

# Insights into Experiential Pedagogy, Volume 6, 1979

## GROUP DECISION MAKING IN A COMPUTER GAME ANALYSIS OF DEMOGRAPHIC AND PSYCHOSOCIAL VARIABLES

John P. Loveland, New Mexico State University

Larry Wall, New Mexico State University

Arthur Whatley, New Mexico State University

### ABSTRACT

This paper reports the results of a study goal setting behavior in a computer simulation game. Selected demographic and psychosocial variables were found to be related to attitudes towards goal setting and the actual goals set by a decision making group. In addition, problems and implications of using instructional techniques, specifically a computer game are discussed.

### INTRODUCTION

Computer simulation games and experiential learning approaches have become increasingly popular modes of instruction in the classroom. A growing body of literature (4,7,17) is becoming available which reports on the effectiveness of these techniques for developing both cognitive and effective learning environments for the student (3,18). As simulation and experiential learning techniques become more widespread, their use as experimental settings for behavioral research will also increase. The overall purpose of this paper is to report the results of a two year study of demographic and psychosocial factors influencing group decisions and goal setting in a simulated environment. Specifically, the objectives of the paper are: to describe a computer simulation game used in teaching business policy; to evaluate this game and computer simulations in general as experimental setting for testing behavioral hypotheses; and finally, to report the results of a study of decision making and goal setting behavior of participants in the simulation game.

### BACKGROUND

The background section is divided into two parts; the first describes the computer game. The use of computer games as research settings is also discussed. The second part reviews the literature relative to the demographic and psychosocial variables in the study.

#### The Computer Game

The computer game used in this study was developed specifically for classroom use in a required Business Policy course in the College of Business Administration and Economics at New Mexico State University (9). The game is similar to other computer policy games. Participants are required to make decisions which influence the performance of their company relative to other firms in a competitive environment. There are, however, unique features of the game which make it a more realistic and comprehensive mode for teaching managerial decision making and providing integration for policy students.

The firms which comprise the industry produce and market two products; a consumer good and an industrial good. Deterministic demand, market share, cost, and stock market equations are made available to the student. The summary equations derived from each firm's decisions determine the overall performance of each company. In addition, equal opportunity options as well as environmental-pollution concerns are present in the form of opportunity costs and trade off functions. Thus, each team makes a variety of "quarterly operating decisions" in the areas of marketing, production, finance, social responsibility and personnel.

Students are required to establish operational objectives, annual strategies, affirmative action plans, and a policy framework for their company. The results of each company's performance is then compared with these pre-established criteria as a basis for evaluating the student participants.

#### The Game as a Research Setting

Approximately two years ago research was undertaken to investigate relationships between selected demographic and psychosocial characteristics of the participants in the game and a variety of performance indicators and attitudinal characteristics of the participants. These characteristics were directly associated with the operating rules of the game. The decision to use an instructional vehicle, the computer game, as an experimental framework for testing behavioral hypotheses not directly related to cognitive or affective learning raises serious questions.

Wilstead and Hand utilized a business simulation game to study the determinants of aspiration levels (18). They indicate that simulation games are appropriate settings for testing behavioral hypotheses concerning goal setting and aspiration levels. They do, however, offer a caveat about generalizing the results of such studies to the "real world of organizations.

Anderson (1) also suggests that gaming simulations provide a natural potential for researching the learning of behavioral objectives. While his research is more related to the learning process, it does provide support for the use of computer games in behavioral research.

Carlson and Misshunk (3) indicate, 'business gaming is a teaching vehicle or technique that makes use of situations specifically designed to represent the actual environmental conditions in the business world. Therefore, the appropriateness of using business games as research settings seems logically related to the extent to which a business environment is meaningfully represented. It seems clear that computer games can serve as research settings.

