DECISION STYLES AND STUDENT SIMULATION PERFORMANCE: A REPLICATION

Robert W. Hornaday
Kent E. Curran
The University of North Carolina at Charlotte

ABSTRACT

Hornaday and Wheatley (4] compared the usefulness of the Rowe Decision Style Inventory (DSI) with the Rotter locus of control scale in differentiating student performance on a management simulation. They found that students with Conceptual decision styles scored significantly higher on a management simulation than other decision styles and that decision style seemed to be closely related to locus of control. This paper re- ports an effort that failed to replicate those findings with a different sample of students and a different simulation.

INTRODUCTION

One of the best justifications for the use of simulations or, for that matter, any form of experiential learning is that there is little relationship between traditional academic achievement and later managerial success [7]. If simulations are to be useful, they mist measure something other than the ability to get a good course grade from an instructor. Therefore, student attributes such as cognitive traits and the ability to work within a group need further investigation (13, p. 279].

BACKGROUND

Is there a relationship between the cognitive style of the participants and performance in management simulations? In one of the few studies of this problem, Wolfe and Chako [15] found that the cognitive structure, ambiguity tolerance, and category width of 49 business policy students were not related to their performance in a simulation. Wolfe and Chako speculated that the programmed nature of the simulation "overpowered" the cognitive attributes of the participants and rewarded instead scholastic ability and rational decision-making. Other studies have considered the relationship of group characteristics such as cohesion (3;14] and marginality (5] with simulation performance.

Hornaday and Wheatley [4] compared the usefulness of the Rowe Decision Style Inventory (DSI) with the Rotter locus of control scale in differentiating student performance on a management simulation. They found that students with Conceptual decision styles scored significantly higher on a management simulation than other decision styles and that decision style seemed to be closely related to locus of control. This paper is an effort to replicate those findings with a different sample of students and a different simulation.

THE DECISION STYLE INVENTORY

The Decision Style Inventory (DSI) developed by Rowe [12], classifies respondents into four decision styles: Directive, Analytic, Conceptual, and Behavioral. The DSI, used extensively in management development programs, has been completed by more than 10,000 practicing Managers.

Table 1

Rowe Cognitive Contingency Model

	Left Hemisphere (Logical)	Right Hemisphere (Relational)	
Tolerates Ambiguity	ANALYTIC	CONCEPTUAL	Thinking (Ideas)
	Enjoys problem solving.	Is achievement oriented.	Proactive
	Wants best answer.	Has broad outlook.	Change
C C	Wants control.	Is creative.	
O O	Uses considerable data.	Wants independence.	Leader
G M	Enjoys variety.	Is humanistic/artistic.	
N P	Is innovative.	Initiates new ideas.	
I L			
T E			Action
I X	DIRECTIVE	BEHAVIORAL	(Doing)
V I			
E T	Expects results.	Is supportive.	Reactive
Y	Is aggressive.	Uses persuasion.	Change
	Acts rapidly.	Needs affiliation.	
	Uses rules.	Is empathetic.	Manager
	Needs power/status.	Communicates easily.	
	Uses intuition.	Prefers meetings.	
Need for Structure	Is verbal.	Uses limited data.	
	TASK/TECHNICAL	PEOPLE/SOCIAL	

VALUES ORIENTATION

Source: Rowe et al., 1985, p. 232.

The DSI is an outgrowth of the work of Driver and Rowe [1] who investigated cognitive decision styles. Rowe developed a cognitive-contingency model to describe how the four decision styles fit within an organizational setting (Table 1). Tests of the DSI support the model (Table 2). Rowe reported that 80 top level executives tended to have Analytic or Conceptual decision styles (12]. Mann [8] found that financial planners in a sample of 30 executives tended to have dominant Analytic decision styles, while strategic planners had dominant Conceptual decision styles.

