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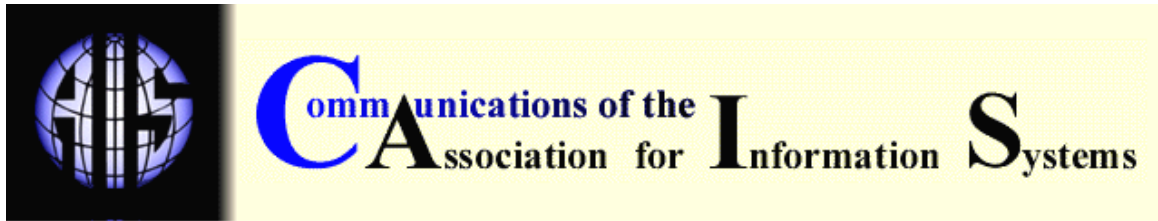
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SPECIAL ISSUE ON THE AMCIS 2001 WORKSHOPS: A THREE-LEVEL APPROACH TO MANAGING CURRICULAR TECHNOLOGY INTEGRATION STRATEGICALLY AT BENTLEY COLLEGE

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ABSTRACT

This paper presents an overview of the unprecedented array of technologies that are employed at Bentley College. These technologies are used in traditional, on-campus courses, and in videoconference and web-based distance learning courses. The paper discusses how Bentley approaches the integration of technology into the curriculum, guided by a three-level approach.

Keywords: Academic technology, technology integration, distance learning, Blackboard, Centra Symposium, Voice Over IP

I. INTRODUCTION

Bentley College has a long history of technology use in the curriculum.   In 1985, it became the first higher education institution to require all undergraduates to have laptop computers, a policy still in effect today.   While much press has been given to Bentley's construction of $22M in new, state-of-the-art academic technology facilities, this seemingly intrepid move represents an evolutionary rather than revolutionary step for Bentley.

While significant progress was made in integrating technology across the curriculum, it became necessary to build discipline-specific, high-technology teaching facilities to maintain momentum. Faculty could only continue to use general-use classroom technology resources to a point, after which it became necessary to provide instructional facilities capable of supporting "deep" integration of software in the curricula.

The workshop consisted of two parts. In Part 1, workshop participants learned about Bentley College's strategic approach to technology integration. It described how the College came to see the necessity for building, discipline-specific specialty laboratories for teaching on-campus students and some of the resources that support this approach, such as the Academic Technology Center. This discussion was highlighted by a walking tour of the labs. Part 2 was a hands-on workshop that provided a broad overview of two technologies Bentley uses to support its web-based courses.

To support the synchronous components of its web courses, Bentley employs Centra Symposium, a voice-over-IP application that enables classes to "meet" in real-time, over the Internet. Centra Symposium allows live, two-way voice communication through student and faculty PCs at even 56 K dialup speeds. The asynchronous components of web courses are supported through Blackboard, a courseware application used in over 1800 on-campus and distance learning courses at the College since its introduction in January 2000. Blackboard enables faculty to post syllabi, course documents, offer quizzes and polls, hold electronic discussions, post announcements, and much more.

THE ACADEMIC TECHNOLOGY CENTER

The Academic Technology Center (ATC) is dedicated to serving faculty. Its primary mission is

- to promote research, development, and integration of technology into the curriculum,
- to aid teaching and learning and
- to prepare Bentley students for the business world of the information age.

The Academic Technology Center was founded in late 1998 and includes 12 staff members with varying technology and research backgrounds.

Through individual and small-group sessions, ATC staff help professors create and maintain course web pages, integrate videoconferencing and web-based resources into curricula, and identify technology resources for conducting research. The ATC supports faculty through one-on-one advising, workshops, and assistance with instructional technology projects and distance-learning initiatives. Faculty may also call upon the ATC for help in finding, acquiring, and using software relevant to their courses.

An indicator of the ATC's success in integrating technology into the curriculum is the adoption of Blackboard by 75% of the college's full-time faculty within 24 months after its introduction."

