BUILDING A STRONG FOUNDATION: USING A COMPUTER SIMULATION IN AN INTRODUCTORY MANAGEMENT COURSE

Tracy A. Thompson
Jill M. Purdy
Patricia M. Fandt
University of Washington, Tacoma

Although computer simulations often have been used in the capstone course at the end of the undergraduate business school curriculum, our experience indicates that computer simulations also are an excellent tool for use in the beginning of an undergraduate business curriculum. Introductory courses in business management typically familiarize students with the body of management knowledge, skills, and techniques needed to solve problems and make decisions. With the appropriate introductory course design, a simulation can allow students to apply their newfound knowledge by solving problems and making decisions in a somewhat realistic environment where decisions are complex and interdependent and where results are measurable. Because they provide hands-on experience, simulations can help students develop an almost intuitive understanding of business including clear insights into how functional elements can be coordinated (Keeffe, Dyson, & Edwards, 1993). In addition, simulations can provide opportunities for students to learn the behavioral skills they will need to interact effectively with others in group and organizational settings.

Authors' Note: Requests for reprints should be sent to Tracy Thompson, Business Program, University of Washington, Tacoma, 1900 Commerce Street, Tacoma, WA 98402-3100.

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After identifying the major objectives of an introductory course in an undergraduate management curriculum, we examine how computer-based management simulations can help meet those objectives. We develop and discuss seven criteria for evaluating total enterprise simulations for use in an introductory management class and provide assessments of 11 currently available simulations based on student and faculty evaluations. In conclusion, we offer suggestions on designing introductory management courses to include computer-based management simulations.

Objectives of the Introductory Management Course

As the first course of the undergraduate business curriculum, the introductory management course serves as the foundation for all future courses. We use the metaphor of an hourglass to describe the role of this course within the undergraduate curriculum (see Figure 1).

The introductory course introduces learners to traditional core concepts and provides an overview of the issues managers face. Learners progress upward into courses that offer greater depth in more narrowly focused, specialized areas (which often culminate in a concentration or major). Finally, the capstone business policy course returns to the broad perspective used early in the curriculum. Interdisciplinary synthesis and transformation are the goals of the final stage of the undergraduate business curriculum.

As the first step in management education, the introductory management course is critical to developing students' schemas for management. We see three main objectives of this introductory course: (a) to introduce students to the primary content areas of the management field; (b) to bridge the gap between management theory and practice by offering a cross-functional, applied approach to management; and (c) to assist students in developing management competencies and skills in areas such as teamwork, problem solving, strategic thinking, and communication.

Ideally, the introductory management course provides students a general but solid foundation for progressing to the second and third stages of the hourglass model where students narrow their focus in more specific and detailed courses and then return to a broader but more in-depth emphasis. It should serve as a touchstone through which new concepts and skills are linked as the learners develop a paradigm for understanding organizational processes.

