Developments in Business Simulation and Experiential Learning, Volume 29, 2002

A BUSINESS GAME DISTANCE EDUCATION APPLICATION: LEARNING OUTCOMES AND EXPERIENCES

Wolfe, Joseph
Experiential Adventures LLC
Jwolfe8125@aol.com

Flores, Luis
Northern Illinois University
M60LGF1@wpo.cso.niu.edu

Ritchie, William
Florida Gulf Coast University
writchie@fgcu.edu

ABSTRACT

Distanced Education (DE) for many student populations has become a an alternative to traditional in-resident education. A number of business games have been used in long-term distance education situations. This study examined the comparative learning outcomes and supposed internet-associated benefits of using a game in this fashion. DE learning results were no better or worse than those associated with the course's normal delivery mode. The supposed benefits regarding DE's regarding flexibility, communications access and timeliness were not realized. The role of in-class technical support and follow-up appeared to be a discriminating factor between the two universities sampled.

INTRODUCTION

Distance Education (DE) has arrived at the collegiate level. Some universities, such as Open University, Athabasca University and the University of Phoenix, have built their entire missions around the delivery of off-campus programs. Thomson Learning has recently announced that is it joining a consortium of sixteen schools to start an online university called Universitas 21 Global. In making the announcement its president and chief operating officer David Shaffer stated "There's a tremendous demand unmet by bricks-and-mortar' universities (Cherney, 2001). Others, such as the University of Notre Dame, Southwest Missouri State University and Stanford University's online Master's in Electrical Engineering offer DE programs along with traditional on-campus course delivery methods. Business education for the professional market has also joined the field. It has been estimated that 710,000 students were enrolled in DE courses in 1998, and this number will increase to about 2.3 million by 2002 (Grimes, 2001). Similarly, corporate spending on e-learning will increase from $2.1 million in 2000 to about $14.2 million in 2004 (Eure, 2001).

Alternatively, a number of ambitious efforts have already failed. Quisic Inc., one of the largest of the e-learning companies, has abandoned university courses in favor of corporate training. Pensare, Inc., which was developing MBA programs for Duke University and the University of Pennsylvania's Wharton School, filed for bankruptcy in Spring, 2001. Despite these failures, the success of the Apollo Group's Phoenix University proves profits can be made by online, DE-based universities

Because the internet offers great outreach potential, and business schools have been high adopters of computer-driven teaching technologies, it is natural that a number of business games are now played on-line by degree-pursuing students. The typical operating mode for business games and simulations since their introduction in the late-1950s had been for them to be locally administered and controlled by the instructor. With the advent of the internet, however, some game developers have distributed their games solely on the internet**,** while simultaneously administering the simulations for the instructor. Games such as *NetStrat* (n.d.), *Conglomerate* (Elgood, n.d.), *Team Leadership* (Kelly, n.d.), *CAPSTONE* (2000) and *Marketplace* (Cadotte &

The authors gratefully acknowledge teaching assistance provided by Brett R. Gaskill at "HiSup" University.

Bruce, n.d.) are simulations of this type. Just as internet applications have been burgeoning so too have been the adoptions of distance-administered games. CAPSTONE's author stated there were 300 adoptions of this simulation in 2000 and expects them to increase to 400 adoptions in 2001. The *Marketplace* family of games has been doubling their adoptions every year for the past four years. Instructors themselves have begun to develop their own local area business game networks to capitalize on the outreach and networking abilities of internet-basedplay (Burns, 1998; Griffin, *et. al*.1999; Machuca & Barajas, 1997; Overby, *et. al.*, 2000; Raychaudhuri (in press); Siu & Chau, 1998).

Given this high level of resource commitment to DE in terms of money on the part of DE-providing institutions, career and time choices by faculty designing DE-based courses and using the internet for educational purposes, and students and players who should reap the learning benefits commonly associated with game play, a rigorous examination of the learning results associated with a DE-administered business game is warranted.

BACKGROUND

Distance Education can be defined as a formal approach to learning during which the majority of instruction occurs while the learner and the educator are at a distance from each other (Verduin & Clark, 1991; Garrison & Shale, 1987). University-sponsored distance study began in the United States in 1874 at Illinois Wesleyan University (Rumble, 1986) followed by the Correspondence University in Ithaca, New York in 1883 (Mackenzie & Christensen, 1971). From these beginnings the medium has evolved from postal mail to audiocassettes to videocassettes via the phonograph, the telephone, AM/FM and short wave radio, television, and finally the internet.

LITERATURE REVIEW

A large number of studies have examined the effects of Distance Education on its students, instructors and their institutions. The conclusions of these studies have been summarized reviews by Schlosser and Anderson (1994), Moore and Thompson (1997), Verduin and Clark (1991) and Lesh and Rampp (2000). It has been found that DE is at least, if not more effective, in obtaining learning outcomes when contrasted with traditionally-taught classes (Boucher, Hunter & Henry, 1999; LaRose, Gregg & Eastin, 1998; Souder, 1993). Moreover, for certain student populations it may be a superior course delivery method.

