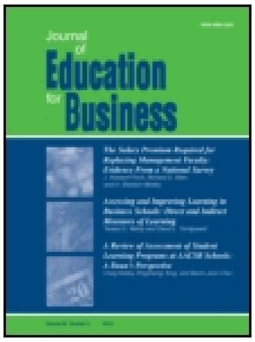

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Can a Simulation Help Achieve Course Objectives? An Exploratory Study Investigating Differences Among Instructional Tools

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ABSTRACT. A simulation, like any pedagogical tool, must be evaluated in terms of its effectiveness in achieving course objectives. This study investigated how well a particular simulation did in achieving course objectives and compares its performance to the textbook and papers used in the course. Compared to the textbook and the papers, students consistently gave the simulation the highest ratings on several learning-related measures. In addition, it was found that the simulation had the strongest associations with a set of measures designed to assess general course learning objectives. Further, the results suggest that the degree of involvement in the simulation had an effect on simulation-specific learning objectives as well as more broadly defined course learning objectives. We recommend the prudent use of simulations and suggest that professors regularly undertake a comparative outcome assessment of the instructional tools they are using in their courses.

In today's workplace, corporate recruiters are seeking business students who have "real-world" skills in addition to a college degree (Mariani, 1997; Scott & Frontczak, 1996). A student graduating with a business degree is expected to have experienced the complexities, uncertainties, and ambiguities of decisionmaking in a business environment. However, it is not easy to find or develop learning environments in which students can experience situations that call on them to make a number of strategic business decisions in a changing environment. Co-ops and internships often give students exposure to a business environment (Mariani, 1997), yet seldom are students really given much responsibility in these positions, and often they are not exposed to the truly multidimensional aspects of a business.

Research indicates that employers feel that students are entering the business world without some of the necessary knowledge, skills, and experience that would allow them to solve real-world business problems and function effectively (Arora & Stoner, 1992; Deckinger, Brink, Katzenstein, & Primavera, 1990; Scott & Frontczak, 1996). In fact, some employers feel that business educators have a tendency to focus too much on theory and not enough on the practical application of skills and knowledge (O'Brien & Deans, 1995). Criticism of the traditional education process indicates that the standard learning process is not preparing students to operate effectively in today's business environment. "For many years businesspeople have been telling educators that business needs students with communication skills, students who can think, students who can tolerate ambiguity" (Chonko & Caballero, 1991, p. 14).

An area of particular concern is the students' analytical, problem-solving, and decisionmaking abilities. Not only do students need to know the theories and concepts, but they also need to know how to apply the theories, concepts, and skills to business problems. Students simply do not have enough exposure to making business decisions in uncertain and ambiguous environments. To deliver future employees with strong problem-solving and decisionmaking skills to the workplace, we must adopt an educational process that improves and cultivates these abilities.

In an attempt to improve student decisionmaking and analytic abilities, some business educators have turned to computer-based simulations (Alpert, 1993; Cadotte, 1995; Pascoe, 1992; Weinstein, 1996). The primary objective of a simulation is to offer students an opportunity to practice the decision-making process using real-life business scenarios. "A simulation is an experimental learning exercise in which students practice the design, implementation and control of business strategies. They worry about the applications, not the definitions, of business concepts, principles, and methods. Decisions do not occur sequentially but simultaneously and interactively, just as they do in the business world. The paramount objective is to help students internalize business thought through the practice of business decision making" (Cadotte, 1995, p. 10). Most simulations expose students to dynamic and competitive environments where they must use their knowledge and analytical skills to make meaningful decisions. Some, however, have questioned the effectiveness of simulations.

Researchers investigating the effectiveness of simulations in business education have produced contradictory and inconclusive findings (e.g., Bredemeier & Greenblat 1981; Greenlaw & Wyman, 1973; Miles, Biggs, & Schubert, 1986; Moutinho, 1988; Randel, Morris, Wetzel, & Whitehill, 1992; Smith & Boyer, 1996; Vaidyanathan & Rochford, 1998; Wolfe, 1985). In one of the earlier articles that reviewed the research on the instructional effectiveness of simulations, Greenlaw and Wyman (1973) found that although simulations appeared to teach some "intangibles," they did not appear to be very effective at achieving course objectives. Since their review 25 years ago, research on the instructional effectiveness of simulations has continued to produce mixed results. Randel et al. (1992) reviewed 68 studies that had compared the instructional effectiveness of simulations with other instructional methods and noted that a majority (56%) of them found no difference between simulations and traditional pedagogical methods, 32% found that simulations led to better student performance, and only 5% favored traditional instruction. The inconclusive findings of past research were a primary motivation for the current study. A simulation, like any instructional tool, must be evaluated for effectiveness in achieving course objectives. In our study, we not only examined the effectiveness of simulation as an instructional tool, but also compared it with other, more traditional methods.