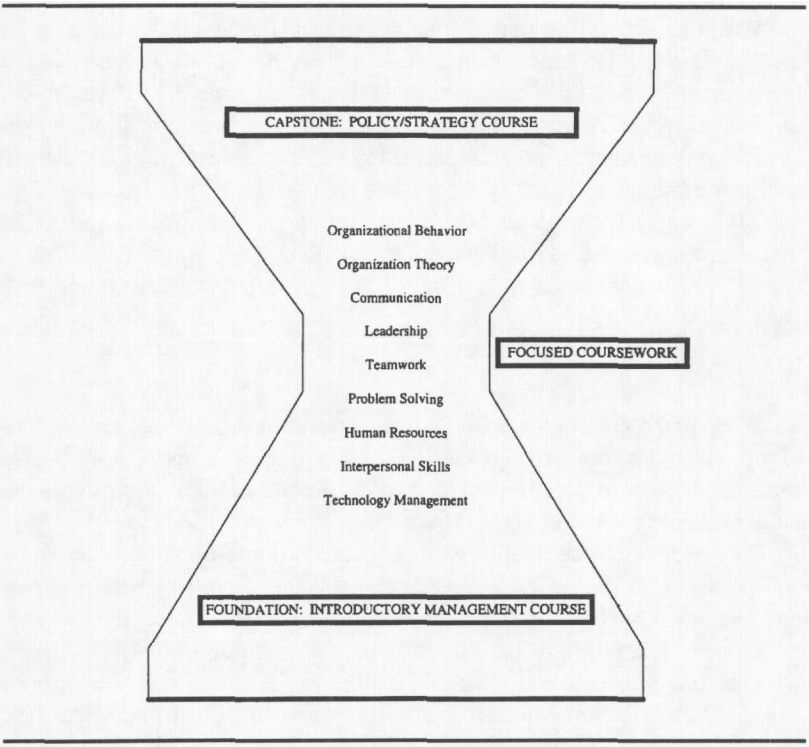

Figure 1: Hourglass Model of Management Curriculum

Computer-Based Management Simulations and the Introductory Management Course

Although numerous types of computerized management simulations exist (Keys & Wolfe, 1990; Wolfe, 1993), we limit our discussion to those that pertain to the total enterprise. Such simulations typically are used in the capstone policy/strategy class where students are expected to perform at a fairly high level and integrate their past course work. Others have discussed the benefits of using strategy simulations in this context (see Keeffe et al., 1993; Morris, 1995; Parks & Lindstrom, 1995; Stone, 1995). Although some of the benefits occur in both contexts, we focus on how simulations add special value to the introductory management course.

As might be expected, using simulations in the introductory course offers both advantages and disadvantages. On the positive side, total enterprise

management simulations can foster a rich and holistic understanding of management concepts and theories, preparing learners for their future course work and organizational experiences. However, simulations also can present new and different challenges. In the following, we discuss six pedagogical advantages of using simulations. We then discuss some problems commonly encountered by those using simulations in the introductory class and suggest a strategy for how they can be overcome.

Simulations model an interdependent open system. One key advantage of computer simulations is that they offer a fairly realistic model of the interdependence of decisions that managers make in an organizational setting. By providing beginning students with a series of episodes that allow them to see connections between decisions, simulations teach or reinforce real-world concepts. Through inductive reasoning, deductive reasoning, or both, learners discover the conceptual relationships intended by the instructor (Burns, Gentry, & Wolfe, 1990).

Simulations allow students to experience behavioral processes. Management education has been criticized for its strong emphasis on analytical content to the exclusion of associated behavioral process involved in managing organizations (Porter & McKibbin, 1988). Yet, knowledge about the behavioral processes that lead to results is at least as important as knowledge about analytical techniques that can help make strategic choices (Stumpf & Dunbar, 1990). A computer simulation early in the students' program can offer learners opportunities to experience the behavioral processes involved in management and may reduce some of the current biases in management education. In particular, simulations can provide abundant opportunities for learning about team process. When a team of learners makes these decisions, the team members experience the dynamic interplay of how groups function in the workplace environment. In this respect, simulations go further than other teaching methods in bridging the gap between the classroom and the world of real-life business decision making.

Simulations promote active learning. Although the simulated business is small enough that students become involved and can see and experience each aspect of the enterprise, the exercise usually is complex enough to require that students interact with one another to take action. It is important that this interaction nourishes the active learning process in the introductory business course. Of particular value are the frequent discussions and debates that arise because of the complexity, interconnectedness, and novelty of the decision making.

Simulations develop critical and strategic thinking skills. The skills of strategic planning and thinking are not easy to develop; a great deal of practice, feedback, and coaching are needed. An advantage of simulations is that they provide a variety of interconnected business situations in which participants repetitively analyze circumstances, establish objectives, and lay out plans of coordinated activities that extend several planning periods into the future (Wolfe, 1993). High-level thought processes are required to understand, inform, and persuade team members concerning a continuous stream of issues. Exposing students to these conditions early in their course work helps them to begin the process of enhancing their critical thinking skills and developing their skills in communicating with one another.