Rowe posits the following characteristics for the four DSI styles:

Style	Under Stress	Motivated by	Reacts using	Stimuli seen
Directive	Becomes annoyed	Power/Status	Precepts	Serially
Analytic	Follows rules	Challenge	Insight	Logically
Conceptual	Is erratic	Recognition	Creativity	Spatially
Behavioral	Avoids	Acceptance	Instinct	Behaviorally

The DSI consists of 20 statements, each with four responses corresponding to Directive, Analytic, Conceptual, and Behavioral decision styles. Respondents must rank the four responses to each statement by scoring the response most "appropriate" for them with an "8," the next most "appropriate" response with a "4," then a "2," and finally, a "1" for the least "appropriate"

response. The sum of the 20 subscale responses is the score for that decision style.

Respondent style scores are compared to the average DSI scores for the population as a whole. A style score that exceeds the average by seven points or more is considered the respondent's dominant or most frequently used style. Scores within a range of plus or minus seven points from the average are considered back-up styles. Least preferred styles are identified by scores seven points or more below the average. It is possible for a respondent to have two dominant styles or no dominant style. The DSI classified student

Table 2

Summary of Decision Style Subscale Scores by Occupational Groups

Group	N	Directive	Analytic	Conceptual	Behavioral
General Population	10,000+	75	90	80	55
Female Managers	93	74	88	74	64*
Female Architects	224	65**	96	85	55
Police Chiefs	151	71	90	81	58
Ph.D. Psychologists	5	62**	75**	103*	60
Male Architects	141	65**	95	86	54
U.S. Male Managers	54	72	94	81	53
Japanese Managers	21	69	79**	84	68*
Financial Planners	19	75	100*	74	51
Strategic Planners	11	62**	81**	100*	57
Top Level Executives	80	70	90	93*	47**
Business School Seniors[a]	128	77	88	73**	62*
Business School Seniors[b]	174	75	84	75	63*

* Dominant Decision Style.
** Least Preferred Decision Style.

[a] 1985 sample of Business Policy Students (ENSIM).

[b] 1986 sample of Business Policy Students (BML).

Source: Rowe et al., 1985, p. 235.

respondents into decision style categories by identifying each student's dominant decision style.

The Rotter scale contains 29 pairs of forced-choice statements, including six dummy pairs [9]. A higher score on the Rotter scale indicates that the respondent has a more "external" locus of control, that is, he or she feels they are controlled by events. Lower Rotter scale scores identify respondents who have a more "internal" locus of control. They feel more in control of their fates.

METHOD

Both projects attempted to answer the general research question: Are decision style and Rotter scale score related to student performance in a management simulation?

Both studies tested three hypotheses:

Hypothesis 1. There is no difference in overall student grade point averages across the four decision styles.

Hypothesis 2. There is no difference in student locus of control scores across the four decision styles.

Hypothesis 3. There is no difference in student simulation performance across the four decision styles.

Statistical testing of the hypotheses controlled for the effects of student academic major and sex.

The 1985 Simulation.

The simulation used in the 1985 study was developed by Carl Gooding (2), 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. All firms within a class section were in direct competition with one another.

The 1986 Simulation.

Students in the 1986 sample participated in The Business Management Laboratory (BML) [6]. BML presents more challenging marketing and production conditions than does ENSIM, but has less demanding environmental and labor constraints. Because BML is limited to a maximum of eight firms per industry, each class section had two industries. BML firms competed directly with a maximum of seven competitors. BML and ENSIM are rough- ly equal in difficulty. Both are more complex than most other general management simulations.

The Sample.

All business policy students in four class sections (128 students) taught by one instructor at a large Southeastern university during the spring semester of 1985 participated in the ENSIM simulation. Students were grouped randomly into two-member ENS TM 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 per cent of each student's semester grade. Most student work on the ENSIM simulation was done outside of class.

The 1986 Sample.

Students in five sections of business policy at a mid- sized Southeastern university constituted the 1986 sample. The first author taught three of the sections; the second author the remaining two. The authors grouped the participants into three member teams, attempting to place one accounting major on each team. Due to attrition, nine of the teams finished the competition with only two members. The BML team score counted 20% of each student's course grade, based upon growth, profitability, liquidity, and leverage measures achieved after 10 decision periods over a 10 week time period. Four practice decisions were completed for familiarization with BML. As with the 1985 sample, most student work on BML was accomplished outside of class.

