

# Developments in Business Simulation & Experiential Exercises, Volume 13, 1986

## PERFORMANCE AND ATTITUDINAL AFFECTS OF A DECISION SUPPORT PACKAGE IN A BUSINESS GAME

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### ABSTRACT

Traditional wisdom from the MIS/DATA Processing field suggests that Decision Support Systems (EWS) improve corporate decision making and planning. This paper investigates this question utilizing four business policy sections, two with EWS packages and two without. It was found that the use of EWS produced a more positive overall attitude toward game play, a greater willingness to perform planning, and a better understanding of game play and planning, than handscored work sheets. It could not be determined that a significant difference occurred in the performance of teams with and without the EWS, although the evidence suggests a change in this direction.

### STUDY METHODS

Students in four independent business policy sections played the Executive Simulation (ES) for 9 simulated quarters; one trial decision set and two simulated years of operation. One professor taught two sections and two different professors taught the other two sections. The sections were designated A, B, D and C. Sections C and D were taught by the same professor. Sections B and D were randomly selected to receive the EWS with one random choice being made from A and B and one from C and D. For simplification we will hereafter designate the sections receiving the EWS as BW and DW. The sections utilizing handscored worksheets will be designated A and C.

#### Sample Characteristics

Table 1 describes the demographic characteristics of each business policy class. An analysis of variance across all sections indicates that there were no differences in demographic characteristics of sections except on Sex and years of employment worked part time. Therefore a Duncan's Multiple Range test was run on these two characteristics. The results of this test are shown in Table 2. From Table 2 it can be seen that there are significantly more females than males in section C than in section A. Section BW also had significantly more female students than did section A or section rA4. Under part time employment it can be seen from Table 2 that section A had significantly more years of part time employment than section C or DW. While the class composition by sex and part time employment could affect game and attitudinal results, the differences cited are not significantly different on any characteristics across the two classes taught by the same instructor, C and DW.

None of the instructors of the policy sections evaluated had previous business game experience. The game was introduced by the authors and scored by the same graduate assistant for all four classes. All game decisions and analysis was done outside of class. All questions concerning the ES

were referred to the ES author or to his graduate assistant. No attempts were made to integrate the game with other course materials. The instructors in the classes referred all game questions to the game author outside of class. Students were taught to use the EWS by a co-author. Step-by-step instructions for using handscored work sheets were provided in the student game manual.

Each professor utilized different materials for the case and strategic management portion of their class. The following summary will describe these materials.

Section A used the text by Thompson and Strickland, entitled, *ic Management*, Third Edition, by BPI. Cases were assigned daily and one case was written from outside research. The game was used as a class discussion, but all game decisions were made outside of class as in the other sections. Daily case discussion composed 80 percent of total grade and a comprehensive case write-up and a final exam counted 20 percent. The ES was discussed during one class period and it was implied that it would count as part of the case discussion grade.

Section BW used the text by Byars, entitled Strategic Management, by Harper and Row. Readings and cases were assigned daily and 7 cases were required during the semester. Four exams were given over the text chapters. Two case analyses were required of each student in addition to daily preparation. Although the game was assigned a grade of 10 percent of the course no specific game grade was given and students received a game grade of pass/fail.

Section C and DW used the text by Wheelen and Hunger entitled Strategic Management and Business Policy, published by Addison/Wesley, 1983. Daily case assignments were made and a group case project was assigned. The same groups assigned to cases worked together in making game decisions. The group case and peer ratings counted 20 percent of the grade assigned in the course. While no specific grade was assigned the game, it was implied that the game would count as part of the group grade. Two hourly exams counted for 50 percent of the grade. Class work counted 15- 20 percent, and group presentations counted 15-20 percent and a final project counted 10-15 percent.

Two major tests of EWS affects were administered at the end of the game to all participants: an eleven item questionnaire with subquestions on the planning sheets and functional areas (see Table 3 and 4) and a ten item attitude questionnaire utilizing a five point Likert scale (see tables 5 and 6). Performance with and without the EWS was evaluated by an analysis of variance performed, utilizing ROI for each team for each quarter (see Tables 7 and 8). The formula used for ROI is earnings before interest and taxes divided by total assets.

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## HYPOTHESES TESTED

The following hypotheses were formulated to test the affects of attitude development and performance effects of the use of decision support systems in a game-the EWS.

- H1 The use of the EWS produces a more positive overall attitude toward game play than does the use of the HWS.
- H2 The use of the EWS produces the willingness to perform more planning for game play than does the use of the HWS.
- H3 The use of the EWS produces a better understanding of game play and planning than does the use of the HWS.
- H4 The use of the EWS produces a higher ROI than does the use of the HWS.