STRATEGIC APPROACH TO INTEGRATING TECHNOLOGY

Bentley approaches the integration of technology as a three-level cumulative process. Briefly,

- Level One is defined as the building of a sophisticated IT infrastructure. It is grounded in Bentley's long experience with laptops for all students.
- Level Two leverages the infrastructure and investments in information technology in the classroom to change *how* faculty teach. For example, SAP may be used to illustrate examples in accounting courses, replete with exercises for students that give them some sense of how SAP is used.
- Level Three comprises a more fundamental change in *what* is taught: an accounting course becomes an accounting information systems course, business law becomes cyberlaw, and marketing becomes e-marketing. At Level Three, technology is not used at the periphery, but rather is used as an underlying theme throughout a course.

A discussion of each level follows in Sections II, II, and IV, with more detailed descriptions and examples within each level.

II. TECHNOLOGY INTEGRATION LEVEL ONE – A SOPHISTICATED INFRASTRUCTURE

Bentley's long history of laptop use necessitated a relatively sophisticated network to support teaching and learning. This network is consistently upgraded to provide a 'leading edge' information technology environment to all students and faculty. In the summer of 2000, six Cabletron Smartswitch Routers connected via gigabit Ethernet were installed as the network core. The mid-2001 network configuration allows for switched 10/100 mbps connections to network hubs from virtually every network port on campus. The network hubs, one or more of

which is located in every building, are connected to the core via gigabit Ethernet uplinks. The gigabit uplinks are shared by anywhere from 12 to 312 users, depending on the type of equipment in use.

Student residences are wired "port-per-pillow", with additional network ports in the common areas of most dormitory buildings as well as central locations on campus (dining commons, library, coffee shop, etc.). The college leases a T3 line, providing a full 45 MB of Internet bandwidth. Network management tools are also in place to prioritize and manage mission critical network activities.

SERVERS

Servers at Bentley are divided into broad classes, each based on network domains:
1. Servers that provide system functions such as network authentication, management of print queues, and backup of critical data.
2. Academic servers provide personal networked file storage for students, access to the Virtual Lab and distance learning,
3. Servers that support specific academic initiatives.
4. Administrative servers host the college's main databases, process credit card transactions, and provide development space.
5. Web servers allow access to Bentley's marketing information, student and faculty personal web pages, and access to course content and registration information.
6. Lotus Notes servers for mail, collaboration, and specialized applications.

WIRELESS NETWORKING

Wireless networking is currently available in six buildings on campus, with greatest use taking place in the Library. Students may borrow a wireless network card from the Library if they do not own one.

CLASSROOM TECHNOLOGY

Sixty-six out of the 89 classrooms are "smart"; that is, they have at least a podium-mounted, networked PC and an installed LCD projector. In addition to access to the Internet, World Wide Web, and Virtual Lab (a centralized repository of specialized course software and utilities) faculty can access files and instructional materials they prepared and stored on their personal network share. This arrangement provides convenient and secure access to PowerPoint presentations, spreadsheets, documents and other materials. Classroom facilities are supported by Client Services. A phone help line for equipment emergencies is staffed during all scheduled teaching hours.

STUDENT MOBILE COMPUTING PROGRAM

Our Mobile Computing Program, which provides a laptop computer to every new full-time freshman student, was developed with input from then current Bentley students. The machines are loaded with software and are network-ready, which means students can access Bentley information anytime, from nearly anywhere on campus.

Entering freshmen pick up a laptop computer during First Week and keep it for 24 months. At the beginning of their junior year, they exchange it for an updated model. This two-year "refresh cycle" gives students access to more current technology.   The current model used by incoming freshmen is a PIII 700 Mhz system, with 128 MB RAM, a 20 GB hard disk, and a 15" active matrix display.   We have a campus license for Microsoft Office and, in mid-2001, supported both Windows 98 and Windows 2000 as the operating environment.

Classroom Technology. Connecting classrooms to the Internet and college computing resources provides a myriad of possibilities for teaching and learning, yet it also creates opportunities for students to read their personal email and surf the web. In response to faculty feedback about this drawback of technology in our port-per-seat classrooms, we collaborated with Enterasys Networks to develop a classroom control technology named PROF™. PROF provides our faculty with complete control over the network and Internet resources in a classroom – they

can turn off email and Internet access and redirect student attention to the topic at hand. This technology has been critical to the success of our mobile computing program and the integration of computers into the classroom.