Another objective of tour research was to understand better how students' differing degrees of involvement in the simulation influence learning outcomes. Simulations require that students be active participants, encouraging them to pay attention, become more active in the learning process, and develop an interest in the simulation. Often, the ultimate result is a higher degree of involvement in the course, and an enriched learning experience (Moutinho, 1988; Randel, Morris, Wetzel, & Whitehill, 1992; Smith & Boyer, 1996). It is believed that knowledge learned from the simulation is more likely to be integrated into the cognitive structure of the participants because of the high level of active participation (e.g., Randel, Morris, Wetzel, & Whitehill, 1992). Degree of involvement can be diminished or enhanced depending on a number of factors, which can include, but are not limited to, characteristics of the instructor and the grading strategy of the course (Alpert, 1993; Anderson & Lawton, 1992; Wolfe, 1985). According to Wolfe (1985), the personality, skill, and motivation expressed by the instructor can have significant effects on the degree of involvement in, and effectiveness of, the simulation. Degree of involvement in the simulation appears to be an important factor in assessing its effectiveness. Therefore, as part of the current study, we assessed the relationship between degree of involvement with the simulation and learning outcomes. Specifically, we believe that the more involved students are in the simulation, the more effective it will be at achieving various learning objectives.

In summary, the purpose of our research was to evaluate the effectiveness of a particular simulation in achieving course objectives and compare its performance with that of two other instructional tools used in the course. Further, we investigated the effect of involvement with the simulation on simulation-specific and general course learning objectives.

Method

The Sales Force Management Course

The study was conducted over 2 semesters in three Sales Force Management (SFM) courses. The course was an elective, usually taken by undergraduate seniors. The primary objective of the course was to introduce students to the activities, concepts, issues, and problems of managing a sales force. The overall grading structure of the course included the simulation (40%), current topic papers (10%), three exams (40%), and class participation (10%). A total of 48 questionnaires were used in the analysis.

The Simulation Component

The simulation used in the course was Day, Dalrymple, and Sujan's (1995) Sales Management Simulation (SMS). Students self-selected into groups of three or four members. Participants in the SMS act as sales force managers and must make decisions regarding hiring, firing, territory assignments, salary, commission rates, sales contest funds, pricing, production forecasts, product focus (whether to emphasize the high- or low-end product), training, time management, the purchase of marketing research reports, and finally, how to react to reports from disgruntled employees.

At the beginning of the SMS, the students evaluated a set of resumes, selected salespeople, and then assigned each to a territory. Each following period (representing one quarter), students evaluated another set of resumes and could hire up to five more employees. They had to make good selection, placement, and compensation decisions, or later in the game, the employee hired could send in a letter expressing some form of discontentment. For example, a sales manager (a student) would receive a complaint letter if the employee's resume indicated that he or she had lived in one area for an extended period (based on high school, college, employment history, current address) and yet had been placed far from his or her hometown. If the manager did not take immediate action (e.g., transfer the employee back to his or her home region), the likelihood that the employee would quit increased. These disgruntled employee letters added a dose of realism to the game, and students often developed quite a love-hate relationship with them.

Students competed with each other on a number of variables including market share, profit, sales volume, and customer satisfaction. These variables were evaluated at the middle and end of the game, with the final assessment being given more weight. The game was run weekly for 10 weeks, simulating 10 quarters of play. The simulation grade comprised three parts. Fifteen percent was based on standings on the aforementioned competitiveness-related variables, 20% on a series of four written reports that explained the student's decisions and strategy, and 5% on an oral presentation.

We believe that it is possible to enhance the critical thinking component of a simulation by having the students write out their thought processes, thus the 20% mentioned above. Students were asked to turn in a series of reports that clearly detailed why they made various decisions. They explained what they saw occurring in their market, how they reacted to the changes, and what long-term strategic plans they outlined for future quarters. Further, students were asked to reflect on past decisions. If they made good decisions, they had to explain why the decisions were good. More important, if they made a decision that in hindsight was poor, they were to explain why it turned out to be a poor decision and how they could now take corrective action.

Measures

Students assessed the simulation, the textbook, and the current topic papers. The simulation-specific questions addressed whether or not the SMS helped the student understand SFM problems and issues; whether the SMS made the course more interesting, allowed the student to apply what he or she was learning, and helped him or her retain knowledge about the course; how involved the student was with the SMS; if the student felt it was a useful learning tool; and finally, if he or she would suggest using the SMS in future classes. The textbook questions assessed whether the book helped the students learn the concepts in the course, kept them interested, and made them think, and whether they would suggest the book for future classes. Questions regarding the current topic papers asked if students thought the papers were a useful learning experience, if they helped them understand the importance of concepts covered in class, and if they would suggest having the assignment in future classes.