Hi was tested by the ten attitude questionnaire. H2 and H3 were examined by the eleven item questionnaire. H4 was tested by the analysis of ROI across the groups with and without the EWS.

## RESULTS

### Results from Questionnaire and Attitude Survey

Table 3 presents the results of an analysis of variance between the two sections playing the game with the EWS, BW, and DW, and the two sections playing the game without the EWS, A and C, on the eleven item questionnaire. The means for every question answered by the EWS groups BW and DW were more positive than the means for questions answered by the HWS groups, A and C. The difference in the means was significant at the .05 level and more positive for all questions except questions 1, 3 and 6. EMS user sections did not think their teams were more successful, did not make significantly more alternative decisions than non-users, and did not meet significantly more often than non-users. On the other hand EWS user groups were found to be significantly different from nonuser groups in that they: completed worksheets more frequently, reached a consensus decision more often, spent more time on each decision set, found the simulation reinforced concepts taught in the policy course to a greater extent, thought they had a greater improvement in understanding, used financial ratios in alternative evaluation more often, and believed more strongly that their performance would improve if they played the game again.

Table 4, presents only the data on the questionnaire pertaining to groups taught by one instructor, C and DW, and hence more likely to represent only difference stemming from the use of the EWS. In these two sections the direction of the larger means is the same as that discovered across all four sections. However, there are more questions that did not produce significant differences at the .05 level. As in Table 3, questions 1, 2 and 6 were not significant. However, question 11, belief that performance would improve if they played the game again, did not prove to be significantly different for the two groups.

The results of the attitude questionnaire items are presented in Table S for all students, with analysis of variance performed for sections without the EWS, A and C, across

the sections with the EWS, sections BW and DW. The students responded to each question on a 5 point Likert type scale ranging from Strongly Agree to Strongly Disagree. All questions elicited means that were more positive for the students using the EWS than for ones without it. Additionally, all F scores were significant at beyond the .05 level of significance. Students seem to enjoy the game more using the EMS. With the EWS they considered the game to be less work and less difficult. The use of the EWS apparently caused them to view the planning and the learning process more positively. The teams utilizing the EWS say they did more planning and less guessing and that they completed the planning sheets more often than reported by the teams without the EWS. EWS users are more interested in playing the game again, believe that they understand the planning process better, and are more positive toward the ES as a learning experience. Table 6 presents the findings for the same attitude questionnaire, but with analysis of variance reported only across the two groups taught by one instructor, C and DW. In every case the direction of attitude shift was in the direction hypothesized. On questions that were significantly different, the EWS section answered the questions in a more positive manner.

### Results of Performance Analysis

Tables 7 and 8 present the results of analysis of variance across teams with and without the EWS on ROI for each quarter of the ES game play. In every case BW and DW sections produced ROIs that exceeded those of A and C. However, the differences were significant only in quarters 1 and 8 and for the over-all game ROI. The same pattern was discovered for ROI Mean differences between sections C and DW, the two sections taught by the same instructor. All mean ROI's for the section using the EMS were greater, but only in quarter 6 and for the overall mean were significant differences found.

## DISCUSSION AND CONCLUSIONS

Although all mean questionnaire scores across the sections with and without the EWS supports Hi, Hi cannot be accepted without qualification on this basis alone, since the populations were found to be significantly different in sex and part time employment composition and since they were taught by different instructors using different materials. A further test of Hi across the means of the two policy sections taught by one instructor, C and DW (Table 6) produced means in the expected direction and all ten items showed significant differences at greater than the .05 level. Therefore Hi is accepted. In a test of H2 and H3 all means were found to be significantly different and in the expected direction, except means for 3 questions which were not significant. Again, H2 and H3 are not accepted unqualifiedly because of sex and part time employment differences. A further test utilizing only sections C and DW produced means in the direction hypothesized, except for four questions that were not found to be significantly different. Since the significant findings dealt with the planning question of H2, H2 is accepted. The significant findings also dealt with an understanding of game play and planning, therefore, H3 is accepted.

H4 was tested by analysis of variance of mean ROI's for each quarter. All of the ROI differences across the four sections A and BW and C and DW (Table 7)

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and across the two sections, C and DW (Table 8) were found to lie in the expected direction and the mean differences seem to be growing more significantly different as the game progressed. The overall mean was also significantly greater for the EWS group. However, H4 cannot be accepted from the test of all 4 sections because of sex and part time employment differences. In Table 8 dealing only with C and DW the mean ROI differences support H4, but only one quarter and the overall mean proved significantly different. H4 must be considered nonconclusive.

