides of this controversy and to offer some evidence on how to resolve it.

### Evolution of Business Games

The seminal management simulation game was the Business Management Game developed by McKinsey and Company, Inc. in 1956 with the notion of applying war-gaming techniques to business [1]. The business gaining movement gained momentum when the American Management Association introduced its top management policy making game in 1957 [10]. This momentum was accelerated by the enthusiasm of early game designers, the aggressive marketing tactics of computer manufacturers pushing for more applications for computers, and major universities searching for means to better utilize their new computers [11].

Today, most business schools use a business simulation game of some variety; particularly, in the instruction of business policy courses [9]. In a recent study conducted by Eldredge and Galloway [4], almost half of the 198 AACSB-accredited undergraduate programmers responding, reported utilizing a management game to teach Business Policy. Their study also found that the utilization of games as a tool for teaching Business Policy will be even more prevalent in the future. Because of the widespread popularity of utilizing games in the instruction of Business Policy courses, the importance of resolving the confusion regarding its effectiveness as a pedagogical tool has become imperative [13, p. 378].

### Business Gaming Effectiveness Research

A review of the literature on the benefits of business games offers results that are conflicting and confusing. On the positive side, there is evidence that gaming appears to support the objectives of strategy-making, goal-setting, and decision making [19] while enhancing student learning, interest, and motivation [15]. Further evidence suggests that gaming is beneficial in conditions requiring high organizational learning and adaptation [20] and is a "worthwhile learning environment capable of teaching many of the policy and decision-making elements of a business policy course" [21, pp. 363-364]. In addition, it has been demonstrated that business games are effective learning mediums for international business concepts [7] and can be used successfully to create varied learning environments [17].

On the negative side, Neuhauser states that there is "little evidence that games are in any sense efficient or effective methodological devices" [11, p. 124]. Gaining has been shown to have no positive effect on decision effectiveness [12] or on student class performance [5;3;16]. And, a finding of major importance is that there is no evidence that game performance has any relationship with subsequent career success [14].

In sum, the studies to date on the utilization of business games do not reflect, to any degree of satisfaction, the effectiveness of gaming in teaching business policy courses.

### Making Business Gaming More Effective Research

The majority of the research on business gaining has been directed at its effectiveness and not on what can be done to improve the effectiveness of gaming. The work that has been done offers a good starting point for those who strive to improve the effectiveness of gaining. To begin with, Low [8] found that trial runs at the start of the game are crucial to gaming effectiveness and that last-minute installation of games should be avoided at all costs. Barton [2] found that a repeat play of games will enhance effectiveness. In addition, group size has been found to be a determinant of game effectiveness with the smaller the group, the better [12]. The authors have found groups of two to be the most effective size in their work on gaming effectiveness to date. In addition to these precursors of gaming effectiveness, other facets that could be of concern are game complexity, game realism, and student characteristics to name but a few. The purpose of this study is to examine the relationship between the personality orientation of students and group performance in management simulation games.

This study considered four student characteristics as factors affecting simulation performance. These are: student scholastic grade point average (GPA), gender, academic major, and personality orientation. The first three factors (GPA, gender, and academic major) were selected because of the intuitive judgment of the authors, based on four years' experience with the simulation, that student overall GPA seemed to have no affect on simulation performance, but that females and

accounting majors seemed to do better than males and non-accounting majors.

The personality orientation used here is the concept of marginality developed by Ziller [22]. Marginality refers to the orientation of an individual relative to two or more different groups of individuals. A marginal individual has the ability to assume an intermediary role between two different groups whereas nonmarginal individuals identify with a particular group and tend to distrust all outsiders. Marginality is considered to be a useful trait for those who must coordinate, mediate, and integrate the activities of two or more groups. The ability to remain neutral, a willingness to change decisions when necessary, and a tendency to search for information before making a decision characterize marginal individuals. Salespersons, for example, were found to be more marginal than teachers, principals, and university students. First line supervisors, who deal daily with workers, union stewards, and middle management were the most marginal of all. Left unanswered was the question of whether marginal individuals seek positions requiring marginality (sales or supervision), or if they develop marginality as a result of working in these positions [22].

