CONCEPT

Using Computers To Teach The Art Of Management

W. Timothy Rhodus

When teaching the science of management, it is important that students understand basic principles of management theory and how to apply them under alternative conditions. When teaching the art of management, it is important for students to realize that memorizing the solution to a problem or knowing how to arrive at a solution using a cook book approach will not prepare them for the day-to-day decisions that must be made by all managers. Realizing that management decisions are dependent upon key assumptions such as environmental conditions, organizational goals, and resource endowments, will better prepare students to handle unusual situations that were not covered in class. Thus, focusing on higher levels of learning, such as evaluating and synthesizing, is essential for students who are developing management related problem solving skills.

Newcomb and Trefz (1987) propose that educators have the opportunity to develop instructional objectives so as to include learning at four different levels of cognition:

- remembering
- processing
- creating
- evaluating.

When students are asked to allocate scarce resources to alternative production possibilities so as to maximize enterprise profitability, they are learning to *create*. Alternatively, when students are asked to develop a strategic marketing plan that most effectively combines organizational strengths and weaknesses, environmental opportunities and challenges, and company goals and explain why, they are learning to *evaluate*. By using a variety of teaching strategies: class discussion, case studies, writing assignments, and laboratory experiments, professors can provide the necessary practice in learning at higher levels of cognition.

Unfortunately, many concepts related to management cannot be captured within case studies, written assignments, or experiments. In those cases, computer simulations can be very effective in demonstrating and/or measuring the implications which result from a single or series of management decisions. Computer simulation models have been used in teaching management principles in a variety of applications: agribusiness management (Dahlgran, 1986), farm management (Anderson and Ikerd, 1985), orchard management (Davis and Thiele, 1981), dairy herd management (Schmidt and McCracken, 1988), nursery management (Ball, 1986), and greenhouse management (Brown, Fonteno, and Nelson, 1985). By simulating the impact of a management decision on expected revenues, expenses, production volume, resource utilization, etc., these models generate the kind of information that a manager requires when making a decision and thus provide students with the opportunity to develop important problem solving abilities.

However, presenting students with computer models does not necessarily imply that they are learning at the higher levels of cognition. For example, students may be able to memorize the impact on firm profit of a price increase for a factor of production but not be able to suggest and evaluate alternatives aimed at compensating for the drop in profit. Without having students study the impact of a wide variety of scenarios or measuring how much change in one variable is needed to overcome the effect of a change in another variable, they are not able to appreciate the interrelationships of the "reality" being simulated. This highlights the need for carefully designed course assignments and test questions.

Computer Aided Instruction

Using computer simulations as a complement to the traditional lecture/discussion format in an agricultural management class needs to be differentiated from computer aided instruction (CAI). The term CAI has been used to represent a wide range of computer applications for teaching purposes, such as simulators, management games, programmed learning, and computer managed instruction (Babb, 1987). Babb defines CAI as a more limited set of software that teaches a specific topic, may contain exercises that reinforce what is taught, and often times developed more as a substitute than a complement to the teacher.

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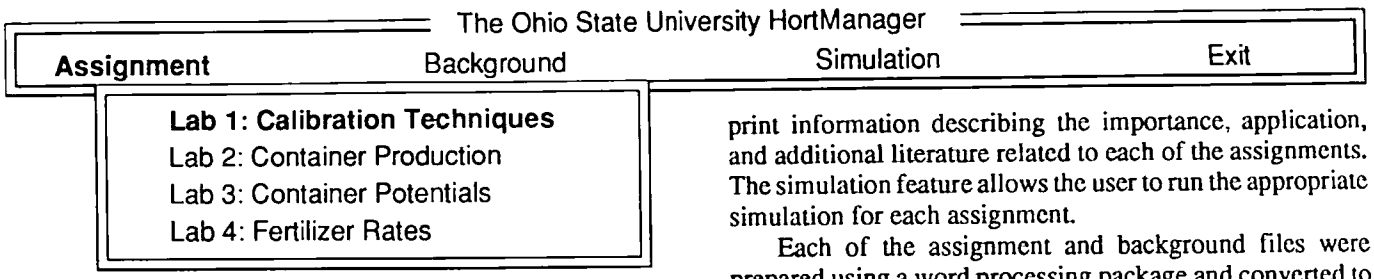
Figure 1: Assignment menu options in HortManager.



The effectiveness of CAI instruction on student learning and student satisfaction has been compared to that of the traditional lecture/discussion approach (Beilock, et al., 1986; Birkenholtz, et al., 1989; Schmidt and McCracken, 1988; Pokorny, 1988; Ball, 1986; Rohrbach and Stewart, 1986; Trede, et al., 1985; Weber, et al., 1985; Johnson, et al., 1984; and Osburn, et al., 1981). These studies have generally yielded positive findings regarding student satisfaction to the incorporation of computers in the course but have yielded mixed results when comparing student learning between CAI and the traditional method. As a result, CAI instruction is at best equal to but probably not more effective than the traditional lecture format. This implies that student satisfaction of the learning environment can be improved by incorporating computer programs into courses but these programs should be viewed as only support mechanisms for the professor, not a replacement.

HortManager

In 1989, a new microcomputer program was developed by the author at The Ohio State University, Department of Horticulture. This program is titled HortManager. One of the key developmental objectives of this program is that it should provide a common interface for all simulation assignments. In this way, students will be presented with an easy-to-follow, menu oriented, standardized approach to running microcomputer simulations. Too often, professors overlook the benefit of providing a common interface (environment) under which programs operate. As a result, students are required to learn a new series of commands when running different programs and are not able to accumulate their computer experiences as readily as if all programs were developed to run under a common set of commands.