The successful DE student is one with high persistence levels, believes the results of failing the course are serious, believes they will succeed in the program, can work alone, know**s** how to manage their time, is goal oriented**,** and feel**s** they are academically well-prepared (Powell, Conway & Ross, 1990). The successful DE student is also married, has a high literacy level and is female.

Notwithstanding these results some authors such as DeAmicis (1997); Toth-Cohen (1995) and Phipps and Merisotis (1999) question the conclusions drawn about DE's learning benefits due to the lack of adequately controlled experimental investigations. Although this observation is often true**,** those defending computer-assisted DE point out a number of theory-based reasons why this education method would be superior to traditional teaching methods.

Hazari & Schnorr (1999) observed the computer, because it is an interactive medium, provides the immediate feedback and assessment that is important if learning is to occur (Gagne, Briggs & Wager, 1992; Eagan, Sebastian & Welch, 1991; Moore & Thompson, 1990; Verduin & Clark, 1991). Computer usage also allows learning to be self-paced rather than instructor-paced (Barker, 1988; Billings, 1986; Gutierras, 1989; Hebda, 1988; Kosmahl, 1994; Stephens & Doherty, 1992); Webster & Hackley, 1997). At the least, it has been observed DE does not produce inferior learning outcomes and therefore no harm has been done. More importantly for society as a whole, these outcomes are obtained at lower costs to both the students and the institutions using the method (Russell, 1999; Clark, 1983, 1985, 1991, 1999).

Although a large number of effectiveness studies have been conducted**,** relatively few have involved DE applications in business education at the collegiate or adult level. Of the nine effectiveness studies summarized by Lesh and Rampp (2000), only one study involved a business course. Of the eleven experimentally controlled DE studies reviewed by Moore and Thompson (1997)**,** none dealt with business course-work. Six of the studies dealing with business course DE applications were anecdotal and did not evaluate learning effects associated with such computer-facilitated learning situations.

Despite the oversights of these reviews**,** a few studies *have* involved business courses. A student opinion study by Webster & Hackley (1997) involved accounting within a wide array of courses teaching such subjects as chemistry, engineering, physics, political science and sociology. Their subjects (n=247) pursued 29 different courses offered by six North American universities. Actual learning outcomes were not assessed**,** although many of the elements necessary for creating a viable DE environment were present in the technologies employed. It was found DE gave the students a sense of empowerment but the remote DE environments were judged "less rich" than those experienced by those taught in locally-controlled environments (LE).

A study by Siu and Chau (1998) collected student opinions regarding the value of web-based instruction in a marketing course. The subjects (n=54) were more satisfied with the site's information content and were less satisfied with its navigability and user friendliness. In the same year Burns (1998) reported his personal experiences with *AutoSim* (James, Kinnear & Deighan, 1995) played via a dedicated home page. The author observed a wide range of player internet skill and comfort levels as well as multiple problems with the word processing software players used

for communication purposes. Other negatives involved contracting a computer virus and working in a "faceless" and impersonal learning environment.

A conference session presented at the annual meeting of the Association for Business Simulation and Experiential Learning by Griffin *et. al*. (1999) also noted a number of negative elements associated with an internet-based Senior-level Advanced Accounting course. These negatives were basically associated with the technology being used and the students' inability to deal with the technology. Their list of problems included the following:

- The occurrence of course-delaying breakdowns.
- Slower delivery of course content for the same amount of content delivered in face-to-face class sessions.
- Internet slowness at certain times of the day which necessitated changing course schedules.
- Awkwardness in providing feedback on assignments and tests opposed to using handwritten marginalia commonly associated with face-to-face coursework assignments.

Alternatively, two positives were noted:

- Ease in which written assignments were read as all submissions were typed rather than handwritten.
- Ease in the grading of spreadsheet assignments as any errors in the assigned problems could be found in the submitted spreadsheet files.

In a demonstration session the following year before the same professional group (Overby *et al.,* 2000) indicated the feasibility of using any one of three very popular computer-based business games using Microsoft's NetMeeting. NetMeeting allowed instructors to engage in DE without having to modify the simulations themselves.

Based on the literature just reviewed a number of questions exist regarding the efficacy and efficiency of using web-based business games. These questions exist because no controlled study has been conducted on the learning outcomes associated with a business game administered via the internet. Additionally, no study has been conducted on learner satisfaction levels associated with a DE game versus one that is conducted in the traditional LE mode and the role the technical support may have on learning outcomes or course satisfaction levels. The following section presents and rationalizes the hypotheses used to test these questions on the comparative effects of DE versus LE teaching in high support and low support teaching environments.

HYPOTHESES

The study's first hypothesis tested whether learning outcomes experienced by DE groups were equal to or superior to those experienced by LE groups. This hypothesis was based on the general finding that DE participants do no worse, and sometimes better academically, than traditionally-taught students (Boucher, Hunter & Henry, 1999; LaRose, Gregg & Eastin, 1998; Souder, 1993).