Simulations enhance personal development. Students learn a great deal about themselves through a computer simulation exercise, especially when it occurs in an introductory class. Some find themselves tested for the first time. Can they succeed, and possibly thrive, within a highly unstructured venture environment? Can they deal with the ambiguity that is inherent in any new venture? Can they work with other people? Simulations provide an opportunity for learners to discover their interests, become aware of their strengths and weaknesses, and learn fundamental lessons about being prepared, meeting deadlines, and acting ethically.

Simulations support faculty goals. In addition to providing students with a schema for understanding their future course work, computer simulations have several qualities that make them desirable to faculty members (Gunz, 1995). First, they change the focus of the class from teacher oriented to student oriented by shifting the emphasis from the *teaching* of the instructor to the *learning* of the student. Second, simulations use faculty time effectively in the typically large introductory business class. Student teams act as self-managed work teams, giving the faculty member the opportunity to interact with teams as needed. Third, simulations make the course material come alive, providing numerous examples and experiences.

COMMON PROBLEMS WITH SIMULATIONS

As with any pedagogical tool, simulations can lead to some unwanted outcomes for both students and faculty members. Students may fail to see connections between theory and the simulation experience. They may view the simulation as unrealistic and try to "psych out" the game. Introductory students also may be frustrated or overwhelmed by a simulation's complexity

or the computer interface, particularly early in the course. Finally, the team dynamics may backfire as students encounter conflict or an overenthusiastic team member who takes over. All of these outcomes can sour the students' classroom experience and interfere with learning.

Most of these problems can be avoided by careful planning and course design. The first step toward successfully using a simulation in an introductory management class is to carefully evaluate all of the available simulations and select one that best matches the objectives of the introductory management class. The second step is to design the course around the simulation to achieve the benefits we listed in the preceding and to avoid the pitfalls. The remaining two sections of this article cover these steps in more detail.

Evaluating Management Simulations

In the following, we identify seven criteria that can be used to evaluate and choose a computer simulation for an introductory management class, and we review 11 total enterprise simulations. (See the appendix for a complete list of simulations reviewed.) Where appropriate, we include recommendations that stem from our assumptions about the characteristics of a typical undergraduate introductory management class. However, our intentions are not to impose our preferences and select the one "best" simulation. Instead, we categorize the simulations according to the criteria so that the reader may choose the simulation that most closely matches faculty preferences, the university culture, curricular goals, and the characteristics of students. Table 1 summarizes our findings.

Both student and faculty input were used to create the criteria and categorize the 11 total enterprise simulations reviewed. Student teams played at least two periods of each simulation and provided extensive written feedback on the software, administrator's manual, and player's manual for each simulation. Multiple faculty members also reviewed each simulation and its manuals. Finally, two of the simulations were used in regular introductory management courses, providing additional student and faculty input.

The technical demands of each simulation are not assessed here given that the computer equipment required to run each simulation is relatively simple. All of the simulations discussed in the following are DOS-based programs designed for IBM-platform computers, making them accessible in nearly any university computing environment. However, as many student players pointed out, the DOS format can be challenging for those who are used to a Windows operating environment.

DOMESTIC VERSUS INTERNATIONAL INDUSTRY

Choosing between an international and a domestic industry context is difficult because cogent arguments can be made for selecting either an international or a domestic simulation. Table 1 shows that 6 of the 11 simulations reviewed operated in an international context. Given that international issues are increasingly integrated into the curriculum, a simulation with an international context can provide many opportunities for learning. However, international simulations add significant complexity to most simulations. Not only must students master the basics of running a domestic business, they must master additional concepts related to doing international business such as exchange rates, cultural differences, and treaties. Given the primary goals we identified for introductory management, we generally agree with Klein, Fleck, and Wolfe (1993) that such concepts are more appropriate and more accessible later in the students' course work. However, an international simulation would be appropriate if the instructor or curriculum has a strong international focus and believes the students to be adequately prepared to handle international issues.