Before looking at the behavioral characteristics investigated in this study, two additional questions are relevant to the appropriateness of simulation games or other experiential techniques in behavioral

## Insights into Experiential Pedagogy, Volume 6, 1979

research. The first question concerns the possible interaction effect of using business games simultaneously as both learning environments and experimental environments. The second concern is philosophical and involves a question of ethics. Since most experiments require researcher introduced controls, might these controls have some differentiating effect on what students learn as a result of playing an experimentally controlled computer game?" These questions were not directly investigated in the present study, however, certain implications did emerge during the course of the research and are discussed in the Implications section of the paper.

### Behavioral Literature

A plethora of research has been conducted on each of the three personality constructs investigated in this study, i.e., risk aversion, tolerance for ambiguity and need for achievement. (5,6,14,15) However, there is a noticeable lack of research relating any two of these constructs, and a total absence relating all three. Examples of current research should suffice to make clear the point that these variables are, however, closely related.

Steers (16) notes that among supervisors with high need for achievement scores increased feedback and goal specificity led to increased performance. Concurrently, greater performance was obtained from supervisors with low need for achievement scores by using participative goal setting. Johnson and Stinson (6) report similar results. They found that one relationship between task ambiguity and satisfaction for high need achievement scores tended to be more negative than the relationship between task ambiguity and satisfaction for low need achievement scores.

In a study of McClaskey (10), two findings emerge that are relevant to this study. First, perceived ambiguity has an important impact on organization structure. The decision maker's tolerance for ambiguity will affect the way the organization is structured to deal with ambiguous situations. A second equally important finding is that the amount of ambiguity perceived by the individual decision maker is adjusted to reflect the individuals need for stimulation and closure. Thus, tolerance for ambiguity varies among individual decision makers and is manifested in differing organization structural changes.

Most of the research involving the construct to risk or risk aversion occurs in the financial rather than organizational behavior literature. Further, most of the behaviorally oriented studies of risk focus on the group and the phenomena of the risky shift. There is, however, one study that has relevance to the present investigation. Hunsaker establishes that environmental incongruity and an individual's incongruity adaption level (amount and tolerance for ambiguity) are important factors influencing the degree of risk perceived and incorporated in decision making. (5)

There are numerous studies of the correlates of attitudes toward goal setting and actual goal setting behavior. (15,18) These studies demonstrate both the theoretical and empirical linkage between a variety of attitudinal and value constructs and managerial goal setting behavior. No study exists, however, which investigates the relationships between goal setting and the simultaneous effect of the three variables selected for this research.

### HYPOTHESES

The hypotheses which guided this study reflect the relationships between the demographic and psychosocial variables and certain dimensions of group decision making.

Hypothesis I is multifaceted and specifically consists of: sex, ethnicity, and years of previous business experience influence on individual's attitudes toward:

- a) participation in group goal setting process
- b) feedback in the goal setting process
- c) goal specificity in the goal setting process
- d) goal difficulty in the goal setting process

Hypothesis II - Sex, ethnicity, and years of previous business experience do not influence an individual's need for achievement, tolerance for ambiguity and risk aversion.

Hypothesis III - Need for achievement, tolerance for ambiguity and risk aversion influence on individual's attitudes toward the group goal setting process, specifically:

- a) attitudes toward participation in the goal setting process
- b) attitudes toward feedback
- c) attitudes toward peer competition
- d) attitudes toward goal difficulty

Hypothesis IV - There is a significant relationship between the profit decision reached by a decision making group and the need for achievement, tolerance for ambiguity, and attitudes toward risk of the members of the group.

Hypothesis V - The strategy selected by a decision making group is dependent upon the group members need for achievement, tolerance for ambiguity, and risk aversion.

The setting for this study was the business simulation game previously described. The game was a required part of a business policy course at a southwestern university. The subjects for this study were 183 junior and senior students enrolled in five sections of a required business policy course. The students were divided into 40 teams of either 4 or 5 members. These teams were then given the responsibility of managing their respective business firms.

The actual objectives developed by each of the 40 teams provided an unobtrusive measure of actual goal setting behavior. Because of the difficulty in quantifying some of the objectives, only one of the stated objectives was selected for each team. This was a profit objective expressed as net income as a percent of sales. There were four possible strategy alternatives available to each group which they could select to accomplish their objectives: growth, stability, retrenchment, or a combination strategy. The combination strategy is relevant as the market environment of the game provides for the production and sale of two entirely different products.