The final set of measures assessed general learning outcomes in the course and were not specific to any particular instructional tool. These questions measured whether the course increased the students' ability to discuss SFM issues intelligently, whether taking the course increased the students' understanding of the role of SFM in business, whether the course improved their critical thinking and analysis skills, whether it improved their computer skills, and finally, whether it improved their writing skills. All questions used a scale ranging from 1 (*strongly disagree*) to 9 (*strongly agree*). In addition, questions were asked about the students' GPA, expected grade in the course, and gender.

Results and Discussion

Ratings of Key Variables

In Table 1, we present the mean ratings of the SMS, the textbook, and the papers, as well as ratings of the general learning objectives measured in the course. All ratings were analyzed as a function of self-reported GPA, expected grade in the course, and gender. No differences were found based on these variables. Although not the focus of our research, it should be noted that, consistent with Vaidyanathan and Rochford (1998), we did find a weak correlation between student performance on the simulation and performance on the second midterm ($r = .34$, $p = .075$) and the final exam ($r = .30$, $p = .08$).

The data in Table 1 show that students consistently gave the SMS the highest ratings. For example, they felt strongly that the simulation made the course more interesting, helped them apply what they were learning in class, and overall was a useful learning tool. Further, the students strongly endorsed using the simulation in future classes. The textbook and the papers also received positive ratings; however, their scores were consistently lower than the SMS ratings. One compelling comparison between the measures is that the students felt significantly stronger in their recommendation of the SMS compared with the textbook or the papers (all

TABLE 1. Means and Standard Deviations of Key Measures

	M	*SD*
SMS-specific measures		
Helped understand SFM issues	7.43	1.39
Made course more interesting	8.02	1.16
Applied learning	7.51	1.23
Helped retain knowledge	7.48	1.29
Useful learning tool	7.96	1.02
Level of involvement	8.27	.96
Suggested future use	8.33	1.00
Book-specific measures		
Helped learn concepts	6.52	1.86
Kept me interested	5.02	1.80
Made me think	5.65	1.77
Suggested future use	5.15	2.14
Paper-specific measures		
Useful learning experience	6.38	2.41
Helped understand SFM concepts	6.88	1.84
Suggested future use	7.43	1.60
General learning objective measures		
Increased ability to intelligently discuss SFM issues	7.69	1.11
Increased understanding of SFM's role in business	7.94	1.00
Improved critical thinking skills	7.33	1.12
Improved computer skills	5.96	2.27
Improved writing skills	5.85	1.89

Note. Ratings were made on a 9-point scale and coded so that the higher the rating the greater the degree of agreement with the issue.

paired t tests > 4.0, all $ps < .01$). In summary, the ratings indicate that the students felt that the SMS was the most useful pedagogical tool in this course. Though this could simply be a reflection of student perceptions of the textbook and the papers, we would argue otherwise. The current topic papers are a common instructional method and, in an absolute sense, scored quite well. Informal conversations with students revealed that the content of the papers is valuable, just not as valuable as the SMS. Further, the textbook is one of the leading books in this area of study and did manage to avoid unfavorable ratings, which is not always easy for a textbook.

The evaluations of whether or not the course met some basic learning objectives were relatively favorable. The students felt that the course increased their ability to discuss SFM issues intelligently and to understand the role of SFM in business, and that it improved their critical thinking skills. The students did not feel as strongly that the course had improved their computer or writing skills. Nevertheless, the lower scores on these two variables make sense, as the main objectives of this senior level course did not include improvement in computer or writing skills. In fact, the lower scores of these measures suggest that the measures have some degree of face validity.

Associations With Learning Objectives

Although the ratings in Table 1 indicate a more positive response to the SMS, they do not give insight into how the SMS, textbook, or papers relate to the more general learning objectives of the course. In Table 2, we show the correlation between the measures of general course learning objectives and the measures of the SMS, the textbook, and the papers.

The data in Table 2 show that the SMS was more closely associated with the learning objectives in the class when compared with the textbook and the papers. These findings suggest the SMS was strongly tied to the learning objectives in the course. In fact, on the two key SFM learning measures (ability to discuss SFM issues intelligently and role of SFM in business), the SMS measures have significant correlations on 13 out of 14 associations (93%), whereas the textbook has 3 out of 8 (37.5%) and the papers do not have any significant correlations.