GENERIC VERSUS SPECIFIC PRODUCT

Two different schools of thought govern the selection of products and services that simulated organizations produce and sell. Some simulations offer generic products that are unfamiliar or unidentifiable to students, whereas others favor specific products that are familiar to most student-consumers. Each approach has advantages that are discussed here.

Table 1 shows that 7 of the 11 simulations we reviewed involve clearly identifiable products such as athletic shoes, air travel, and other consumer goods and services. These types of products have two advantages: They maximize the realism of the simulation, and they allow students to conduct research on real-world organizations in that industry. Simulations that involve specific products allow instructors to integrate case studies and research assignments into the simulation experience. On the negative side, simulations that involve specific products and services tempt students to use their "consumer expertise" to make decisions rather than employing the tools and techniques that the class is intended to introduce. Students also may believe that they can identify the "right" decisions if they simply do enough research on the industry.

Of the 11 simulations, the remaining 4 use generic products (akin to the well-known widget) that are not identifiable or tangible. Using a simulation that involves a generic product forces students to make decisions based on theory rather than on experience or gut instinct. Generic products also help

TABLE 1

Summary of Simulation Evaluations

Simulation	*Type of Industry*	*Type of Product*	*Interactive Feedback*	*Overall Complexity*	*Performance Index*	*Written Support Materials*
Airline	Domestic	Specific	No	Moderately complex	None	Excellent
Allison Industries	Domestic	Specific	No	Simplest	None	Poor
Business Management Laboratory	Domestic	Specific	No	Moderately simple	None	Excellent
The Business Policy Game	International	Generic	Yes	Most complex	Multidimensional	Excellent
The Business Strategy Game	International	Specific	Yes	Moderately complex	Multidimensional	Excellent
CEO	Domestic	Generic	Yes	Moderately simple	Multidimensional	Fair
Chopsticks Company	Internati onal	Specific	Yes	Simplest	Unidimensional	Fair
Corporation	International	Specific	No	Most complex	None	Fair
Micromatic	Domestic	Generic	Yes	Simplest	Multidimensional	Fair
Strategy!	International	Specific	No	Most complex	Unidimensional	Excellent
Threshold	Domestic	Generic	Yes	Moderately simple	Multidimensional	Fair

students understand that management concepts and skills are applicable across a wide range of products and services. However, such simulations are perceived as less realistic by students, and students may struggle to gain an understanding of product and industry characteristics.

We suggest that instructors choose between specific and generic simulations based on their individual course goals. For example, an instructor who wishes to incorporate research on real organizations into the simulation would likely choose a specific product simulation. An instructor who wishes to focus on the behavioral issues that teams face may find that a generic product simulation provides sufficient team challenge without the added complexity of real-world comparisons.

DECISION ENHANCEMENTS

Because an introductory management class is intended to provide a broad overview of the total enterprise, a simulation should offer managerial dilemmas and situational opportunities that require a variety of both qualitative and quantitative tools for decision making. We have omitted many computer simulations from this review because they were not sufficiently broad in scope; we assessed total enterprise simulations only.

Although the context for decision making varies across these simulations, each offers a fairly wide range of decisions concerning marketing, production, finance, and human resources. However, the simulations do vary according to whether they offer additional information, scenarios, and real-time managerial dilemmas. Such enhancements not only increase the realism of the game, they also allow the instructor to introduce new topics, such as labor issues and ethics, that are not necessarily encountered in the normal operation of the simulation.

Table 1 shows that of the 11 simulations reviewed, 2 offer no such enhancements and 3 offer additional information bulletins and scenarios that provide new information that may influence students' decisions. Bulletins may provide additional economic, industry, and/or firm-specific information to which student managers can react, but no additional decisions are required beyond the normal simulation decisions. An additional 6 simulations go one step further to include more comprehensive dilemmas that require students to make a decision or decisions in addition to the regular decisions they normally make in a simulation period.