In addition to the measure of actual goal setting behavior, measures of four psychosocial variables were obtained for each of the subjects participating in the game. Demographic data were also obtained for each participant. This information was collected by questionnaire administered to each subject prior to the beginning of the game. The questionnaire

## Insights into Experiential Pedagogy, Volume 6, 1979

consisted of five sections. The first section was designed to obtain three demographic measures. Sex - The respondents were classified as either male (n=121) or female (n=62). Ethnicity- The respondents were classified into two categories; Mexican- American (n=43) and other (n=140). The other category was almost totally Anglo with only a small percentage Black, Chinese or Native-American. Years of Business Experience - The respondents were sorted into three categories. The first category contained students with no business experience (n=77). The second category contained students with less than 2 years

experience (n=35). The final category contained students with 2 or more years of business experience (n=71).

NA - the second section of the instrument was developed by Borgatta and Bohrnsted (2). The questionnaire is designed to measure an individual's need for achievement and need for affiliation. Of the 21 items included on the instrument nine are relevant to the measurement of need for achievement.

TA - The third section of the instrument consisted of 16 items and measures an individual's tolerance for ambiguity. This questionnaire was developed by Rydal and Rosen (14). In an effort to mask this part of the instrument 20 items from the Rokeach (13) dogmatism scale were randomly inserted.

RA - The fourth section of the instrument was a choice dilemma questionnaire developed by Kogan and Wallach (8). This questionnaire consisted of 12 items and measures an individual's attitudes toward risk.

Attitudes Toward Goal Setting - The final section of the instrument is a modification of a technique used by Steers (12) to measure attitudes toward goal setting. The questionnaire consisted of five items measured on Likert type scales; participation, feedback, peer competition, goal specificity, and goal difficulty. Using a coefficient alpha test of reliability this instrument has a reliability score of .53. Although low, this value falls within the acceptable level for exploratory research (9).

### FINDING AND ANALYSIS

The first and second hypotheses were tested using the analysis of variance subroutine found in The Statistical Package for the Social Sciences (11). Table I contains a summary of the results of the statistical analysis for Hypothesis I.

Results in Table I reveal that the influence of the selected demographic variables on an individual's attitudes toward the five dimensions of the goal- setting process is minimal. Of the five dimensions of goal setting only three were effected by differences in the selected demographic variables. Specifically, a difference exists between males

TABLE I

Summary of F values for one-way analysis of variance for selected demographic variables and attitudes toward the goal setting process (n=183)

	Sex	Ethnicity	Years of Business Experience
Participation in Goal Setting	9.45*	.16	1.70
Feedback in Goal Setting	2.10	1.39	1.52
Competition in Goal Setting	4.49**	6.86*	1.95
Specificity of the Goal	2.99*	.15	.47
Difficulty of the Goal	.16	2.49**	.12
*Significant at .01 level			
**Significant at .05 level			
***Significant at .10 level			

and females in respect to attitudes toward participation in the goal setting process. Also, the desirability of competition in the goal setting process was viewed differently by males and females and by Spanish surname students and others. Finally, there is a weak, significant at the .10 level, difference between males and females in terms of attitudes toward goal specificity.

While some significant differences do exist in attitudes toward the goal setting process vis-à-vis the selected demographic variables, the overall results do not support Hypothesis I.

The results of the analysis of Hypothesis II appear in Table II. The results indicate that sex, ethnic group and years of business experience do not influence an individual's need for achievement, tolerance for ambiguity or risk aversion.

