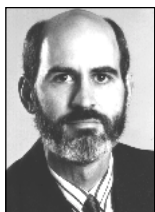


Editor's Note: The following paper was a finalist in the 2000 DSI Instructional Innovation Award Competition. The other finalists will be published in upcoming issues of Decision Line.

Teaching Network Management Hands-On: Experiences with a Student-Run Internet Service Provider

Robert P. Minch and Sharon W. Tabor, Boise State University



Robert P. Minch

is a professor in the College of Business at Boise State University. He has a PhD in management information systems from Texas Tech University, and was on the faculty of the Krannert Graduate School of Management of Purdue University before coming to Boise State. He has published in a variety of journals including *Decision Sciences*, *MIS Quarterly*, *Journal of MIS*, *The Journal of Organizational Computing and Electronic Commerce*, *Interfaces*, and *Human Factors*. Dr. Minch has received a number of teaching awards, and authored a number of grants that have funded electronic classrooms and networking laboratories. During the last five years, Professor Minch has dedicated the majority of his efforts toward the development and teaching of new telecommunications and network-related classes, and the creation of a recently-instituted Networking and Telecommunications degree program—one of only a few that exist in colleges of business.

rminch@boisestate.edu



Sharon W. Tabor

is an assistant professor of computer information systems at Boise State University. She received her Ph.D. from the University of North Texas in 1997, following a lengthy management career for several major technology firms. Industry associations include IBM, American Airlines, Control Data, and Beckman Instruments. Dr. Tabor's teaching and research interests include electronic commerce, networking and telecommunications, network management, and network security.

stabor@boisestate.edu

Teaching Network Management is a challenge requiring the melding of theory and practice, with both technical and managerial aspects. While formal approaches to network management, such as the ISO's five-part taxonomy, may be covered extensively in lecture, it is very difficult for students to appreciate the importance and applicability of these concepts without experiencing them in practice. Furthermore, students have trouble integrating technical and managerial issues, often neglecting one area (typically, important but often abstract business considerations) and over-emphasizing the other (usually, concrete but narrowly-defined software technologies).

We have undertaken an ambitious and realistic approach to teaching Network Management at Boise State University in which students operate their own self-contained and fully functioning Internet Service Provider (ISP), BSU.net. Since its inception in 1996, students have fulfilled the required roles to provide all major ISP services such as dial-up access and web hosting, support customers demanding near-100% service availability and technical help, coordinate with business partners supplying downstream and upstream bandwidth, and account for financial expenditures and resources. We started the project with little more than a 400-square foot room and the optimism that we could obtain the necessary donations, partnerships, and other resources necessary for success.

Student Candidates

Students apply for permission to take the Hands-On Network Management (HONM) class after completing the Introduction to Networking and Telecommunications class with a grade of A, or that class and a Computer Networking class with a grade of B or better in both. Exceptions are sometimes granted, but success in the previous classes impacts the ability of the student to get the most from the hands-on experience. Each student expressing interest in the class is interviewed with emphasis on their course achievement in prior classes, experience with computers and networks, and the desire to learn in a non-traditional environment. During semesters when we attract particularly strong technical talent, we can also open enrollment to a few students with less experience but the motivation and capacity to learn from their peers. Occasionally students from other programs, such as Computer Science, Teacher Education, and the MBA program have been admitted on an experimental basis.

Major Educational Objectives

The goals of the HONM class were designed to merge the development of practical, real-world skills with the application of technical theory and broader business knowledge. Developmental goals of the course seek to:

- Motivate theory and concepts learned in this and previous networking classes through application in a real-world environment.

- Integrate technical and business networking issues and cause students to appreciate the importance of this integration.
- Help fund state-of-the-art computing and networking equipment through revenue from customers.
- Provide a unique, notable, and compelling learning environment that will bring out the best efforts of the students and engender pride in their achievements.

Innovative and Unique Features

The course was designed to maximize student contact with technology and emphasize the business issues that all organizations must deal with. Innovative and unique features of the HONM class include the following.

Realism of the learning environment

Because the class operates a production network, successes and failures are immediately evident in terms of the ISP's services and customer satisfaction. For example, a new and improved home page will often bring customer compliments, while a mistake in setting proper permissions for a customer's web space (denying them the ability to publish their web, for example) will quickly bring cries for help.

Integration of technical and business issues

Class members are continuously balancing business opportunities and needs with technical capabilities and limitations. At the start of a semester, students are often very enthusiastic about experimenting with new hardware, software, and systems. As they consider the business needs of BSU.net, however, they are drawn into important realizations about the value of relatively simple and elegant solutions and the need to test new services on separate experimental systems rather than the production network.

Collaborative learning opportunities

Many of the most important (and often most non-technical) lessons in the class come from other students and group work.

Typically each student is a member of two permanent teams and several ad-hoc project groups over the semester. The permanent teams are carefully organized at the start to include some members with existing expertise and others with the desire to learn in that area. Many will say at the end of the course that their most valuable learning experiences were due to their interactions with peers.

High degree of student decision making

Within broad parameters, students are able to and encouraged to make their own business and technical decisions. This has resulted in them deciding who to target as customers, what services to offer, and substantially setting the scope and direction of the ISP.

Motivating effects on students

Students almost always volunteer to dedicate more time and effort to this class than their others, and exhibit this dedication in numerous ways. At all times one student carries an ISP-owned cell phone, with a 24-hour monitor contacting them if a system goes down. On many occasions the "on-call" person has come in during the middle of the night to investigate a possible problem, and in at least one case a student team worked most of the night to reach a solution. In addition, a large percentage of students volunteer to help the next semester's class come up to speed, and some have volunteered to help for several semesters and even years into the future.