Students in the 1985 sample represented the normal range of business school majors, but the students in the 1986 sample attended a university that offers majors only in Accounting and Business Administration. For direct comparison, all non-accounting students in the 1985 sample were grouped into one category.

FINDINGS

Reliability.

Alpha subscale scores of the 1986 sample stand in stark contrast to those of the 1985 sample.

1985 Sample
n=128

Directive	Analytic	Conceptual	Behavioral
.754	.793	.766	.788

1986 Sample
n=174

Directive	Analytic	Conceptual	Behavioral
.319	.468	.473	.654

The acceptable instrument reliability found in the 1985 test of the DSI collapsed in the 1986 sample.

Table 3

Analysis of Variance

Criterion: Overall Grade Point Average

Business Policy Students

Category	1985 Sample (ENSIM)				1986 Sample (BML)			
	n	mean	F	p.	n	mean	F	p.
Decision Style	128	3.04	3.049	.27	174	2.84	2.773	.02*
Directive	30	2.83			34	2.75		
Analytic	21	3.42			27	3.06		
Undetermined	12	2.94			9	2.89		
Conceptual	16	2.96			26	2.87		
Behavioral	49	3.07			78	2.78		
Academic Major	128	3.04	16.893	.00**	174	2.84	8.786	.00**
Accounting	30	3.42			23	3.08		
Non-Accounting	98	2.86			-	-		
Business Admin	-	-			151	2.80		
Sex	128	3.04	2.928	.10	174	2.84	4.045	.04*
Male	67	2.86			102	2.78		
Female	61	2.99			72	2.91		

* p. < .05
** p. < .01

Distribution of Decision Styles.

Distribution across dominant decision styles of the two samples were similar (Table 3). Rowe reported average decision style subscale scores for different occupational groups (Table 2). Both samples of business college seniors were more Behavioral and less Conceptual than the general population.

Hypothesis Testing.

Comparing the results of testing Hypothesis 1 (Table 3) slight differences exist in GPA relationships between the two samples. First, the 1985 students (ENSIM) reported a significantly higher mean GPA than the 1986 students (BML). Second, in the 1986 sample, Analytic styles reported significantly higher GPAS than the other styles. 1985 Analytics also had higher GPAS, but the difference was not significant. In both samples, accounting majors reported higher GPAs than non-accounting majors. Females in both

samples reported higher GPAs than male students, but the difference was statistically significant only in the 1986 sample. While students in the 1985 sample reported higher GPAS, the results of testing Hypothesis 1 within each sample compare favorably.

Table 4

Analysis of Variance

Criterion: Rotter Scale Score

Business Policy Students

Category	1985 Sample (ENSIM)				1986 Sample (BML)			
	n	mean	F	p.	n	mean	F	p.
Decision Style	128	9.25	2.541	.04*	174	9.95	0.708	.58
Directive	30	8.37			34	9.76		
Analytic	21	7.67			27	9.44		
Undetermined	12	9.08			9	8.44		
Conceptual	16	9.38			26	9.65		
Behavioral	49	10.12			78	10.49		
Academic Major	128	9.25	1.333	.25	174	9.95	3.952	.04*
Accounting	30	8.53			23	8.30		
Non-Accounting	98	9.45			-	-		
Business Admin	-	-			151	10.22		
Sex	128	9.25	0.140	.70	174	9.95	4.096	.04*
Male	67	9.36			102	9.40		
Female	61	9.13			72	10.74		

* p. < .05
** p. < .01

Table 4 contains results of testing locus of control scores across the three categories in both samples. As a group, the 1985 sample (ENSIM) had a more internal locus of control than the 1986 sample (BML). Locus of control was significantly related to decision style in the 1985 sample, but not in 1986 sample. The lower Rotter scale scores of the 1985 Directive and Analytic students indicated a sore internal locus of control. The difference in locus of control between male and female students was marked in the 1986 sample: males more internal. The difference in the 1985 sample was not significant. There was considerable difference in the results of testing Hypothesis 2 between the two samples.