Computer Laboratory. The Bentley campus is laptop-based, not laboratory-based, but we do provide a state-of-the-art laboratory facility to supplement our laptop program. A general-purpose computer laboratory for students is equipped with more than 90 PCs. All are networked to DeskJet color printers and to high-speed laser printing. A scanner station is available to scan both text and photographs. The laboratory also offers two "quick print" stations for specialized projects such as resumes and transparencies. Network drops enable laboratory users to connect their laptop to network resources; two stand-alone DeskJet printers are available for direct hookup to notebook computers. Students can get help from trained student consultants and from a library of reference and technical manuals available for loan. The laboratory also houses a Student Computing Help Desk, which offers hardware and software support to students on or off campus. Both the laboratory and the Help Desk are open more than 100 hours per week.

FACULTY/STAFF COMPUTING

Each full-time faculty and staff is provided with either a notebook or desktop computer, which is replaced every 2-3 years. All computers contain the college's suite of standard software. Software is upgraded annually. Part-time staff and faculty can access an array of machines available in the departments for "shared use". All computers can access a networked printer. Full-time help desk and technical staff support faculty and staff during business hours. In addition, numerous web-based (element K) and instructor-led tutorials and short courses related to the use of the computing equipment and application software are available. All files on desktop and laptop computers can be backed-up automatically and restored through a product called Connected™.

III. TECHNOLOGY INTEGRATION LEVEL TWO – LEVERAGING THE INFRASTRUCTURE TO CHANGE *HOW* WE TEACH

Level Two of Bentley's technology integration strategy enables faculty to utilize extensive investments in information technology to engage students more actively in the teaching and learning process. Technologies with general appeal, such as Internet resources, are often employed. In addition, faculty often use discipline-specific software to illustrate examples and allow students to complete exercises. This section describes specific technologies used in teaching at Bentley.

BLACKBOARD

Blackboard is an example of a general-use technology at Level Two that supports changing how faculty teach by using technology. Bentley faculty have used Blackboard to create more than 1,800 password-protected course web sites to support classroom and distance learning. The Blackboard system enables faculty members to post and revise syllabi, announcements, and link to online resources, particularly those in the library. Students can access course-related documents such as PowerPoint slides used in class or a sample spreadsheet that was part of a homework assignment. Students also use Blackboard to participate in threaded discussion groups outside class meeting times, e-mail their class or groups of classmates, and drop off electronic assignments for their professor. The system facilitates group projects as well, enabling student teams to share documents, calendars and online discussion.

CENTRA SYMPOSIUM

Centra's Symposium product is another general-use Level Two technology that supports web-based distance learning initiatives at Bentley. Symposium enables classes to "meet" in real time over the Internet. Symposium's voice-over-IP technology allows for live, two-way voice communication through student and faculty PCs. Lectures can be enhanced with PowerPoint presentations, video, synchronized browsing to relevant web sites, and other on-screen graphics.

The objective is to ensure that off-campus students receive the same high-caliber instruction that students receive in traditional campus-based courses at Bentley.

VIDEOCONFERENCING

Bentley College has several on-campus sites for videoconferencing, an "older" technology that changes the way in which teaching is done. Videoconferencing expands the reach of college programs in taxation, financial planning, information design, marketing, international studies, and other areas. For example, taxation classes are regularly taught to students on campus concurrently with students gathered at remote sites in downtown Boston, Worcester, and Hartford, Connecticut. The College has seven videoconferencing-enabled on-campus locations, which are used for both regular distance learning classes as well as to bring remote guest speakers into non-distance education courses.

E-CAMPUS SERVICES FOR LOCAL AND REMOTE STUDENTS

In the fall of 1999, the college launched its E-campus, which was designed to provide web access to an array of services for both on-campus and distance students. E-campus is the gateway to a constellation of secure, self-service administrative functions aimed at students, faculty and staff. For students services include access online admissions applications, grade look-up, financial aid information and applications, student accounts status and registration eligibility, credit card payment via the web, and course availability searches based on subject, time, date and instructor. Faculty value the capacity to view electronic class rosters with thumbnail photos to accelerate the process of putting names to faces at the beginning of the term, and to submit grades electronically. Finally, numerous human resources functions are available, including applying for employment, the internal circulation of faculty and staff candidates' resumes, the annual benefits enrollment process, and the retrieval of various tax, payroll and accrued vacation information.