To further investigate the differing degrees of relationship between the SMS-, textbook-, and paper-related measures with regard to general course learning objectives, regression models were developed and tested. Instead of running regressions with all the SMS, textbook, and paper measures acting as predictors, these three sets of measures were first simplified. First, the SMS, textbook, and paper measures were factor analyzed. All measures loaded as expected, demonstrating unidimensionality within each scale. Factor loadings for the SMS measures ranged from .89 to .76, the textbook measures ranged from .92 to .36, and the paper measures ranged from .90 to .87. Crossloaders between scales did not exceed .23. Cronbach's alpha for each scale was as follows: SMS $\alpha = .90$, textbook $\alpha = .68$, and papers $\alpha = .83$. Because of the unidimensionality of each scale and its reliability, the mean of each scale was used in the following regressions. This analysis needs to be interpreted with caution given the small sample size. Typically it is desirable to have a minimum of five cases per variable for this type of analysis; however, given the exploratory nature of the research, it seems reasonable to develop a regression model to try to better understand the relationships between the variables. With a sample size close to 50, the results are likely to be fairly stable.

Regression models were run with each general learning objective as a dependent variable and each summated scale (SMS, textbook, and papers) as predictors. The only two significant models were those is which the three variables were used to predict (a) whether the course improved the students' ability to discuss SFM issues intelligently ($F = 15.92$, $p < .001$) and (b) whether the course increased the students' understanding of the importance of the SFM role in business ($F = 6.89$, $p < .01$). In the first model (discuss SFM issues), the standardized beta coefficients and significance values for each predictor were as follows: SMS $\beta = .67$, $p < .001$; textbook $\beta = .039$, $p > .10$; and papers $\beta = .11$, $p > .10$. In the second model (increased understanding of SFM issues), the standardized beta coefficients and significance values for each predictor were as follows: SMS $\beta = .31$, $p < .05$; textbook $\beta = .15$, $p > .10$; and papers $\beta = .15$, $p > .10$. It is important to note that in each model the simulation variable was the only statistically significant predictor of each learning objective measure. Further, the standardized betas demonstrate the relative strength of the relationship between each predictor and the dependent variable, again indicating the superiority of the SMS in achieving some key learning objectives in the course.

Involvement Effect

An a priori speculation was that students who were more involved with the SMS would learn more. In general, students were highly involved with the SMS. On the 9-point scale indicating degree of student involvement with SMS, the lowest rating given was 5, and the most frequent was 9 (54.5%). Given this ceiling effect, the group was divided into those who were highly involved (rating = 9, $n = 26$) and those not as highly involved (rating < 9, $n = 22$). The mean scores between each group were significantly different from each other (7.4 vs. 9.0, $t = 10.21$, $p < .001$), supporting this median split.

The data in Table 3 show that the degree of involvement with the SMS had a significant effect on a number of measures. The more students were involved with the SMS, the more they felt it influenced their understanding of SFM issues and that it made the course more interesting. More important, the students who were more involved with the SMS also had significantly higher scores on the general learning objective measures. In fact, on all general learning measures, the students who were more highly involved with the SMS also had the higher ratings.

One strong counterargument to the above is that perhaps the involvement effect is simply a reflection of grades, as better students may be more involved

TABLE 2. Correlations Between Instructional Methods and General Learning Objectives

	Intelligently discuss SFM issues	Role of SFM	Improved computer skills	Improved critical thinking skills	Improved writing skills
SMS-related measures					
Helped understand SFM issues	0.62**	0.46**	0.14	0.28	0.16
Made course more interesting	0.62**	0.30*	0.51**	0.13	0.04
Applied learning	0.50**	0.48**	0.17	0.31*	0.22
Helped retain knowledge	0.61**	0.60**	0.17	0.37**	0.33*
Level of involvement	0.34*	0.22	0.45**	0.13	-0.06
Useful learning tool	0.62**	0.47**	0.18	0.20	0.13
Suggested future use	0.56**	0.32*	0.36*	0.15	0.34*
Book-related measures					
Helped learn concepts	0.32*	0.41**	0.05	0.23	0.02
Kept me interested	0.12	0.10	0.07	-0.02	-0.01
Made me think	0.33*	0.24	0.36*	0.15	0.24
Suggested future use	0.18	0.18	0.15	0.24	0.22
Paper-related measures					
Useful learning experience	0.13	0.04	0.21	-0.03	-0.02
Helped understand SFM concepts	0.16	0.15	0.07	0.00	-0.06
Suggested future use	0.20	0.25	-0.02	0.16	-0.11

*Correlation significant at the .05 level.
**Correlation significant at the .01 level.