## RESEARCH DESIGN

The research question under consideration in this study was: "What effect, if any, does the GPA, gender, academic major, and marginality of business policy students have on their performance in a business policy simulation?"

### The Simulation

The simulation used was developed by Carl Gooding [6], presently at East Carolina University, and further modified by Dan Voich at The Florida State University. Called ENSIM (Environmental Simulation), the game is a highly competitive general management simulation with dynamic environmental constraints. The game offers a realistic simulation of a manufacturing firm producing two products in competition with up to 19 other firms. Student groups select pricing, marketing, inventory, and purchasing strategies and establish debt, equity, and dividend policies. Students make 29 decisions each monthly operation cycle. ENSIM has been used for intercollegiate MBA competition in the Southeast on several occasions. ENSIM relies heavily upon accounting information and provides participants with a wealth (perhaps an overdose) of data to evaluate for each decision cycle. As mentioned earlier, the authors suspected that students majoring in accounting had an advantage in the ENSIM competition.

### The Sample

Data were collected from 186 Business Policy students (all seniors) at a large, Southeastern university. All students in five class sections took part in the testing. Twenty-three of the students were accounting majors. On the first day of class, students were grouped randomly into two-member ENSIM teams for the management simulation. Teams completed a six-decision practice cycle for familiarization with the simulation before the actual competition began.

The ENSIM team score was based on the growth, profitability, liquidity, and leverage position of each team after 12 decision periods over a calendar time of six weeks. The ENSIM team score represented 30 percent of each student's semester grade.

Most student work on the ENSIM simulation was done outside of class. In class, students pursued policy and strategy studies through lectures and case studies. Before the ENSIM competition began, teams prepared a short ENSIM plan, stating their goals and the strategies they planned to use to achieve these goals during the competition. At the end of the ENSIM competition, teams submitted an ENSIM report, similar to a typical corporate annual report, describing their accomplishments as managers.

### GPA, Gender, and Academic Major

For statistical testing, teams were categorized by GPA, gender, and academic major. Both students in high GPA teams reported above median overall GPAs. All male teams were compared to all female teams. Mixed teams with both sexes or with high and low GPA members were not considered. To examine the effect of academic major, teams with at least one accounting major were compared with teams without an accounting major. Recall that students were randomly assigned to teams, without reference to GPA, gender, or academic major.

### Personality Orientation

After the ENSIM teams were formed, the personality orientation of each student was determined by a marginality instrument that identified nonmarginal, marginal, and undetermined types. The instrument contained five items designed to measure marginality patterned after the geometric figures suggested by Ziller et al. [22]. Scores of zero or one were classified as nonmarginal, two or three as undetermined, and four or five as marginal.

Each two-student ENSIM team was then classified into one of six categories, depending upon the mix of non-marginal, marginal, and undetermined types. Of the 93 teams, 39 had at least one nonmarginal member and 27 at least one marginal. The remaining 27 teams had combinations of nonmarginal and marginal or consisted of two undetermined members. These two combinations were dropped from the comparison of team scores because there was no way to evaluate the difference between nonmarginal and marginal team ENSIM scores.

### Test Hypotheses

Four hypotheses were tested to provide an answer to the research question.

Hypothesis 1: Student GPA has no relationship to team simulation performance.

Hypothesis 2: Gender has no relationship to team simulation performance.

Hypothesis 3: Student academic major has no relationship to team simulation performance.

Hypothesis 4: The marginality of each student has no relationship to team simulation performance.

## FINDINGS

Table 1 shows that GPA has no effect on team ENSIM performance, but that gender, academic major, and marginality have significant effects. Hypothesis 1 is accepted.

Hypotheses 2, 3, and 4 are all rejected. Teams with at least one accounting major clearly outperformed teams without an accounting major. At a lower level of statistical significance. female teams bested male teams, and nonmarginal teams scored higher than marginal teams.