IV. TECHNOLOGY INTEGRATION LEVEL THREE – NOT JUST HOW, BUT *WHAT* WE TEACH

It is at Level Three that Bentley's on-campus teaching and learning facilities become quite distinct from any other college or university campus. The robust infrastructure at Level One and general-use technologies prevalent in Level Two simply are not enough to support core changes in the nature of what is taught. Information technology altered the business and corporate landscape. Providing students and faculty with general technology tools is simply insufficient. What is needed are immersion laboratories, where students and faculty can access a repertoire of the latest software and databases that are changing the business world fundamentally.

Concepts and theories that students learn in class come alive through the college's hands-on, high-tech, discipline-specific, learning laboratories – each among the first of its kind on a college or university campus. These "specialty labs" are each staffed with a full-time faculty director and any number of student staff, all of whom are familiar with the disciplinary technologies. These laboratories are:

- The Hughey Center For Financial Services "Trading Room"
- Accounting Center For Electronic Learning And Business Measurement
- Center For Marketing Technology
- Design and Usability Testing Center
- Center For Languages And International Collaboration

Following is a brief overview of each of these five specialty laboratories.

THE HUGHEY CENTER FOR FINANCIAL SERVICES "TRADING ROOM"

The globalization and integration of financial markets during the past two decades drove innovation and complexity of financial products and increased reliance on rapidly changing technologies.   As the centerpiece of the college's Hughey Center for Financial Services, the

multi-million dollar Trading Room offers firsthand exposure to financial concepts such as portfolio construction, risk management and financial engineering.

While finance students are the facility's primary users, graduate and undergraduate students studying accountancy, information technology, management, marketing, and other business disciplines also take advantage of Trading Room resources. Hands-on trading sessions and mini-classes reinforce course content. The Trading Room is equipped with 67 Dell OptiPlex 733 Mhz PIII computers, each with dual flat-panel displays. Using real-time data supplied by Reuters, Bridge, and Bloomberg, and financial trading software including First Call, Market Guide, Data Stream, and Expo, students explore the fundamentals of constructing an investment portfolio, the role of private information, expectations in pricing securities, and the impact of market making and price taking. The sessions further illuminate the principles of finance theory related to trading strategies, corporate governance issues, and development of risk management strategies. The Trading Room is one of five collegiate trading rooms in the United States, and by far the largest and most sophisticated installation.

ACCOUNTING CENTER FOR ELECTRONIC LEARNING AND BUSINESS MEASUREMENT

Today's accountants are expected increasingly to focus on industry processes. They are asked to develop accounting systems and analyze operational data that drives management decisions. The Accounting Center for Electronic Learning and Business Measurement (ACELAB) provides students with the knowledge and skills needed for tasks such as using an enterprise system and analyzing data for management decision-making.

Students develop a broad understanding of how information flows through an organization, how financial decisions are made, and how accounting relates to other business functions. They also gain practical experience with auditing and tax preparation software, report-generating applications, data modeling, and other professional tools. While the ACELAB existed for several years as a slightly modified computer laboratory, the newly renovated ACELAB consists of two distinct facilities. The first is a breakout room that features group workstations, each with a 42" plasma monitor, individual laptop ports, and the ability for up to five students working on a group project to send the video output of their laptops quickly to the plasma display for better collaboration. There are also 10 individual workstations in this room and an attached high-tech conference room. The second area is an interactive classroom with 36 PCs, flat-panel displays, and projection equipment that can be used for class work, seminars, and presentations.

CENTER FOR MARKETING TECHNOLOGY

An integral part of the college's Information Age Marketing programs, the Center for Marketing Technology (CMT) is a "best practices" lab for exploring the technologies and activities being used in marketing and advertising. The CMT provides students with a full grasp of software options, familiarity with the networked environment, and knowledge of the new frameworks and tools for improved decision-making in marketing. Many marketing courses use the CMT; some are held there exclusively.

The facility is a testing ground for new technology tools in areas such as advertising creation, database marketing, product design and development, mass customization, geographical information systems, sales automation, and marketing decision support. Using CMT resources, students conducted research and developed strategic marketing plans for real world clients that include the Boston Harbor Islands National Park and high-tech start up Turn On Media. This facility features a 39-seat PC teaching classroom flanked by four breakout rooms ("sandboxes") that contain presentation technology connected to the main classroom. Two of these "sandboxes" comprise a focus group suite (focus group and observation/control room), with installed cameras, microphones, and a one-way mirrored window. The activities of the focus group can be displayed in the main classroom as well as be recorded for review and analysis.