In 1985, the results of testing Hypothesis 3 revealed that students with Conceptual decision styles scored significantly higher on the management simulation than did students of other decision styles (Table 5). But this difference did not appear in the 1986 sample. In fact, Analytic styles did better in the simulation in 1986, but the difference between the decision styles was not significant. In neither sample did simulation performance appear to be related to sex or academic major. The main findings concerning the relationship between student decision style and simulation performance from the 1985 (ENSIM) study were not supported by the 1986 (BML) study.

Simultaneous testing of all the variables using two way Analysis of Covariance is reported in Table 6. The results show that after controlling for GPA, locus of control (Rotter Score), and academic major, Conceptual decision styles outscored the other decision styles in the 1985 ENSIM competition. The same results did not occur in the 1986 BML competition. The covariance model had considerably less explanatory power with the 1986 sample data than with the 1985 sample data. The r^2 dropped from .127 (1985) to .030 (1986), indicating

the ANCOVA model was much less useful in explaining variation in simulation performance.

Table 5

Analysis of Variance

Criterion: Simulation Score

Business Policy Students

Category	1985 Sample (ENSIM)				1986 Sample (BML)			
	n	mean	F	p.	n	mean	F	p.
Decision Style	128	82.5	2.515	.04*	174	82.6	0.930	.44
Directive	30	81.5			34	82.0		
Analytic	21	80.2			27	85.1		
Undetermined	12	81.2			9	84.0		
Conceptual	16	87.5			26	82.8		
Behavioral	49	82.7			78	81.8		
Academic Major	128	82.5	0.019	.89	174	82.6	0.877	.35
Accounting	30	82.6			23	84.2		
Non-Accounting	98	82.4			-	-		
Business Admin	-	-			151	82.5		
Sex	128	82.5	2.118	.14	174	82.6	0.193	.66
Male	67	81.5			102	82.8		
Female	61	83.5			72	82.3		

* $p. < .05$
** $p. < .01$

Table 6

Analysis of Covariance

Criterion: Simulation Score

Business Policy Students

Source of Variation	1985 Sample (ENSIM)			1986 Sample (BML)		
	df	F	p.	df	F	p.
Covariates						
Rotter Score	1	0.139	.71	1	0.235	.62
Grade Point Average	1	0.193	.66	1	1.769	.18
Main Effects						
Decision Style	4	2.895	.026*	4	0.669	.61
Academic Major	6	1.230	.298	1	1.322	.57
Two-Way Interactions						
Style with Major	17	1.681	.059	4	1.548	.17
Residual	98			162		
Covariate Raw Regression Coefficient						
Rotter Score	0.070			-0.070		
GPA	-0.029			0.196		
Multiple r²	.127			.030		

* Probability of no difference < .05.

DISCUSSION

Before rushing to abandon the DSI as a method of measuring decision styles of business policy students, two other major conditions must be considered which may have made it difficult to compare the two samples.

The testing conditions were dissimilar. Different simulations were used (ENSIM and BML). The ENSIM study used two-member teams, six practice decisions, and 12 actual decisions; while the BML study used three-member teams, four practice decisions, 10 actual decisions, and counted 10* less for each student's course grade. The change from two-member teams (ENSIM) to three- member teams (BML) undoubtedly had an effect on the importance of group dynamics as opposed to individual decision styles. Still, if the DSI is to have any value in measuring cognitive traits of business policy simulation participants, it must be robust enough to overcome these relatively minor variations.

The other major external condition is probably more important. Perhaps the failure to replicate the ENSIM results with the BML sample has more to do with respective student populations than with DSI scores. While both samples consisted of senior business policy students at AACSB business schools, the 1985 sample had higher grade point averages and lower Rotter scores. The ENSIM sample came from a major university located in a small city with a traditional student body of over 20,000 students who live away from home, do not work during the semester, and avidly cheer their usually successful big-time football team. The BML sample, on the other hand came from a mid-sized (10,000 students) "computer campus" in a large city where most of the students work during the school year. A large percentage live at home and have no football team at all. It is possible that the characteristics of these two very different student groups may have important effects on student performance, especially in activities as dynamic as a simulation.