A second developmental objective was that HortManager should be adaptable to a variety of courses and computer applications. In this way, HortManager can be customized for many different uses. The only requirement would be that specific directories or subdirectories would need to be identified for each computer application being run. HortManager was developed using Turbo Pascal (Borland International) and designed to run on IBM compatible systems. Memory requirements for the program are minimal. However, memory requirements for the computer applications which HortManager controls vary. The program was first applied in the Nursery Management course at Ohio State University.

The program consists of three parts: assignment, background, and simulation. The assignment feature allows the user to scan and/or print any of the assignments used in the class. The background feature allows the user to scan and/or print information describing the importance, application, and additional literature related to each of the assignments. The simulation feature allows the user to run the appropriate simulation for each assignment.

Each of the assignment and background files were prepared using a word processing package and converted to an ASCII format for viewing in HortManager. Each of the simulations were developed using the LOTUS 123 (Lotus Development Corporation) spreadsheet and compiled using @Liberty (SoftLogic Solutions, Inc.). This enables HortManager to run each simulation without using LOTUS 123. While currently not available, HortManager could just as easily run simulations developed under Pascal or any other language.

At present, four assignments and simulations are developed for use in the nursery management class, Figure 1. Initially, these assignments were merely copies of previous lab assignments used in the course that the students solved by hand either during or outside of class. After developing the simulations, it became obvious that students have the means (simulation model) and the time (recalculation is immediate) to address many new and more complex questions regarding nursery management and thus learn at a higher level of cognition. Lab assignments were then rewritten to incorporate questions aimed at having students create and evaluate.

Simulation Benefits

Regardless of commodity or type of business orientation, computer simulations can be used to reinforce learning of management concepts and accomplish the following: (1) provide students the opportunity to make business decisions where the outcome is uncertain, (2) teach students to conduct an economic analysis before making a decision, (3) provide students the opportunity to apply previously learned analytical skills, (4) teach students to read and interpret financial performance records (Dahlgran, 1986). Additionally, incorporating a simulation over time, provides the opportunity for students to learn what works and what doesn't at their own pace.

For example, students who are competing against each other in a marketplace often begin rather conservatively so as to learn how certain decisions impact their firm's market share and resulting profits. After discovering that profits are directly related to balancing selling prices and total expenses, they begin to raise prices or lower expenses in order to generate a positive profit. However, this learning occurs at different times for different students. Those who have a greater understanding of accounting and finance principles appear to enjoy an advantage in this area. Once mastered, the concept of covering costs is then applied to the more important issue, strategic planning. In this way, a well developed simulation will allow the students to proceed at their own pace and constantly discover new challenges.

In addition to providing opportunities for making decisions, simulations also provide the opportunity for students

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Using Logic Puzzles for Critical Thinking

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Introduction

Industry is looking for the graduate that can organize and assimilate information to solve problems. There is continued call for universities to increase the number of citizens capable of effective personal and professional problem solving and leadership (Ellerbroch et al., 1987). But many high school graduates who enter college may lack the ability to solve complex problems (Fulkrod, 1986). This may be due, in part, to the emphasis in education on memorization. Overemphasizing memorization has a tendency to keep students at the lowest level of learning (Posler, 1987).

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Piagetan theory states that intellectual development exists in four levels and that completion of the fourth level, formal operational, occurs around 15 years of age (Piaget and Inhelder, 1969). McKinnon (1971) disagrees with this, stating that as many as 50% of college freshmen still operate at level 3, concrete operational. Herron (1975, 1978) supports the concept that students may not be at the formal operational level; however, much of science is taught assuming that students can handle formal thinking.

Fulkrod (1986) would strongly support the idea that many of our college students are not equipped to think on the fourth level, probably due to lack of training and experience. Herron (1978) found that students exhibiting formal operational development scored considerably higher on exams than students with concrete operational abilities. Instructors need to develop methods which encourage students to use the formal operational thought process in science courses, especially those students with weak science backgrounds. But, using concrete scientific examples that are not understood by these students may further hamper their development to think at the formal level. This article presents a teaching

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to express their thoughts and motivations (strategy) orally or in writing. By requiring a writing assignment or series of assignments with each simulation, students will learn how to express what they did, why they did it, what they accomplished, and what they are going to do next. Depending upon the format of the questions, students can be asked for information requires they to remember, process, create, or evaluate what they have learned from the simulation.

Finally, organizing students into teams and having them interact and arrive at one set of decisions promotes social interaction, develops interpersonal communication skills, and prepares them for working in an organization after graduation. Too often, students are able to sit through a course and never say more than, "Here," or learn the names of any of their classmates. By providing some of these social benefits, team simulations are a very valuable addition to any class.

Summary

Given that the art of management is something that is best learned through practice, students need to be provided with sufficient opportunities to develop their decision making skills when the cost of failure is relatively inexpensive and painless. Computer simulations provide the opportunity for reinforcing management concepts discussed in lecture by presenting realistic outcomes that result from various management decisions within a hypothetical firm. By incorporating a series of computer simulations into a horticultural management class through a common computer interface such as HortManager, students will also experience minimum program learning time and a sense of continuity across classroom computer assignments. However, failure to develop simulation assignments and test questions that focus on the higher levels of cognition, creating and evaluating, will result in students only becoming familiar with another computer program and not fully comprehending the intricacies of managing a business.

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