H_1: Students playing the business game via Distance Education will demonstrate learning levels that are equal to, or higher than, those achieved by the traditionally-taught students.

One of the benefits supposedly associated with web-based education is its ability to give participants a sense of control and self-direction. This control allows them to plan their own study times and pace their learning based on their own needs (Barker, 1988; Billings, 1986; Gutierras, 1989; Hazari & Schnorr, 1999; Hebda, 1988; Kosmahl, 1994; Stephens & Doherty, 1992; Webster & Hackley, 1997). The study's second hypothesis thusly was stated as:

H_2: Students playing the business game via Distance Education will express higher levels of self-control over their learning experience.

Another benefit attributed to DE is the instructor's ability to provide faster student feedback (Billings, 1986; Egan, 1991; Gagne & Briggs, 1992; Hebda, 1988; Kosmahl, 1994). Two hypotheses needed to be tested here because feedback comes from two sources in a business game situation. One source is from the instructor or Game Administrator. The other source is from the game itself via its various print-outs and reports. Thus the next two hypotheses dealt with the *speed* at which feedback was provided by the two sources.

H_3: Students playing the business game via Distance Education will express higher levels of satisfaction with the speed at which they receive feedback from the Game Administrator or instructor.

H_4: Students playing the business game via Distance Education will express higher levels of satisfaction with the speed at which they receive feedback from the business game itself.

In addition to learning being optimized through fast feedback, the feedback must be useful to the student (Billings, 1986; Hazari & Schnorr, 1999). It has also been found that players prefer face-to-face feedback over impersonal feedback (Andrusyszyn, van Soeren, Laschinger, Goldenberg & DiCenso, 1999; Burge & Howard, 1990; Cragg, Andrusyszyn, & Humbert (1999). As was the case for the two previous hypotheses, the usefulness of any feedback can be determined by the source's quality. Given the same simulation was used for both groups, the nature of the feedback would be the same for all players. A difference can occur, however, between the quality or usefulness of the feedback provided by either the LE instructor and the DE Game Administrator**,** even though the game is the same. Accordingly the next two hypotheses were:

H_5: The student groups playing the business game will express equal levels of satisfaction with the quality of the feedback they received from the game.

H_6: Students playing the business game via Distance Education will express lower levels of satisfaction with the quality of feedback received from the distant Game Administrator.

The last hypothesis dealt with the role of player technical proficiency in DE's acceptance or expressed satisfaction levels. Burns (1998), Griffin *et. al*. (1999) and Siu and Chau (1998) have all noted that many technical problems accompany DE's use. It is possible these problems are a damaging intrusion rather than an aid to learning and that high technical support at the local level is necessary to insure a satisfying experience. This hypothesis was stated as:

H_7: Students playing the game under high support conditions will have fewer interface problems.

METHODOLOGY

Four sections of senior-level business students in a strategic management-type course at two universities designated LoSup (n=74) and HiSup (n=65). Players were randomly assigned to 3-4 member decision making teams in six separate industries. One-half of each school's industries played the game in the DE mode while the other half played the game in the (LE) mode. Although separate, the industries operated under the same basic parameters for eight simulated business quarters. The simulation was a NAFTA version of the moderately complex *The Global Business Game* (Wolfe, 2000). An in-class coin-flip determined which industries played the game via the DE and LE modes.

A test of mean score differences in a pre-game take-home game knowledge examination showed the groups were equally prepared for the game at LoSup but not unequally prepared at HiSup. At HiSup the DE group scored higher on its pre-game knowledge. The level of pre-game preparation was also different between the universities with HiSup obtaining a mean score that was 75.9% higher than that achieved by LoSup (p=.05, t=10.5, df=64). The results are presented in Table 1.

Table 1
Pre-Game Test Scores

Variable	LoSup		HiSup	
	DE	LE	DE	LE
Score	16.17	16.23	32.06	24.81
t-Statistic	-0.22		3.39	
Significance	n.s.		p=.05	

A test of the demographics associated with the group created by random assignment indicated they were statistically the same by age and gender and were the same at HiSup by majors and grade-point-averages (GPAs). The treatment and control groups created at LoSup were not the same by majors and GPAs. Cross university comparisons on majors could not be conducted due to differences in the majors available. The results of this analysis is presented in Table 2.

All players received the same, on-site, jointly-presented game orientation sessions and technical briefing for two class periods led by the simulation's author. Once the game began all groups and industries were administered separately for the rest of the semester except that all players at HiSup received in-class technical assistance provided by an assigned teaching assistant dedicated to helping players access their files and input and interpret their decisions. Weekly in-class discussions of the game were also conducted by the technical assistant.

Players at LoSup operated in a more *laissez-faire* environment where the instructor was always available for team coaching but did not supply dedicated technical support. The LE industries were processed and coached by the course's local Game Administrator. DE industry players interacted asynchronously with their game's administrator via e-mail. Their decision sets were processed and the period's results, along with commentaries on their decisions by the DE administrator, were to be returned via e-mail within twenty-four hours.