The different test results may be symptomatic of the larger problem of generalizing research results based upon student samples to the problems faced by practicing managers. If research results cannot be replicated with other student samples, how can they apply to the real world?

CONCLUSIONS

Three major conclusions are drawn from this study.

1. The use of the DSI in measuring cognitive traits among business policy students is suspect. It is apparently not robust enough to be used across different sample schools or even relatively minor differences in simulation conditions. In addition, 1986 sample produced unacceptably low reliability scores.

2. Conceptual decision styles did not perform better on the simulation than the other decision styles in the 1986 sample.

3. The strong relationship between locus of control and decision style indicated in the 1985 sample did not occur in the 1986 sample.

RECOMMENDATIONS FOR FUTURE RESEARCH

The DSI should not be abandoned for use with business policy students without further testing. It is short, easy to administer and provides a base line for comparison with various occupational groups.

The search for the effects of other cognitive traits on student simulation participation should continue.

REFERENCES

[1] Driver, M. and A. J. Rowe, "Decision-Making Styles: A New Approach to Management Decision Making," in Cary Cooper (editor), <u>Behavior Problems in Organizations</u> (Englewood Cliffs, N.J.: Prentice-Hall, 1979), pp.

[2] Gooding, C. "Decision Making Under Environmental Constraints: A Management Simulation Game," Unpublished Doctoral dissertation, University of Georgia, 1976.

[3] Gosenpud, J. J. "Personality Variables on Group Cohesion, Team Participation and Total Learning," <u>Proceedings, Thirteenth ABSEL Conference</u>, 1986, pp. 115-118.

[4] Hornaday, R. W. and W. J. Wheatley, "Exercise Right Brain Skills in the Classroom: Use a Simulation," <u>Proceeding, 46th Annual Meeting of the Academy of Management</u>, 1986, p. 371.

[5] Hornaday, R. W. and W. J. Wheatley, "Four Factors Affecting Group Performance in Business Policy Simulations," <u>Proceedings, Thirteenth ABSEL Conference</u>, 1986, pp. 17-21.

[6] Jensen, R. L. and D. J. Cherrington, <u>The Business Management Laboratory</u> (Plano, Texas: Business Publications, 1984).

[7] Livingston, J. S. "Myth of the Well-Educated Manager," <u>Harvard Business Review</u>, Jan-Feb, 1971, pp. 79-87.

[8] Mann, H. B. "Relationship Between the Decision Making Styles of Corporate Planners and Other Planners," Unpublished Doctoral dissertation, University of Southern California, 1982.

[9] Rotter, J. B. "Generalized Expectancies for Internal Versus External Control of Reinforcement," <u>Psychological Monographs: General and Applied</u>, 1966, Vol. 80, No. 1, Whole Number 609.

[10] Rowe, A. J. and J. D. Boulgarides, "Decision Styles: A Perspective," <u>Leadership and Organizational Development Journal</u>, 1983, Vol. 4, pp. 3-9.

[11] Rowe, A. J., W. Bennis, and J. D. Boulgarides, "Desexing Decision Styles," <u>Personnel</u>, 1984, Vol. 61, pp. 43-52.

[12] Rowe, A. J., R. 0. Mason, and K. E. Dickel, <u>Strategic Management & Business Policy: A Methodological Approach</u>, (2d ed.) (Reading, Mass: Addison- Wesley, 1985).

[13] Wolfe, J. "The Teaching Effectiveness of Games in Collegiate Business Courses: A 1973-1983 Update," <u>Simulation & Games</u>, September, 1985, pp. 251-288.

[14] Wolfe, J. and T. M. Box, "Relationships Between Team Cohesion Dimensions and Business Game Performance," <u>Proceedings, Thirteenth ABSEL Conference</u>, 1986, pp. 11-16.

[15] Wolfe J. and T. I. Chacko, "Team-Size Effects on Business Game Performance and Decision-Making Behaviors," <u>Decision Sciences</u>, Vol. 14, pp. 121-133.