We tend to favor simulations that offer such managerial dilemmas or decision enhancements. They help students realize that not all managerial decisions are routine programmed decisions, they demonstrate that a variety

of actions can be taken in any situation, they suggest that no single "right" way exists to solve the dilemma, and they increase course flexibility.

AVAILABILITY OF INTERACTIVE FEEDBACK

Simulations vary in the degree to which they offer easy-to-use and interactive feedback on the outcomes of their decisions. Accessible, interactive feedback allows students to see how decisions are interrelated, enhancing diagnostic skills and encouraging integrative thinking. Simulations offering such feedback help reinforce the interactive, open-systems model that students will need to understand as they progress in their managerial curriculum.

Some simulations allow students to generate pro forma statements based on their potential decisions prior to handing in their final decisions in any one period. Other simulations expect students to generate their own spreadsheets to do this. Table 1 shows that 6 of the 11 simulations offer interactive forecasting tools.

We believe that for introductory students, a good simulation should provide forecasting tools. First, they enable students to quickly begin to interact with each other and focus on the holistic dynamics of management rather than spending their time developing advanced quantitative analytical tools. Second, these aids help student groups to experiment with various decisions and immediately see their impacts before the groups make their final decisions. The ability to see the results of decision making fosters a long-term perspective that encourages groups to view their task as managing a real organization rather than playing a game or solving a puzzle.

OVERALL SIMULATION COMPLEXITY

Simulations vary widely in the number and complexity of decisions to be made, the number of decision periods covered, and the time it takes to complete the decisions for a period. All the simulations we reviewed require students to understand the fundamentals of accounting and finance. However, as Table 1 shows, the games vary considerably in their complexity. Of the 11 simulations, 3 are rated as "most complex" because they involve a corporate structure with standard business units (SBUs) requiring multiple decisions across SBUs. The 2 "moderately complex" games involve a single specific industry with multiple markets requiring sophisticated understanding of idiosyncratic industry parameters and firm data. An additional 3 simulations are "moderately simple" in that they involve making decisions to produce and sell one to three products using relatively straightforward data. Finally,

the remaining 3 simulations are the "simplest," requiring relatively few decisions using relatively simple data.

The characteristics of the student population will partly determine how complex the simulation should be. Although students likely have had some preliminary courses that will help them to complete financial and accounting computations, levels of preparedness vary. Operational measures such as the "passenger-miles" used in *Airline* (Smith & Golden, 1994) are not intuitively understood by most students at an introductory level. In addition, student demographics should be considered. Traditional residential student populations find it easier to arrange group meetings outside of class than do commuter or nontraditional students. A final consideration is whether students will meet exclusively outside of class, meet both in and out of class, or meet exclusively during class time. Students who have fewer external constraints and more time to meet outside of class can likely handle a slightly more complex simulation than can those who have less flexible schedules.

Given our objective of encouraging teamwork, problem solving, strategic thinking, and communication, we believe an introductory simulation should not be so analytically and conceptually demanding that students focus primarily on doing mathematical analyses. Simulations requiring a large number of decisions or the management of multiple business units may not be appropriate for introductory management students because they encourage quantitative analysis rather than qualitative analysis, discussion, and reflection.

QUALITY OF WRITTEN SUPPORT MATERIALS

Simulations varied in the degree to which the written support materials were useful and accessible to introductory management students. We evaluated the player's manual, the administrator's manual, and the reports or forms generated by the software. Well-written manuals can be a valuable learning tool, whereas poorly written materials can make a simulation difficult, frustrating, and time-consuming for the students and the simulation administrator. Similarly, well-conceived and organized reports help students interpret their performance and serve as models of effective information presentation.