TABLE II

Summary of F values for one-way analysis of variance for selected demographic and selected psychosocial variables (n=183)

	NA	TA	RA
Sex	1.09	.06	1.89
Ethnicity	.10	.72	1.55
Years of Experience	.60	.26	.52

The third hypothesis for this study concerns the relationship between the psychosocial variables and attitudes toward the five dimensions of the goal setting process. Analysis of the data associated with Hypotheses I and II indicated that sex, ethnicity, and years of business experience are not significantly related to either the psychosocial

## Insights into Experiential Pedagogy, Volume 6, 1979

variables or attitudes toward the five dimensions of goal setting process. Therefore, these variables are assumed not to exert any confounding effect on the hypothesized relationship between the psychosocial variables and attitudes toward the goal setting process. Both the third and fourth hypotheses were tested using the step-wise multiple regression subroutine found in The Statistical Package for the Social Sciences (11). Table III contains the results of the

TABLE III

A summary of the relationship between selected psychosocial variables and attitudes toward the goal setting process using step-wise multiple regression.

	The Regression Equation		F Ratio	Beta Value of Variables in the Equation		
	Multiple R	R <sup>2</sup>		NA	RA	TA
Participation in Goal Setting	.352	.124	8.44**	.299*	-.017	-.094
Feedback in Goal Setting	.270	.073	4.69**	.167*	.014	-.06
Competition in Goal Setting	.182	.033	2.04***	.206*	-.303	-.095
Specificity of the Goal	.100	.009	.37	.064	-	.053
Difficulty of the Goal	.100	.009	11.32*	.104*	-.160*	.132*

\* Significant at .01 level

\*\* Significant at .05 level

\*\*\* Significant at .10 level

analysis of Hypothesis III.

Results in Table III show that the selected psychosocial variables significantly influence attitudes toward the goal setting process in three areas; participation, feedback, and goal difficulty. While the multiple R's are significant in each of these areas, the amount of variation in attitudes explained by the psychosocial variables is relatively low: 12%, 7%, and 16% respectively.

The fourth hypothesis for this study related the selected psychosocial variables to the actual profit goals established by each decision making group. The results of this analysis appears in Table IV.

TABLE IV

Results of step-wise multiple regression analysis for selected psychosocial variables and profit decisions of decision making groups. (n=40).

Multiple Correlations	Analysis of Variance	Sum of Squares	DF	Mean Square	F Ratio
R = .41	Regression	146.52	3	48.84	
R <sup>2</sup> = .17	Residual	691.57	36	19.20	2.54*
Variable	B	Beta	Standard Error of B	F	
TA	-.98	-.24	.65	2.30*	
NA	-.69	-.25	.43	2.60*	
RA	-.10	-.16	.09	1.05	

\*Significant at the .10 level

The results in Table IV reveal a significant (.10 level) relationship between the selected psychosocial variables and the actual profit goals established by the decision making groups. The low significance levels for both the regression equation and the B coefficients precludes any firm conclusions in this area.

The final hypothesis states that the strategy selected by a decision making group is dependent upon the group members need for achievement, tolerance for ambiguity and risk aversion. The nature of the dependent variable required a nonparametric test. The Chi-square contingency table test

for independence was the appropriate technique utilized for the analysis. The three independent variables were broken at their respective median points and the strategies were grouped into two clusters; contained growth, stability, and retrenchment, and combination or mixed. Thus, a two by two contingency table test was conducted. The results of the Chi-square analysis are presented in Table V.

TABLE V

The Relationship Between Strategy Selection and Mean Group Scores of NA, RA, and TA. (N = 40)

Independent Variables	Corrected Chi-Square	Degrees of Freedom	Significance Level
NA	.12698	1	.72 N.S.
RA	.00199	1	.96 N.S.
TA	1.36256	1	.24 N.S.

A cursory examination of Table V reveals that the relationships are not significant and hence Hypothesis V would be rejected.

## IMPLICATIONS

Three implications emerged from the analysis of the behavioral hypotheses. In addition, there is a major implication concerning the possible interaction effect resulting from the use of instructional games as experimental settings.

The first implication concerns the relationship between the demographic and psychosocial variables.

The "socialization" process through which most students of business pass seems to have an important, moderating effect on an individual's need for achievement, tolerance for ambiguity, and risk aversion vis-à-vis sex, ethnicity, and years of previous business experience. Secondly, this same process tends to offset differences in attitudes toward the group goal setting process relative to these same demographic variables, with the exception of male/female attitudes.