Three two-way analyses of variance further examined the effects of academic major, gender and marginality. The first (Table 2) showed that while the difference between accounting and non-accounting team scores was more important, the difference between nonmarginal and marginal teams remained significant. Interaction between academic major and marginality, while important, was not statistically significant. Note the multiple $R^2$ of .19 when both marginality and academic major are in the linear equation.

Table 3 contains the results of comparing ENSIM scores of male versus female teams and nonmarginal versus marginal teams. The two-way analysis indicated that marginality is more important in distinguishing ENSIM scores than is gender, but the differences between male and female teams remained significant at the .90 level. Interaction between marginality and gender did not appear to be present. The multiple $R^2$ rose to .24 when both marginality and gender were in the equation.

At Table 4, testing of ENSIM scores by both gender and academic major showed that gender remained significant at the .90 level. Interaction between gender and academic major was important (.89 level). The multiple $R^2$ rose again to .34 with both gender and academic major in the linear equation.

Table 5 contains a three-way analysis of variance examining the simultaneous effects of academic major, gender, and marginality of team ENSIM scores. Twenty-eight of the 93 teams were unmixed in academic major, gender, or marginality. The three-way analysis, of course, is weak because of the small number of teams with one accounting major, resulting in three blocks with only one observation. Nevertheless, it is important that all three variables remained significant. Of interest is the rise of the multiple $R^2$ to .50 when all three factors are in the linear equation.

## DISCUSSION

This paper does not attempt to provide a theoretical explanation as to why previous academic achievement (GPA) has no effect on team simulation performance or why gender does. Those matters must be left for further study.

While there are perhaps motivational reasons as to why accounting majors would produce superior results to non-accounting majors, it seems clear that a major reason for the better performance of accounting majors in this study is the format of ENSIM and its reliance upon accounting data. Accounting majors are more familiar with financial and managerial accounting information used in the simulation than are non-accounting majors.

TABLE 1
ANALYSIS OF VARIANCE
TEAM ENSIM SCORE

| | n | Mean | F (p.) |
|---|---|---|---|
| High GPA Teams | 22 | 33.45 | 0.00 |
| Low GPA Teams | 28 | 33.39 | (.95) |
| Multiple $R^2$=.00. | | | |
| All Male Teams | 21 | 32.05 | 3.90 |
| All Female Teams | 19 | 43.63 | (.05)** |
| Multiple $R^2$=.09. | | | |
| Teams with at least one Accounting major | 17 | 35.08 | 7.96 |
| Teams without an Accounting major | 76 | 33.01 | (.00)*** |
| Multiple $R^2$=.08. | | | |
| Teams with at least one Nonmarginal | 39 | 34.36 | 4.49 |
| Teams with at least one Marginal | 27 | 32.26 | (.03)** |
| Multiple $R^2$=.06. | | | |

TABLE 2

| | | | F (p.) |
|---|---|---|---|
| Main Effects | | | 9.242 (.00)*** |
| Marginality | | | 4.416 (.04)** |
| Accountin/Non-Accounting | | | 12.876 (.00)*** |
| Marginality/Accounting Interaction | n | Mean | |
| Nonmarginal/Accounting Teams | 8 | 36.75 | |
| Nonmarginal/Non-Accounting Teams | 31 | 33.81 | |
| Marginal/Accounting Teams | 4 | 37.75 | |
| Marginal/Non-Accounting Teams | 23 | 31.30 | |
| Multiple $R^2$=.19. | | | |

* p. 0.10. ** p. 0.05. *** p. 0.01.