Students and faculty members identified helpful features they felt should be included in all manuals. From the player's perspective, a manual should offer an idea of what students can expect to experience and learn from playing the simulation and should offer suggestions on how to work as a team. From the administrator's perspective, a manual should describe the educational goals of the simulation, offer suggestions on how to integrate the simulation with a course, and tell the approximate time needed to play and administer the simulation. Players and administrators agree that a manual should explain

how the simulation program calculates various statistics. For example, the manual should clearly state whether return on equity is calculated with income before tax or with income after tax.

Table 1 shows that of the 11 simulations evaluated, 5 were rated as having excellent written materials, 5 were rated as having fair written materials, and 1 was rated as having poor written materials. No manual included all of the features just listed, but higher rated manuals tended to offer more of these features and lower rated manuals had fewer of these features. The simulation with the lowest rated manual provided little background information on the simulated company and the decision-making environment, and it gave virtually no information for players or instructors about how the simulation is related to management.

MEASUREMENT OF PERFORMANCE

The final criteria we used for evaluating computer simulations is the measurement of performance. Simulations vary in the types of performance measures they provide to students and the amount of information regarding performance that is given to students. Most simulations give students financial reports including balance sheets, income statements, and possibly additional information such as financial ratio analyses, stock price information, cash flow analyses, and competitor data. As argued earlier, because introductory students have not had advanced course work in finance or accounting, these data should be straightforward and simple.

However, a second and related aspect of performance feedback to be examined is whether or not the simulation automatically calculates a summary index that rates and compares performance across teams. Of the 11 simulations we reviewed, 5 provide a multidimensional performance rating based on a weighted average of various performance indicators such as sales, net income, and growth. Most of these give the instructor some control over how performance is measured in that the instructor can assign weights to the elements that make up the performance index, allowing customization to suit the instructor's goals. An additional 2 simulations offer a unidimensional rating based on a single or composite financial measure. Finally, 4 simulations do not provide any performance index that can be used to readily evaluate and compare simulation performance across teams. Instead, they require the instructor to collect the individual financial reports for each team, generate the desired ratios or analyses by hand, and compile them to make a comparison.

We suggest that simulations offering students a multidimensional measure of performance are highly desirable in an introductory management course.

First, performance is a multidimensional construct, and students should be encouraged to view it this way. In addition, given that the objective of the simulation is to give students general exposure to the concepts of management, using more than one criterion for assessing financial performance avoids the potential for students to focus on "wild moves" to achieve enhanced performance in only one measure. Finally, the instructor's time is saved when performance across teams is calculated automatically by the simulation rather than by the instructor's own hand.

COMPARING AND SELECTING SIMULATIONS

For several criteria, we have made suggestions that stem from our assumptions regarding the objectives of an introductory undergraduate management course that are relatively invariant across institutions. For example, we tend to favor simulations that are not too complex, provide additional decision enhancements, offer tools for interactive feedback, have accessible written materials, and feature a multidimensional performance index. We recognize, however, that the specific context also matters when selecting a simulation, and we encourage readers to assess other factors such as additional curricular goals, institutional features, instructor preferences, and student body characteristics when making a choice.

Designing the Course

Selecting a simulation based on the fit among course objectives, simulation features, and other contextual factors is the first step to successfully using management simulations. A second and equally important step involves designing the course to maximize the benefits and minimize the potential problems of the simulation experience.

Using a simulation in an introductory course presents several challenges for the instructor. The most fundamental challenge is to create links between the simulation and the course material. A total enterprise simulation can illustrate theories and provide opportunities for discussion, but the faculty member must create opportunities for integrating theory and (simulated) practice. In addition, the sequencing of topics and the inclusion of additional exercises to enhance the simulation experience can help the instructor manage the classroom better. In this section, we offer some suggestions for course design so that the simulation enhances course content rather than competes with it.