Table 2
Within-University Treatment and Control Groups By Demographic Characteristic

Demographic	LoSup University		HiSup University	
	Treatment	Control	Treatment	Control
Percent female	50.0%	54.8%	53.1%	50.0%
Age	22.21	22.06	22.00	22.61
GPA	3.15	3.35*	2.94	3.04
Major:				
Accounting	n.a.	n.a.	12.5%	32.1%
Business Administration	n.a.	n.a.	6.3%	7.1%
Finance	38.7%	20.0%	18.8%	21.4%
International Business	9.7%	40.0%	n.a.	n.a.
Management	32.3%	30.0%	18.8%	14.3%
Marketing	12.9%	6.7%	37.5%	7.1%
Operations Management	6.5%	3.3%	6.3%	17.9%

*Significant p=.05, t=2.30, one-tail test, df=54.

Coaching for the DE teams was conducted via e-mail while LE coaching was done through face-to-face interactions with the LE Game Administrator. Objective DE and LE knowledge levels were measured by comparing each group's scores on the instructor's course-material examinations. Subjective reactions to activities and relationships associated with the gaming experience were gathered within and across university groups at the semester's end via a five-point Likert-type instrument. Its scores could run from 1 to10 with a "10" indicating a highly favorable reaction to the characteristic being questioned. Although the same business game was used in each university's course it was only one part of each instructor's total instructional package. The material in Table 3 summarizes the context in which the game was used and the local learning and grading climate created by each LE instructor.

HYPOTHESIS TEST RESULTS

The first hypothesis tested for course-related learning effects associated with DE versus LE-based learning environments. This hypothesis was rejected for the HiSup group (p=.05, t=1.70, one- tail test, df=57) as presented in Table 4. LoSup's DE-group learning levels were equal to, but not superior to those obtained by the LE group. Thus the hypothesis at LoSup was accepted.

The second hypothesis stated DE players would feel they had greater control over the learning experience. This hypothesis was rejected as presented in Table 5 which summarizes all tests associated with attitudes towards the business game experience. The study's third and fourth hypotheses covering the greater speed of game delivery supposedly associated with DE education were also rejected.

Table 3
Course Structure By University

Course Component	LoSup University	HiSup University
Game trial decisions	1	2
Game Decision rounds	8	8
Game pacing	Weekly beginning the semester's fourth week	Twice-weekly beginning mid-semester
Game knowledge examination	One for 15.0% course grade	One for 5.0% course grade
Game performance grade weight	15.0% with "B-" being the lowest possible grade based on the company's following performance weights: 1. Profit— 60.0% 2. ROA— 20.0% 3. EPS— 5.0% 4. ROE— 5.0% 5. Stock Price— 10.0%	5.0% of the course's grade with all economic criteria equally weighted
Game-related Annual Report	Not applicable	One for 5.0% course grade
Game-related Board Meeting	Not applicable	One for 5.0% course grade
Game-related Term Report and class presentation	One for 10.0% course grade	Not applicable
Written case assignments	Assigned questions for six of eleven cases for 20.0% course grade	Not applicable
Oral case presentations	Not applicable	One for 20.0% course grade
Course-work formal examinations	Two for 15.0% course grade each	Two for 20.0% course grade each
Class participation	10.0% course grade	10.0% course grade

Table 4
Learning Levels By Study Group

LoSup University		HiSup University	
Treatment	Control	Treatment	Control
90.5	91.4	77.1	80.6*

*Significant p=.05, t=1.70, one-tail test, df=57.

Table 5
Mean Within-University Reaction Questionnaire Responses

Question	LoSup University		HiSup University	
	Treatment	Control	Treatment	Control
Personal Control	6.37	6.35	5.67	5.74
Game Administrator Feedback Speed	6.24	6.46	6.24	6.16
Game Turnaround Speed	5.90	5.32	6.12	5.92
Game Feedback Quality	5.75	4.56*	5.45	5.54
Game Administrator Feedback Quality	5.21	5.96	5.13	5.49
Overall Response	5.89	5.73	5.72	5.76

*Significant p=.05, t=2.07, one-tail test, df-63.

Hypotheses five and six dealt with the perceived quality of the feedback players received from the simulation itself or their particular game administrator. The DE-based players at LoSup felt the game's feedback was superior while at HiSup both groups rated the quality of the game's feedback the same. Thus this hypothesis was accepted for the LoSup students but rejected for the HiSup players. The sixth hypothesis, which in effect stated feedback from a "live" LE game administrator would be preferred over the written feedback provided by a DE game administrator, was rejected as equal assessments were made of the value of game administrator feedback regardless of its source or presence.

The last hypothesis dealt with the degree the additional technical burden placed on players, due to their having to interface via the internet, affected their playing behaviors and the nature of the communications conducted between players and the Game Administrators. Based on the information presented in Tables 6-7 it can be concluded that timeliness was not achieved at LoSup and internet-use problems, rather than learning coaching, dominated player communications.