Increasing student confidence levels

Many students come to this class with minimal technical or business experience, and the idea of running their own business (technology-intensive, no less) can be overwhelming. This may be particularly true of female students, who are often outnumbered by their male counterparts. Yet through the structure in place, guidance from professors, support from fellow class members, and advice from former class members, virtually all are confidently learning and carrying out their activities at the end of a semester.

Course Content

Supporting class content comes from a variety of sources, including a practitioner-oriented text book, *The ISP Survival Guide*, and relevant handouts and online sources. The BSU.net intranet is a carefully constructed knowledge base providing access to the accumulated documentation from all previous classes. This is organized along several themes, including topic area and group projects, and is full-text searchable as well. Rather than lecture, professors prepare and deliver tutorials on an as-needed basis, with students able to request particular topics around mid-semester.

Each project team researches their area of responsibility using paper and online resources, presenting a summary of their findings to the other students. Unlike many academic projects, this research also commonly involves evaluating vendor offerings, planning implementation strategies, and other practical concerns.

Organization

The organization of the class varies somewhat each semester based upon class preferences, but includes the following overall themes.

Student-centered, flexible organization

The personalities and group dynamics of each class varies—sometimes dramatically. Therefore we allow each class to choose from several administrative structure models and decide whether they would like to select a single chief executive, a team executive model, or even self-organizing work teams.

Professors as board of directors

Very much like a corporate board, the professors strive to provide broad overall direction but not interfere with day-to-day operations.

Documentation-centric approach

Unlike most businesses, this ISP has a near-complete personnel turnover three times per year. Thus a great emphasis is placed on creating and maintaining the organiza-

tional knowledge base on the web, as well as other documentation such as activity logs and personal journals kept by each student. The knowledge base provides a surrogate for the more varied organizational knowledge bases that might be found in our commercial counterparts.

Presentation

Because of the experiential learning approach used, presentation of material in the traditional sense is de-emphasized in favor of learning and applying concepts with a fast-changing market and customer feedback. In addition to the professor tutorials mentioned above, however, the students themselves provide two types of presentations to their peers. One is a weekly or bi-weekly "briefing" where each reviews his or her activities since the last briefing and proposes new initiatives related to their role. The other is a set of more formal project reports in the second half of the semester, where each individual or group educates the class as a whole concerning their area of responsibility, including what has been accomplished and learned, and recommendations for the future.

Effectiveness and Specific Benefits

While we have received very good student evaluations on our university's standard evaluation instruments for the class, it is integral to our overall approach to focus on more tangible and truly relevant measures of success. A few of these follow.

The ISP remains a successful, expanding, going concern after four years

It is financially viable, has a steadily increasing customer base, and a consistently updated network infrastructure.

Students have gone on to successful careers

These include staff positions with commercial ISPs and other high-technology companies. We have many class alumni managing networks, serving as web administrators, and otherwise successfully leveraging their class experiences. Recent

graduates have been vigorously recruited by employers.

Recognition by external organizations

The HONM class and its ISP business has been the subject of several favorable press reports, has been acknowledged as the only known similar project operated by a university class, and has been the beneficiary of several generous equipment and software donations by local and national businesses.

Feedback from former students

Many former students rate the class as a critical and indispensable part of their education.

Challenges and Rewards

The team aspect of the class presents intangible challenges, such as the student who helps others to the extent that his own deliverable (and gradable) results suffer. This kind of learning environment is not for every student. While the screening process is essentially sound, some students cannot handle a semi-structured environment in spite of their initial interest and agreement on fulfilling course requirements. But, perhaps that is also the strength of the class. These are aspects of education the traditional classroom environment does not address. With this small slice of real-life learning, our students learn the importance of the customer and quality customer support; they carry away the ability to isolate and trouble-shoot a problem; they make technology decisions with the business in mind; they learn a different level of team-building and gain a sense of accomplishment they don't get in a traditional classroom setting and small group project.

Challenges for teaching a course like HONM are many, starting with keeping the technology environment as current as possible. At this point we receive a level of funding from the College that allows the introduction of some new technology each year, supplementing actual ISP revenue. Additionally, our close working relationship with the College IT department has been particularly helpful in keeping the

network fairly current with system upgrades and parts replacement.

Preparation and presentation for HONM requires many professorial roles—both traditional and non-traditional—and a great deal of flexibility. In a given semester the traditional role of teacher expands to facilitator, arbitrator, advisor, and motivator. While the scheduled technical topics flow as per any class, the challenges of running a production network mean that occasionally business or technical issues need to take priority over the schedule.

The rewards, however, far outweigh the challenges. One recent graduate told us: "Of all the classes I have taken in my college career, none has been as effective as BSU.net in terms of true learning. Knowledge that I had gathered in prior classes came together for me in this class. By the time the semester ended, I had obtained knowledge and experience that was immediately useful in my regular job."

For us, the course is essentially a new experience each semester, and we grow through seeing our students struggle, discover, learn, and succeed. We find the approach effective and stimulating, and are pleased to offer and participate in this form of experiential learning. ■

PLACEMENT VACANCY, from page 37

Items to submit: (1) Curriculum vita, (2) Statement of activities and service provided to the Institute, (3) Statement of interest and availability to serve a three-year term, (4) Statement of qualifications and experience related to the position, and (5) Description of institutional commitment for the support of the coordinator's job functions for a three-year period. Additional information may be secured from the current coordinator, Gary Klein, at (719) 262-3157 or gklein@computer.org.

All interested parties should submit the items listed above by November 1, 2001, to:

Carol Latta
Decision Sciences Institute
J. Mack Robinson College of Business
Georgia State University
35 Broad Street
Atlanta, GA 30303