The present study indicates that DSS packages such as the Electronic Work Sheets used with Executive Simulation are useful in that they produce a positive attitude toward game play by students and tend to cause them to do more planning. Students indicate that they have a better understanding of game play with the EWS than with hand scored planning sheets. There was some indication that the use of the EWS produces superior performance on the part of students than they can obtain without them. However, the results were inconclusive in this area. A future research design should utilize only one instructor, enroll teams across classes and industries, and place a heavier grade on game performance.

TABLE 1  
ANALYSIS OF VARIANCE FOR DEMOGRAPHIC  
CHARACTERISTICS ALL SECTIONS

Sec.	N	Age/SD	Sex/SD	Hours/SD	GPA/SD	MEANS	PT
						FT	Yrs. Emp./SD
A	30	22.07/.78	1.200/.41	182.3/11.8	2.39/.36	.98/1.58	5.50/2.43
BW	27	21.59/1.19	1.741/.45	178.2/ 7.7	2.65/.44	.80/1.62	4.73/1.84
C	30	21.90/1.24	1.533/.51	183.8/13.7	2.50/.47	.73/1.26	3.62/1.91
DW	31	22.65/2.48	1.323/.47	180.4/18.2	2.57/.50	1.39/2.46	4.10/2.12
F/ratio	2.31	7.62	.92	1.76	.81	4.55	
Sig.	.05	ns.	sig.	ns.	ns.	ns.	sig.

(Note: Sex coded as 1 male and 2 female)

TABLE 2  
DUNCAN'S MULTIPLE RANGE TO ANALYZE SEX AND PT EMPLOYMENT  
DIFFERENCES ACROSS BUSINESS POLICY SECTIONS

		SEX				Shortest Significant Ranges .05 level
		A 1.200	DW 1.323	C 1.533	BW 1.741	
A	1.200	-	.123	.333	.541	R = .238
DW	1.323		-	.210	.418	R = .251
C	1.533			-	.208	R = .259

Means underlined are not significantly different

		PT EMPLOYMENT				Shortest Significant Ranges .05 level
		C 3.62	DW 4.10	BW 4.73	A 5.50	
C	3.62	-	.48	1.11	1.88	R = 1.08
DW	4.10		-	.63	1.50	R = 1.14
BW	4.73			-	.77	R = 1.18

Means underlined are not significantly different

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TABLE 3

ANALYSIS OF VARIANCE OF QUESTIONNAIRE RESPONSES  
ALL STUDENTS

Question	A & C Students W/O EWS	BW & DW Students With EWS	F	P
1.How successful was your team.	3.39	3.64	1.22	NS
2.How frequently did you complete a worksheet:				
a)Sales forecast	3.25	4.10	10.69	.002
b)Production Sch.	2.75	4.11	26.85	.0001
c)Operating Budg.	2.20	3.75	35.10	.0001
d)Cash budget.	2.18	3.71	36.95	.0001
3.No.decision alternatives evaluated prior to final decs.	2.93	2.79	.56	NS
4.How frequently completed work-sheet for each alternative?	2.08	2.82	10.00	.002
5.Decision result group/discussion consensus?	3.76	4.21	5.08	.03
6.How often group met.	1.22	1.08	1.30	NS
7.Average time each decision	1.31	1.58	7.14	.009
8.Extent simulation support reinforced concepts.	2.46	3.53	28.43	.0001
9.Extent simulation improved understanding:				
a)Sales forecast	3.03	3.96	17.77	.0001
b)Pricing & Prom.	3.15	4.17	23.58	.0001
c)Financial Plann.	2.83	3.96	26.00	.0001
d)Production Mgt.	2.89	4.23	38.59	.0001
10.Used financial ratios in alternative evaluation?	1.95	2.77	11.91	.0008
11.If played again would performance improve.	.83	1.00	10.42	.002

Note: Higher means indicate greater frequency or agreement.

TABLE 4

ANALYSIS OF VARIANCE OF QUESTIONNAIRE RESPONSES  
STUDENTS IN SECTIONS TAUGHT BY SAME INSTRUCTOR

Question	C Students W/O EWS	DW Students With EWS	F	P
1.How successful was your team.	3.45	3.71	1.40	NS

TABLE 4 (cont.)