Table 6
Industry Turnaround Time By University

LoSup Industry 1

Activity	Decision Period								Average
	1	2	3	4	5	6	7	8	
Run	14:38	29:42	8:36	59:34	8:06	13:51	100:30	32:43	33:27
Comments	3:15	2:49	2:07	13:58	1:14	11:50	5:25	n.a.	5:48
Task Time	17:53	32:31	10:43	73:32	9:20	25:41	105:55	32:43	39:15

LoSup Industry 2

Activity	Decision Period								Average
	1	2	3	4	5	6	7	8	
Run	9:21	:35	1:57	8:47	29:47	14:01	38:35	9:22	14:03
Comments	3:08	2:34	2:07	18:02	8:20	15:03	10:03	n.a.	8:28
Task Time	12:29	3:09	4:04	2:49	38:07	29:04	48:38	9:22	22:31

HiSup Industry 1

Activity	Decision Period								Average
	1	2	3	4	5	6	7	8	
Run	-:49	5:06	-:09	-4:29	-4:38	7:04	4:48	6:45	1:42
Comments	4:12	5:02	2:25	3:07	7:19	5:25	6:15	n.a.	4:49
Task Time	5:01	10:08	2:34	7:36	11:57	12:29	11:03	6:45	6:31

DISCUSSION

Much has been made of the special learning environment created through the use of DE. Despite this assertion of uniqueness**,** this study's subjects usually rated their DE situation no better or worse than their LE counterparts despite the fact that their interactions with the simulation, and their access to game administrator information and coaching, were completely different from those in the control group. It was also found, while in the process of conducting this study, that numerous problems arose which could have materially mitigated DE's supposed virtues both within and across the two university populations studied. These problems occurred in the areas of (1) internet operating skill and their affects on feedback turnaround times and the administrative load placed on the DE Game Administrator, (2) the ratios of game processing messages to messages supporting or amplifying course-related learning and (3) the DE Game Administrator's attempts to encourage a coaching dialogue with all DE-assigned companies.

Table 7
Player-Initiated Communications

Communications	University Count		University Percent	
	LoSup	HiSup	LoSup	HiSup
Administration:				
Decision Entry	14	4	9.46	7.84
Correcting Entries	4	1	2.70	1.96
File Saving	10	0	6.76	0.00
File Sending	14	2	9.46	3.92
File Retrieval	14	2	9.46	3.92
Password	3	0	2.03	0.00
Address Corrections	2	0	1.35	0.00
Schedule	5	0	3.38	0.00
Complaints	3	0	2.03	0.00
Late Submissions	7	1	4.73	1.96
Virus	3	0	2.03	0.00
Game Teaching Points:				
Report Information	8	2	5.41	3.92
Preview Decisions	7	6	4.73	11.76
Sales Promotion	1	0	0.68	0.00
Demand Creation	0	1	0.00	1.96
Pricing	0	1	0.00	1.96
Subassemblies	5	3	3.38	5.88
Backorders	2	0	1.35	0.00
Funds Transfers	4	1	2.70	1.96
Maintenance	1	1	0.68	1.96
Product Quality	1	0	0.68	0.00
Plant Scheduling	2	2	1.35	3.92
Capacity	3	0	2.03	0.00
Quality Control	1	0	0.68	0.00
Warranty Work	1	0	0.68	0.00
Training	1	0	0.68	0.00
Debt Operations	2	0	1.35	0.00
Debt/Credit Rating	3	2	2.03	3.92
Equity Operations	1	2	0.68	3.92
Dividends	0	1	1.35	1.96
Inventories	3	1	2.03	1.96
Distribution	7	1	4.73	1.96
Private Label Bids	3	0	2.03	0.00
Merlin Reports	1	1	0.68	1.96
Teamwork Problems	8	0	5.41	0.00
Commentary Responses	1	10	0.68	23.53
"Thank Yous"	3	4	2.03	7.84
Total	148	49	100.00	100.00

Timeliness. This examination's results have already been presented in Table 6. "Run" indicates how long after the turn-in time players received their results. "Comments" indicates how long it took the DE administrator to make comments on each team's decision results and to forward them to each company. "Task Time" indicates the total amount of processing hours associated with each run. "Timeliness" was not achieved in the LoSup application as it took from at least 8 hours to more than four days on one occasion to return results to its Industry 1. Its average turnaround time over the simulation's competition amounted to almost 33½ hours. Industry 2 appeared to do better but "Run" differences were the same ($p=.05$, $t=1.58$, $df=9$). Significantly better ($p=.05$, $t=3.31$, $df=17$) turnarounds were obtained at HiSup where a minus runtime value indicates the results were returned to players before the final turn-in time. In two instances results were turned back more than four hours early with an average run returned to each company in less than two hours. Regardless of how long it took players to submit their decision sets or readable files, the DE administrator's "Comments" performance was the same across all groups ($p=.05$, $t=-0.87$, $df=11$). Write-ups were completed and transmitted to all companies within about 6 hours and 22 minutes after a game run had been made.