Finally, need for achievement, tolerance for ambiguity and risk aversion do influence a decision maker's attitudes toward the group's goal setting process and the actual decision made by a group, however, the explanatory value of these psychosocial variables is relatively low. Also, there exists an averaging' or moderating' effect when these variables are studied simultaneously in relation to group decision making, i.e., it is unlikely that an understanding of the group decision making phenomena can be understood by examining single psychosocial characteristics of decision makers. Thus, the overriding implication of this study is that simple models that attempt to explain the group decision making process in terms of one or a few sets of independent variables are incomplete. The process is complex, requiring multivariate techniques and models.

Previously, both theoretical and ethical questions were identified relative to the use of instructional techniques as experimental settings. One of the key problems in this area involves the possible relationships between cognitive and effective learning and experimental controls vis-à-vis attitudinal, demographic and psychosocial variables. A study is currently underway to investigate these problems.

## Insights into Experiential Pedagogy, Volume 6, 1979

### REFERENCES

- (1) Anderson, C.R., "An Experiment on Behavioral Learning in a Consumer Credit Game," Simulation and Games, Vol. 1, 1970.
- (2) Borgatta, E. & G. Bohrnstedt. "Up," Psychology Today, Vol. 4, 1971.
- (3) Carlson, J. & M. Misshauk. Introduction to Gaming: Management Decision Simulations. New York: Wiley, 1972.
- (4) Certo, Samuel C. "Sequence of Test Training and Perceived Learning: An Exploratory Investigation of the Experiential Training Unit," in Sord (editor) ABSEL Proceedings, 1977, pp. 193-201
- (5) Hunsaker, P. "Incongruity Adaption Capacity and Risk Preference in Turbulent Decision-Making Environments," Organizational Behavior and Human Performance, Vol. 14, 1975.
- (6) Johnson, T. & J. Stinson, "Role Ambiguity, Role Conflict, and Satisfaction: Moderating Effects of Individual Differences," Journal of Applied Psychology, Vol. 60, 1975.
- (7) Kelley, Lane. "An Experimental Evaluation of a Didactic-Experiential Approach for Teaching Personnel Management," in Brenenstuhl and Certo, (editors) ABSEL Proceedings, 1978, pp. 291-296.
- (8) Kogan, N. & M. Wallach. Risk Taking. New York: Holt, Reinhart & Winston, 1964.
- (9) Loveland, J. & A. Whatley. Business Policy Simulation. Unpublished Computer Game, New Mexico State University, 1972.
- (10) McCaskey, M. "Tolerance for Ambiguity and the Perception of Environmental Uncertainty in Organizational Design," working paper, Graduate School of Management, University of California at Los Angeles, 1974.
- (11) Nie, N. et. al. SPSS: Statistical Package for the Social Sciences. New York: McGraw-Hill Book Company, 1976.
- (12) Nunnally, J. Psychometric Theory, New York: McGraw-Hill Book Company, 1967.
- (13) Rokeach, M. The Open and Closed Mind. New York: Basic Books, 1960.
- (14) Rydell, S. & E. Rosen. "Measurement and Some Correlates of Need-Cognition," Psychological Reports. Vol. 19, 1966.
- (15) Steers, R. "Factors Affecting Job Attitudes in a Goal-Setting Environment," Academy of Management Journal, Vol. 19, 1976.
- (16) Steers, R. "Task-Goal Attitude, N-Achievement, and Supervisory Performance," Organizational Behavior and Human Performance, Vol. 13, 1975
- (17) Weir, James E. "An Experiment in Assessing the Theoretical Recognition and Application Learning Skills of Student Case Writers," in Brenenstuhl and Certo, (editors) ABSEL Proceedings, 1978, pp. 146-153.
- (18) Wilsted, W. & H. Hand. "Determinants of Aspiration Levels in a Simulated Goal-Setting Environment of the Firm," Academy of Management Journal, Vol. 17, 1974.