TABLE 3. Mean Ratings Resulting From Degree of Involvement With the SMS

	Degree of involvement	
	Lower	Higher
Helped understand SFM issues	6.95	7.84*
Made course more interesting	7.36	8.58**
Applied learning	7.24	7.73
Helped retain knowledge	7.23	7.69
Useful learning tool	7.77	8.12
Suggest future use of SMS	8.14	8.50
Increased ability to intelligently discuss SFM issues	7.09	8.19**
Increased understanding of SFM's role in business	7.50	8.31**
Improved critical thinking skills	6.95	7.65*
Improved computer skills	5.09	6.69*
Improved writing skills	5.82	5.88

*t test of mean differences, $p < .05$.
**t test of mean differences, $p < .01$.

with a course. The effects of overall GPA and expected grade in the course were analyzed, and no differences were found as a function of involvement, reducing possible grade confounds. Further analysis investigated whether the involvement effect held for the textbook and paper measures. No differences in these measures were found as a function of involvement with the SMS, strengthening the argument that involvement measure is not addressing extraneous issues. In looking for alternative explanations to the findings, we also analyzed gender differences. Interestingly, males were significantly more involved ($\bar{x}$ = 8.56) with the simulation than females ($\bar{x}$ = 7.69). The gender difference was quite apparent, with 62.5% of the males being in the highly involved category and 62.5% of the females being in the group that was not as highly involved (χ^2 test of the difference = 2.69, p = .10).

Conclusion and Suggestions

Just as in any business, professors need feedback from the marketplace to make informed decisions about product offerings. As simulations differ in design and execution, it is important to evaluate the effectiveness of a particular simulation in achieving course objectives. This research indicates that the simulation used in this SFM course not only achieved some basic learning objectives, but also appeared to have done so better than the textbook and the current topic papers. Although exploratory, the research adds to the ongoing debate about the instructional effectiveness of simulations (e.g., Randel, Morris, Wetzel, & Whitehall, 1992; Smith & Boyer, 1996; Wolfe, 1985; Laughlin & Hite, 1993; Moutinho, 1988). The simulation was consistently rated quite positively and had very strong associations with basic learning objectives. Further, that degree of student involvement also affected perceptions about the simulation's learning efficacy and its relationship to the overall learning objectives in the course.

Getting students involved with a course assignment or project can be taxing; however, as this research indicates, involvement can have a significant effect on learning. How does the instructor influence involvement in a simulation? First, we believe a key element is the attitude and mannerisms of the instructor (Wolfe, 1985). The instructor must convey, with enthusiasm and conviction, the value of the simulation. Second, the degree of involvement can be influenced through grading strategies. Professors have debated what percentage of a course grade a simulation should be worth (Anderson & Lawton, 1992; Alpert, 1993; Wolfe, 1985); we would argue that it should be a significant one. However, it does not have to be strictly a function of where a team stands on competitiveness variables (e.g., sales, market share, and profits). As described earlier, 20% of the simulation grade in this course was tied to a series of papers used to motivate students to reflect on their decisions and strategies. Furthermore, bonus points can be given to teams *during* the course of play (e.g., highest profits, most improved). Other nongrade incentives may also improve the degree of involvement with the simulation (e.g., encouraging competition, public display of the results, achievement certificates, gift certificates, a large bag of M&Ms for achievements).

It is important to ask ourselves how the things we do and the methods we use to promote learning relate to the learning objectives of the course. Take time at the end of the term to conduct a survey about the book, the assignments, and the projects used in your course. Make sure the survey also includes a few questions about the general learning objectives in the course. Simple data analysis procedures (i.e., means, percentages, crosstabulations, correlations, and regressions) of the collected information may offer valuable information about the effectiveness of each method in achieving the learning objectives. In general, we hope that this research will encourage additional studies that attempt to measure the relationship between the instructional tools used in class and the course's learning objectives.

Limitations

Though this simulation was perceived as an effective instructional tool, it is necessary to point out the following limitations to our research. First, it is exploratory; the small sample size limits the degree of confidence we have in making generalizations from the results. Second, results of this study are specific to the SMS and the instructional tools used in the SFM course. Projection of these results to other simulations is not advised. Although we believe simulations can be effective instructional tools, all simulations are not created equal, and it is up to individual instructors to ensure the quality and efficacy of the one chosen. Finally, the results give no insight into whether or not the students could have learned more from some other instructional method (e.g., cases). Certainly, the optimal way to investigate the effectiveness of simulations compared with other instructional methods would be to use an experimental design (e.g., Laughlin & Hite, 1993; Wellington & Faria, 1996; Vaidyanathan & Rochford, 1998).

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