The table's "Task Time" indicates the total time-spans associated with each period's run. The higher degree of player discipline associated with HiSup generated relatively tight turnarounds averaging about 6½ hours for the entire competition within a range of 2½ to 12½ hours. LoSup experienced very slow turnarounds owing to either late turn-ins or the submission of unreadable files. Between the two industries the average Task Time was almost 31 hours with a range of about 3 hours to slightly more than four days.

Based on this performance it must be concluded that the goal of "timeliness" or speedy turnaround times was not obtained at LoSup. Despite this lack of timeliness LoSup's subjects rated their game's turnaround times on a par with those obtained at HiSup ($t=.50$, one-tail test, $df=57$).

Communications Content and Direction. The specifics associated with the nature of the player and Distance Education Administrator interface was presented in Table 7. These interactions have been categorized by those that were player-initiated, DE administrator-initiated and LE instructor-initiated. The volume of communications traffic was higher for LoSup's players ($p=.05$, $t=3.70$, $df=54$). This amounted to 14.8 messages per company that were not dispersed evenly over the game's run ($p=.05$, $F=36.51$, $df=9,9$). Message content was also different between universities ($p=.05$, $F=3.76$, $df=36,36$). A comparison of each group's handling of the game's internet interface likewise found significant differences ($p=.05$, $F=14.29$, $df=10,10$). At LoSup most of its communications dealt with problems associated with the mechanics of working with sending, recording and retrieving files, apologizing for late decisions, improperly recording their decisions and making inquiries about game hang-ups. HiSup had very few problems in this area and communicated most-often regarding the simulation's teaching components such as asking for judgements about contemplated decisions and following-up on Commentary questions posed by the DE administrator.

As a corollary to the player-initiated communications, the DE administrator's communications presented in Table 8

differed between the two universities. At LoSup more messages (p=.05, F=36.51, df=9,9) involved following-up on late decisions, obtaining properly-recorded decision sets and making processing delay announcements. In the HiSup application relatively few messages dealt with the game's administrative interface but instead were involved with coaching companies and making various teaching points throughout the game's run.

Table 8
Distance Education Administrator-Initiated Communications

Communications	University Count		University Percent	
	LoSup	HiSup	LoSup	HiSup
Administration:				
Decision Entry	5	0	3.23	0.00
File Saving	30	1	19.35	5.56
File Sending	23	5	14.84	27.78
File Retrieval	11	0	7.10	0.00
Address Corrections	1	0	0.65	0.00
Run Announcements	29	4	18.71	22.22
Late Decision Sets	21	4	13.55	22.22
Virus	1	0	0.65	0.00
Grievances/Re-Runs	1	2	0.65	11.11
Coaching Advice	7	1	4.52	5.56
Game:				
Economic Conditions	1	0	0.65	0.00
Cash Flow Analysis	3	0	1.94	0.00
Report Information	1	0	0.65	0.00
Preview Decisions	1	0	0.65	0.00
Subassemblies	3	0	1.94	0.00
Plant Scheduling	3	0	1.94	0.00
Distribution	1	0	0.65	0.00
Retained Earnings	2	0	1.29	0.00
Encouragement	6	1	3.87	5.56
Follow-Up	5	0	3.23	0.00
Total	155	18	100.00	100.00

There was no difference (p=.05, F=1.14, df=10) between the applications regarding communications content initiated by the LE instructors presented in Table 9 although the volume of traffic was twice as high for the LoSup-based teacher (p=.05, t=1.76, df=20). Communications involved the handling of late submissions, the mechanics of running a game-oriented course and interpreting company results. Traffic regarding the last two areas were probably caused by the instructor having had no prior experience with running a game-oriented course or not having the luxury of a teaching assistant. HiSup's instructor was an experienced gamester and had a teaching assistant who administered the simulation and conducted in-class reviews of each industry's company performance.

Distance Education Administrator Comments. The study's DE administrator tried to implement the communication links supposedly associated with Distance Education. After each decision round, comments were e-mailed to each company's members. Table 10 presents the merged range of topics covered and commented on after an analysis of variance determined there were no significant coverage differences between the two universities (p=.05, F= 0.41, df=26,26). The nature and repercussions of company

Table 9
Local Instructor-Initiated Communications

Communications	University Count		University Percent	
	LoSup	HiSup	LoSup	HiSup
Administration:				
Decision Entry	2	0	15.38	0.00
File Sending	0	0	0.00	0.00
File Retrieval	0	0	0.00	0.00
Schedule	1	2	7.69	33.33
Late Decision Sets	2	2	15.38	33.33
Bug/Glitch	0	1	0.00	16.67
Game:				
Economic Conditions	2	0	15.38	0.00
Results Interpretation	2	0	15.38	0.00
Production/Productivity	2	1	15.38	16.67
Backorders	1	0	7.69	0.00
Subassemblies	1	0	7.69	0.00
Total	13	6	100.00	100.00

manufacturing decisions drew the greatest number of comments. Within plant operations most comments dealt with scheduling, staffing and supplying the plant with raw materials and how these decisions affected unit costs. The area of second largest concern was marketing operations. Markets, market-entry strategies, optimal pricing and dealing with stockouts and backorders drew the most comments from the DE administrator. Each firm's finance and accounting areas drew the fewest number of comments with credit problems caused by technical insolvencies and funds transfers between countries dominating the comments.