DESIGN AND USABILITY TESTING CENTER

The Design and Usability Testing Center puts into students' hands the same applications employed by technical communicators, web developers, user-interface designers and usability specialists. Students conduct field studies, create working prototypes for user interfaces and web

designs, and test the usability of their designs. The laboratory experience offers a firsthand look at the intersection of human factors, information design, and usability.

This Center involves three distinct parts.

- A design laboratory contains 24 workstations for creating system prototypes. Each workstation has high-end web development software, rapid prototyping tools, and sophisticated graphics applications.
- A control room serves as the communication center for maintaining systems and operating recording equipment.
- A testing room offers resources for conducting and recording usability tests for corporate clients with installed cameras, microphones, and a one-way mirrored window.

Using the college's telecommunications network, the Design and Usability Testing Center can deliver live video feeds of tests, focus-group interviews, and design meetings to any location in the world.

CENTER FOR LANGUAGES AND INTERNATIONAL COLLABORATION

The Center for Languages and International Collaboration (CLIC) builds students' awareness of other countries and cultures through the use of multimedia materials, state-of-the-art technology, and contact with Bentley peers from other countries. Along with being a key resource for faculty, the center is a valuable training ground for language students, international studies majors, and others in the campus community who want to broaden their knowledge of global issues. At clustered workstations, students use multimedia language programs and web-based resources to tackle course assignments independently or in small groups.

Through the use of Multilingual Jukebox, CLIC offers online course materials in real time for French, Spanish, Italian, Chinese and Japanese; students also use the jukebox to access foreign radio and television programming over the Internet. The "global theatre" is equipped with a 42" plasma screen and videoconference technology and promotes real time collaboration between Bentley students and professors and their counterparts overseas. In addition, international satellite programming offers news, feature programs, and movies in Spanish, French, Italian, Arabic, Hindi, and Japanese. In a special workspace designed to resemble a bistro, students can practice conversation skills with a native speaker in any of the languages taught at the college.

V. CONCLUSION

One indicator of the success of the implementation of this three-level, strategic approach to technology integration is the significant increase in applications to the college – up 58% during the past five years. Another indicator is the results of the annual senior exit survey. With respect to computer use, 90% report that the college contributes moderately or greatly to their capacity to use computers, rendering it the competency area in which Bentley has the strongest impact on its students. In addition, in the past two years, the percentage of students judging that the College has had an extremely positive impact in their ability to use quantitative tools almost doubled. Further, regardless of the undergraduate major chosen, the largest minor is now CIS, a trend that appears to represent a natural extension of the technology focus. Bentley students are gaining an appreciation for the ways in which fields such as marketing, management, finance, and accounting are being changed by information technology, and therefore coupling the knowledge they gain in these and other disciplines with a greater depth of technical expertise through a CIS minor.

Bentley's efforts at technology integration garnered it several recent awards, including the 2001 EDUCAUSE Award for Excellence in Campus Networking. It was the only college or university to be named one of PC Computing's ten "Most Wired Companies" (December 1999). Also, Bentley was chosen by Computerworld as one of the nation's top 20 techno-MBA programs, designated by Nasdaq as a "Premier Partner", recognized by Cabletron Systems and Genuity as best-in-class case examples for Classroom Control (of technology resources) and Internet applications, and solicited by IBM to jointly sponsor the first New England-based "Fly-In" conferences for best practices in the Integration of Technology into the Curriculum.

In 1985, when Bentley was the first higher education institution to require all its undergraduates to have laptops, it became something of a bellweather campus. Bentley faculty have had a long history of integrating technology into the curriculum, and these early efforts proved very successful both in attracting and placing students.

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ABOUT THE AUTHOR

Phillip Knutel is director of academic technology and a faculty member in the management department at Bentley College in Waltham, MA. He is a frequent presenter at conferences on information technology and higher education. He received his Ph.D. in higher education from the University of Michigan, where his dissertation focused on faculty adoption of instructional technology. His Ed.M. and B.S. degrees are from Harvard and Vanderbilt, respectively. Prior to coming to Bentley, he served as director of academic technology at the University of Michigan's office of academic outreach, where he worked primarily with web-based and videoconferencing technologies.

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