2.How frequently did you complete a worksheet:				
a)Sales forecast	3.69	4.11	1.57	NS
b)Production Sch.	2.93	4.19	12.71	.0008
c)Operating Budg.	1.83	3.86	52.42	.0001
d)Cash budget	1.90	3.82	44.80	.0001
3.No.decision alternatives evaluated prior to final dec.	2.97	2.50	2.93	.10
4.How frequently completed work-sheet for each alternative?	2.00	2.86	8.29	.006
5.Decision result group/discussion consensus?	4.31	4.29	.01	NS
6.How often group met.	1.14	1.00	.85	NS
7.Average time each decision	1.31	1.61	4.64	.09
8.Extent simulation support reinforced concepts.	3.00	3.74	10.06	.003
9.Extent simulation improved understanding:				
a)Sales forecast	3.72	4.18	3.69	.07
b)Pricing & Prom.	3.79	4.36	7.08	.02
c)Financial Plann.	3.41	4.11	6.76	.02
d)Production Mgt.	3.52	4.25	9.05	.01
10.Used financial ratios in alternative evaluation?	1.93	3.25	18.15	.0001
11.If played again would performance improve.	.97	1.00	.96	NS

TABLE 5

ANALYSIS OF VARIANCE OF ATTITUDE SCALE ITEMS  
ALL STUDENTS

Item	BW & DW Students With EWS	A & C Students W/O EWS	F	P
1.I enjoyed participating in the ES.	1.63	2.59	30.66	.001
2.The ES was too much work for the time available.	3.87	3.52	2.93	.09
3.I found the ES to be very difficult.	4.11	3.68	5.23	.03
4.The planning process (sales forecasting, production scheduling, etc.) designed for the ES is very effective.	2.25	3.02	21.42	.0001

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TABLE 5 (cont.)

5. We did not make enough decisions in the ES for me to learn what was happening.	3.98	3.37	11.27	.002
6. My team usually completed the planning process in the ES (sales forecasting, production scheduling, etc.)	1.90	3.25	45.89	.0001
7. Our team did more guessing than planning in the ES.	3.40	2.75	9.91	.003
8. I would like to have an opport. to play the ES again.	2.09	2.75	8.61	.005
9. The planning process in the ES helped me understand strategic planning.	1.92	2.75	29.60	.001
10. The ES is an excellent learning experience.	1.77	2.81	28.78	.0001

Note: Higher means indicate higher disagreement.  
 Note: Means computed from five point Likert Scale:  
 1 2 3 4 5  
 SA A U D SD

TABLE 6

ANALYSIS OF VARIANCE OF ATTITUDE SCALE ITEMS  
 STUDENTS IN TWO COURSE SECTIONS  
 TAUGHT BY SAME INSTRUCTOR

Item	DW Students With EWS	C Students W/O EWS	F	P
	MEANS	MEANS		
1. I enjoyed participating in the ES.	1.71	2.17	6.89	.02
2. The ES was too much work for the time available.	3.68	3.69	.00	NS
3. I found the ES to be difficult.	4.04	3.69	1.91	NS
4. The planning process (sales forecasting, production scheduling, etc.) designed for the ES is very effective.	2.11	2.69	9.20	.004
5. We did not make enough decisions in the ES for me to learn what was happening.	4.00	3.55	3.49	.07

TABLE 6 (cont.)

6. My team usually completed the planning process in the ES (sales forecasting, production scheduling, etc.)	1.86	3.38	45.10	.0001
7. Our team did more guessing than planning in the ES.	3.53	3.03	3.08	.09
8. I would like to have an opport. to play the ES again.	2.21	2.31	.13	NS
9. The planning process in the ES helped me understand strategic planning.	1.79	2.41	12.00	.001
10. The ES is an excellent learning experience.	1.75	2.28	4.81	.04

Note: Higher means indicate greater disagreement.  
 Note: Means computed from five point Likert Scale:  
 1 2 3 4 5  
 SA A U D SD

TABLE 7

ANALYSIS OF VARIANCE  
 R.O.I. PERFORMANCE FOR ALL TEAMS

Quarter	BW & DW Teams With EWS	A & C Teams W/O EWS	F	P
1	5.16	3.00	4.77	.04
2	2.28	1.68	.60	NS
3	8.80	7.57	.81	NS
4	5.32	3.24	2.90	.10
5	8.66	6.78	2.01	.17
6	3.95	1.77	3.01	.10
7	11.61	8.17	3.13	.09
8	5.20	6.42	5.17	.03
TOTAL	29.89	18.51	5.67	.03

Analysis of Variance. R.O.I. Dependent Variable use of EWS as Independent Variable.

TABLE 8

ANALYSIS OF VARIANCE OF  
 R.O.I. PERFORMANCE FOR TEAMS TAUGHT  
 BY SAME INSTRUCTOR

Quarter	C Teams With EWS	DW Teams W/O EWS	F	P
1	5.53	4.14	1.32	NS
2	2.53	1.18	1.12	NS
3	9.59	7.46	.82	NS
4	6.93	3.46	1.62	NS
5	9.93	7.17	2.74	.12
6	4.72	1.62	5.13	.04
7	12.28	8.93	1.04	NS
8	5.90	3.52	1.59	NS
TOTAL	33.62	21.24	3.90	.07

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### REFERENCES

Note: Review of Literature omitted from paper. Selected references shown below. Entire paper available on request.

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