The DE administrator tried to advance a coaching environment by offering advice and encouragement along with posing questions for elaboration. Comments were also made on the level of creativity or entrepreneurship demonstrated by the firm. The frequency of these efforts on a per-firm basis is presented in Figure 1 after it had been determined the data sets between the two universities could be combined due to non-significant differences in the amount of coaching supplied to firms at each university. The number of questions posed, and the amount of advice, encouragement and comments made on entrepreneurial effort, was greatest during the simulation's earliest periods and trailed off dramatically at the game's end. This diminution of commentary activity was also confirmed in a split-half test ($p=.05$, $t=1.85$, $df=20$). The degree, how ever, to which the firms at the two sites responded to the administrator's questions differed. Those at LoSup responded to only one of the 80 questions posed for a 1.3% response rate. Those at HiSup responded to 12 of 43 questions posed for a 27.9% response rate.

CONCLUSIONS AND RECOMMENDTIONS

This study's results makes it possible to draw a number of conclusions about DE instruction using business games

Table 10
Commentary Topic Areas

Topic Area	Proportion
Marketing/Logistics:	
Prices	7.25
Private Label Bids	1.15
Market Share	2.54
Markets/Countries	12.21
Sales Force	2.93
Wholesaling	1.65
Shipping	2.93
Backorders	4.33
	34.99
Operations Management/Plant:	
Production Schedule	8.40
Workers	6.49
Foremen	1.02
Overtime	3.05
Unit Costs	4.83
Finished Goods	1.15
Subassemblies	7.25
Maintenance	9.67
Quality Control	0.38
Warranty Work	3.05
Expansion/Construction	2.80
Automatons	1.02
	48.39
Finance/Accounting:	
Cash	1.53
Cash Transfers	2.67
Short Term Investments	0.64
Bond Operations	1.15
Overdrafts/Credit Rating	5.85
Stock Operations	3.31
Dividends	0.76
	15.88

while also suggesting a number of areas for future research. DE is not associated with lower learning results so no harm had been done. It did not, however, realize its many theorized benefits. Its only benefit was one of relieving the local instructor of game-processing chores. It also appears that DE, or the simulation used in this study, is very robust. Despite the many problems LoSup's players had with sending and receiving their results, and the extra hours they spent because of this, their overall reactions to the experience were the same as those at HiSup. Table 11 summarizes all player reactions to the experience across the two universities.

Based on this DE application, a number of guidelines regarding the method's use can be advanced.

1. If students do not possess computer fluency strong technical assistance must be provided.
2. If computer fluency is present, or technical assistance is available, interactive market games such as *The Business Management Laboratory* (Jensen, 1996), *The Business Strategy Game* (Thompson & Stappenbeck, 1998) and *The Business Policy Game* (Cotter & Fritzsche, 1995) can be used.
3. If computer fluency is not present, or technical assistance is not available, noninteractive market games such as *CAPSTONE*, *Threshold Competitor* (Anderson, Scott, Beveridge & Hofmeister, 1999) and *The Management Accounting Game* (Goosen, n.d.) as turn-ins by players are self-paced.

The game used in this study, as is the case with most other top management games was a interactive market simulation and accordingly entailed batch processing. This meant turnaround speeds were determined by the swiftness at which the slowest team in the industry submitted a usable decision input which robbed the DE situation of its often-cited self-paced learning.

This study's results also highlighted the role the local instructor plays in creating an optimal learning environment as well as indicating how different approaches to teaching the same material may bring about different learning results. The LoSup instructor employed a more traditional use of the game where it was used in combination with a number of cases spread throughout the semester. HiSup's instructor made the game central to all activities. The differences in their approach highlight a number of issues that have implications for the practice of good DE education and the use of business games in general.

Figure 1
Coaching Components By Firm

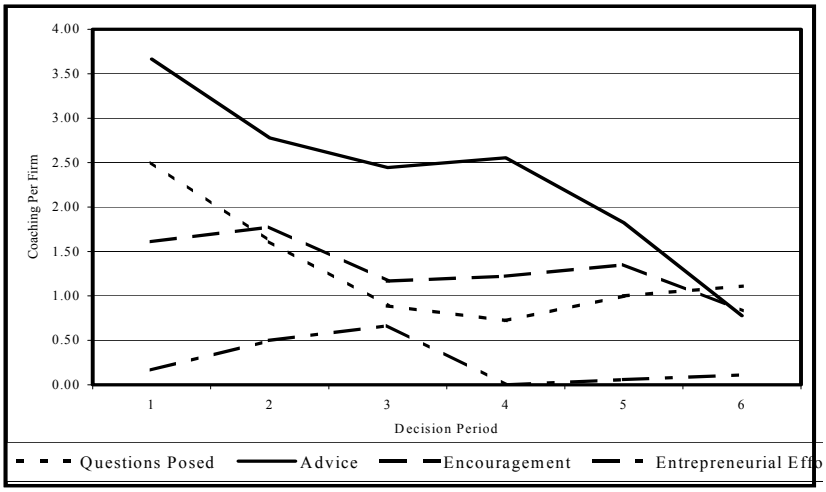

Table 11
Mean Across-University Reaction Questionnaire Responses

Question	LoSup	HiSup
Personal Control	6.37	5.67*
Game Administrator Feedback Speed	6.24	6.24
Game Turnaround Speed	5.90	6.12
Game Feedback Quality	5.75	5.45
Game Administrator Feedback Quality	5.21	5.13
Overall Response	5.89	5.72

*Significant p=.05, one-tail test, df=60.