TABLE 3
TWO-WAY ANALYSIS OF VARIANCE
TEAM ENSIM SCORES
MARGINALITY BY GENDER

| | | | F (p.) |
|---|---|---|---|
| Main Effects | | | 3.83 (.03)** |
| Marginality | | | 4.25 (.05)** |
| Gender | | | 3.83 (.07)* |
| Marginality/Gender Interaction | | | 0.00 (.97) |
| | n | Mean | |
| Nonmarginal/Male Teams | 6 | 33.83 | |
| Nonmarginal/Female Teams | 7 | 36.71 | |
| Marginal/Male Teams | 7 | 30.71 | |
| Marginal/Female Teams | 8 | 33.50 | |

Multiple $R^2$=.24.

TABLE 4
TWO-WAY ANALYSIS OF VARIANCE
TEAM ENSIM SCORE
GENDER BY MAJOR

| | | | F (p.) |
|---|---|---|---|
| Main Effects | | | 10.30 (.00)*** |
| Gender | | | 3.03 (.09)* |
| Accounting/Non-Accounting | | | 15.07 (.00)*** |
| Gender/Accounting Interaction | | | 2.69 (.11) |
| | n | Mean | |
| Male/Accounting Teams | 3 | 39.00 | |
| Male/Non-Accounting Teams | 18 | 30.89 | |
| Female/Accounting Teams | 5 | 37.20 | |
| Female/Non-Accounting Teams | 14 | 33.71 | |

Multiple $R^2$=.34.

* p. 0.10. ** p. 0.05. *** p. 0.01.

The findings support the marginality construct presented by Ziller et al. [22]. Group work on the ENSIM simulation required no integration or coordination with other work groups. The ENSIM simulation measured the performance of diad work groups where the ability to focus on activities within the work group constituted an advantage, not a disadvantage. There was no way for marginals to use their integrating skills.

Finally, the simultaneous comparisons, while statistically weak, provide evidence that academic major, gender, and marginality are important independent factors that should be considered by simulation administrators.

TABLE 5
THREE-WAY ANALYSIS OF VARIANCE
TEAM ENSIM SCORE
MAJOR BY MARGINALITY BY GENDER

| | | | F (p.) |
|---|---|---|---|
| Main Effects | | | 7.30 (.00)*** |
| Major | | | 11.42 (.00)*** |
| Marginality | | | 3.84 (.06)* |
| Gender | | | 3.78 (.06)* |
| Major/Marginality/Gender Interaction | | | 0.36 (.55) |
| | n | Mean | |
| Accounting Teams | 5 | 39.00 | |
| Nonmarginal/Male Teams | 1 | 40.00 | |
| Nonmarginal/Female Teams | 2 | 39.00 | |
| Marginal/Male Teams | 1 | 37.00 | |
| Marginal/Female Teams | 1 | 40.00 | |
| Non-Accounting Teams | 23 | 32.52 | |
| Nonmarginal/Male Teams | 5 | 32.60 | |
| Nonmarginal/Female Teams | 5 | 35.80 | |
| Marginal/Male Teams | 6 | 29.67 | |
| Marginal/Female Teams | 7 | 32.57 | |

Multiple $R^2$=.50.

* p. 0.10. ** p. 0.05. *** p. 0.01.

## CONCLUSIONS

The answer to the research question posed by this paper is that previous academic performance has no effect on student performance in business policy simulations, but each of the three other variables--academic major, gender, and marginality--had a significant effect. Teams with at least one accounting major scored higher than teams without an accounting major; all-female teams outperformed all-male teams; and nonmarginal teams did better than marginal teams.

These findings lead to one major conclusion. Simulation administrators, by controlling team composition, knowingly manipulate team performance in business policy simulations. Careful consideration should be given to the academic major, gender, and marginality of students assigned to simulation teams. Conversely, the evidence indicates that the overall academic achievement (GPA) of students can be ignored in forming simulation teams.

Adding the results of this study to the existing research on gaming, there is now empirical evidence suggesting that practice sessions, group size, academic major, gender, and the marginality of participants all affect student group performance in management simulations. Future research should be aimed at understanding why GPA is not related to group simulation performance; why all-female teams are superior to all-male teams; and in developing simulation settings that will require the coordination skills of marginal personality types.

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