ORDER OF COURSE TOPICS

The order in which topics are presented is critical to the success of the simulation experience in the introductory management course. One challenge is that students must learn the background of their simulated organization and develop relationships with their teammates at the same time they are learning textbook material. This places heavy demands on both students and the instructor early in the course. We recommend establishing teams as early as possible and maintaining these teams for all group activities in the course. We also suggest waiting to begin the simulation until some fundamental course topics have been covered.

Because most simulations provide students with little guidance in team dynamics, interpersonal communication, goal setting, decision making, strategic planning, and organization design, these subjects need to be discussed early in the introductory management course. We begin the simulation experience with team discussions of individual strengths and weaknesses as well as expectations for team membership. Next, teams establish formal objectives, peer evaluation standards, and penalties for noncompliance. Making team members write their commitments down tends to increase their accountability to one another, and it serves to relieve new students' apprehension about team membership.

After students have studied the background and parameters of the simulation, we introduce the concept of strategy and have teams create mission statements and strategic plans. Our discussion of decision making serves as a prelude to the teams' first decision-making period.

As the simulation progresses, we create as many links as possible between textbook readings and the experiences in the simulation. For example, theories of communication, motivation, conflict, performance, and leadership can be discussed in class when students encounter these problems within the simulation teams.

TEAM SELECTION

The criteria used to select team members may have a larger influence on the quality of the team experience than do the characteristics of the simulation. We prefer to maximize the diversity of teams for two reasons. First, diverse teams more accurately reflect the increasing diversity in the workplace. Second, diverse teams are more likely to encounter the challenges in communication, decision making, interpersonal relationships, teamwork, and the like that result in a rich, dynamic learning experience. We suggest administering some type of problem-solving or learning-style inventory and

using that long with gender, race, major, and work experience to create team heterogeneity.

EVALUATION OF STUDENT PERFORMANCE

Because simulations cannot measure student team behavior, we supplement the simulation's performance evaluations with several additional measures. One tool that has proved to be very effective is peer evaluation. Students provide their teammates with written peer evaluations based on the specific criteria that each team developed earlier in the course. They also assign scores to their teammates that are averaged and make up a percentage of each student's course grade. Peer evaluations also provide an opportunity for students to learn about communication, motivation, and performance appraisal.

In addition to this individual-level assessment, various qualitative assessments of team process are made during the course. These assessments provide the opportunity for teams to review the goals they wrote for themselves at the start of the course and demonstrate the need for feedback and managerial control. At the end of the simulation period, we require formal presentations in which teams explain and analyze their process and performance. Presentations are evaluated on how well teams analyze their planning, controlling, and team processes and on team members' oral communication skills.

Conclusion

Using a simulation does have some costs, particularly if teams are expected to accomplish all of their decision making during class time. Discussion of team process and simulation results can take a significant portion of class time, possibly precluding discussions of current events, video clips, and case studies. There is little time for experiential exercises. However, we argue that the simulation provides a high-quality, interdisciplinary, skill-building, and integrated experience that eliminates the need for supplementary exercises.

In addition, early in the course, students will more than likely experience frustration with the simulation and the team processes. Students are being exposed to a heavy dose of new content and curriculum design. They are expected to learn a computer simulation and begin to develop work group norms. Similarly, startup costs are heavy for faculty members who also need to be managing several activities at once. In our experience, students' frustration and the hectic workload for faculty members slowly diminish when the student teams begin to manage the process, gain confidence, and develop accountability.

Clearly we believe there are important benefits derived from the use of computer simulations in an introductory management course. In addition to the benefits that are directly linked to course objectives, simulations can provide opportunities for personal growth. Simulations remind learners of their power to influence group and organizational life and the decisions that are made. They encourage self-reflection, and the insights gained often are humbling even as they provide a clearer picture of group and organizational reality. The process of going through a simulation opens up new ways in which to behave at the individual level and provides suggestive clues for how organizations might be changed. The impact of such an experience typically is intense, and so the insights gained are easily and often fondly remembered (Stumpf & Dunbar, 1990).

Appendix
Simulations Reviewed in This Article

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