The LoSup instructor also created a somewhat "fail safe" and team-oriented environment which diminished the role of individual accountability for results. In the grading scheme used, even the worst-performing company in the industry would receive a "B-" grade. This meant a company merely had to submit a decision set, regardless of its quality or whether it bankrupted the firm, and it would still receive a relatively high grade. The game's pre-test of knowledge was also done on a team basis so it was not known how

well-prepared each team member was for the game experience.

At HiSup the same weight was given to the game but individual effort was more easily detected. Grades for company performance could run the gamut from "F" to "A", individual grades were recorded on the pre-game test of knowledge, poor performing team members could be "fired" from their companies and the course's teaching assistant reviewed all company results every week in class, thus putting social pressure on players to perform well. The results of these actions appear to have produced a different motivational level that had learning results consequences.

Based on game knowledge test scores HiSup's players were better prepared for the competition. LoSup's team-based scores were about one-half of those generated by HiSup's individual-based scores. This lack of technical knowledge by LoSup's students may have made it difficult for them to understand what was happening to them in the game. This was indicated by the players on their industry's poorest performing teams feeling the game's feedback was less useful ($p=.05$, $t=2.98$, $df=21$).

LoSup's use of the game also produced relatively weak relationships between game play and course-related learning. At HiSup it appears the game was an important factor in the learning equation. These relationships were explored and are presented in Table 12. As shown all correlations except one is in the expected direction and that exceptional correlation is not significant. Thus, players with high aptitudes, when measured by their SATs, have higher grade-point-averages and these higher grades were associated with higher grades on the course's content. The crux of this study's work, however, was conducted at the group or company team level. Thus at HiSup the firm's average GPA was strongly related to the firm's economic performance. It appears the players' high game preparation was useful for player game test scores were strongly related to firm performance. Most importantly, firm performance was strongly related to course knowledge test scores.

Table 12
Individual and Team-Based Relationship At HiSup

Variable Relationship Examined		Coefficient	
Independent	Dependent	Correlation	Determination
Player Aptitude	Academic Achievement	0.26	0.07
Player Aptitude	Game Test	0.07	0.01
Player Aptitude	Course Tests	0.13	0.02
Player Academic Achievement	Game Test	0.18	0.03
Player Academic Achievement	Course Tests	0.82	0.52
Player Game Test	Course Tests	0.08	0.01
Firm Aptitude	Firm Performance	-0.05	0.00
Firm Academic Achievement	Firm Performance	0.52	0.27
Firm Game Test	Firm Performance	0.62	0.38
Firm Aptitude Variance	Firm Performance	0.10	0.01
Firm Academic Achievement Variance	Firm Performance	0.29	0.08
Firm Game Test Variance	Firm Performance	0.63	0.40
Firm Performance	Firm Course Tests	0.67	0.44

Notice should also be taken of the role of within-team variances in player aptitude, academic achievement and game technical knowledge. The role of team cohesion as a precursor of high game performance has been cited and researched in the business game literature (Meising & Preble, 1985; Wolfe & Box, 1988; Wolfe, Bowen & Roberts, 1989). An element in a firm's cohesion is the degree of homogeneity or similarity that can be found amongst its members. Thus it would be ideal for a team's members to have a high average level of game technical knowledge but that this knowledge level to be high at the individual level so that they could all be more-equal decision making partners. This was the case at HiSup where team standard deviations in academic achievement and game technical knowledge were significantly correlated with firm performance.

In order to clarify some of the problems associated with this study's DE application the following research studies are suggested:

1. The motivational effects of creating "fail safe" grades for game performance. Research has found the amount of final grade weight assigned to game performance does not affect learning levels (Wolfe & Roberts, 1985-1986) but no research has been conducted on how learning levels may be affected by guaranteeing a high grade regardless of performance.
2. Why players competing in industries that forced numerous delays on their time schedules state they had more control over their conduct of the game than those competing in an industry experiencing no time delays and efficient operations.

3. Under what conditions do firms seek help. This would help clarify why firms that were clearly in trouble did not seek help or respond to what were believed to be helpful inquiries from their DE administrator.
4. Study the differential learning effects produced by non-interactive games versus those that are interactive. All business game effectiveness studies have been conducted on the latter type while the former are growing in their popularity with the rise of the internet. Research into the advantages and disadvantages of this type of generic game is clearly warranted.

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