
Chapter 1: Academic Technology

The academic technology environment at CU-Boulder experiences a tension between a subset of the campus that seeks to lead in innovative and creative uses of technologies and a larger subset of the campus that seeks standardization, ease-of-use, and robust support for existing technologies.

The sections of this chapter span the spectrum between standardization to innovation. Those sections in the standardization camp address the need for creating enterprise-wide services, and increasing the robustness of existing services. One section addresses continued funding for and increased numbers of technology-enhanced classrooms. One addresses increasing the scale and robustness of a central learning management system. And finally, one addresses the need for a centralized student response system.

Other sections of this chapter address the flow from innovation to standardization. They ask the campus to identify innovative approaches to technology which can be offered and supported more broadly for the entire campus. One of these sections addresses the need for a more robust and standardized digital asset management environment on campus. One section addresses the need for centralized coordination of research computing. And finally one section addresses the need to enable student-owned mobile computing devices to interface well with the enterprise wide technology services on campus.

Still other sections of this chapter are squarely in the innovation camp. They reflect a need to support and encourage innovations in educational technologies. One section promotes the innovative and effective use of technology-enhanced learning spaces. Another section focuses on evaluating new technologies from within the context of effective methods for teaching and learning.

A theme that cuts across all sections of this chapter is the need to have increased faculty participation in decisions about academic technology. A second cross-cutting issue is the early consideration of assistive technology in technology adoption decisions. This approach needs to be better integrated into the campus's IT environment, especially in the case of academic technologies that can enhance or obstruct students' learning.

The campus currently provides basic infrastructure to the vast majority of faculty who wish to use technology in their teaching. From classrooms to basic IT support to the existence of the Distributed Academic Technology Coordinators, the campus does a good job of meeting most of the needs of the "average" faculty user. At the same time, it has not created a systematic method of learning from innovative users of technology and then distilling from their experience how the broader campus community might benefit from their experience.

Academic technology innovation needs to be both understood and managed at CU-Boulder. Were resources much more broadly available, the campus could innovate

purely with creative uses of technologies, but that is too costly of an approach. A more affordable and sustainable approach would be to innovate on pedagogical methods, first, and then identifying appropriate and (sometimes) innovative uses of technologies that enable or enhance the innovative pedagogical methods.

Concurrently, there is a need to investigate these new technologies systematically, and to disseminate the results of that investigation so that standardized and robust support for technologies used in innovative teaching and learning methods can be developed for the entire campus. Likewise, there is a need to move some existing technologies (such as clickers and learning management systems) to a more robust, supportable state to encourage widespread and cost-effective adoption.

1.1 Classroom Technology

Major Issue: CU-Boulder needs to evolve its model of a smart classroom to support:

- (a) an increasingly complex and variable technology environment,**
- (b) multiple levels of user sophistication with technology, and**
- (c) multiple pedagogical approaches,**

or risk

- (a) negatively impacting innovations in campus use of educational technology,**
- (b) decreasing interoperability of the campus educational technology environment, and**
- (c) general obsolescence of the “smart classroom” model (and, consequently, [d] risking considerable capital investment).**

A. Background/Rationale

Instructors expect technology in their classrooms. Despite the increasing appearance of online and blended instructional delivery options, traditional classrooms will remain the primary educational space on the CU-Boulder campus for the next 5 years. Further, given the high penetration of personal laptops and presentation software, it is likely that an increasing number of instructors will expect to have the capability of using technology in their classroom teaching. In other words, the use of technology for classroom teaching, per se, will cease to be an innovation in itself.

The “smart classroom” model¹ is CU-Boulder’s central method of supporting technology for classroom teaching. An excellent investment, the Smart classroom is now central to campus IT infrastructure. The best evidence of its effectiveness is that the demand by instructors for Smart classrooms continues to increase, despite a build-out to 63% of all centrally-scheduled classrooms: smart classroom functionality is now a standard expectation of instructors on our campus. At this point, the majority of faculty who request a Smart classroom are scheduled in one. However, most classes are accommodated in a technology-enhanced facility, this accommodation often requires a compromise in the class meeting time or the location. Increasing the number of technology-enhanced facilities would alleviate these constraints, particularly for the most popular class times. The campus should pursue steps to protect, strengthen, and evolve the Smart classroom model so that it continues to be highly effective and responsive to instructional needs.

The effectiveness of CU-Boulder’s model of a “Smart classroom” as a standard suite of tools is achieved primarily when 3 conditions are present.

¹ Smart facilities include: Projection system – projector, or LCD panel, with security mount controller for interfaces, remote monitoring system for proactive support, network/ethernet connectivity, projection screen bank lighting controls, and multi-standard DVD/VCR Ceiling speaker systems. (Large rooms contain Closed Caption decoders and Assistive Tech Listening Device Microphones/sound reinforcement.) Many rooms also include: overhead projector, cable TV, and slide projectors.

1. The Smart classroom model is most effective when there are enough tools that packaging them together is cost-effective.
2. The model is most effective when personal technologies (laptops, PDA's, cell phones) are not common in the classroom and technologies are either solely in the hands of the instructor, or are provided by the campus (e.g., when technology-intensive assignments and activities are completed primarily in computer labs rather than in classrooms).
3. In its current configuration, the Smart classroom is most effective when technology uses are extensions or variations of a "presentational" pedagogy, which emphasizes central display of content (e.g., video, overhead transparencies, PowerPoint slides, other blackboard replacements).

The conditions that make Smart classrooms effective are changing. In the past 5 years, the user base for classroom technology has changed considerably. Each of the conditions that make the Smart classroom so effective are now undergoing rapid change and need to be re-considered as the Smart classroom evolves.

1. The technology environment is increasingly complex and variable. There are simply a far greater number of tools and devices available for educational use. It is time to re-examine whether the suite of technologies that met classroom needs 5 years ago best meet the needs of today's classrooms. Indeed, students and instructors now possess so many portable personal technologies that the Smart classroom is as much about providing an *interface* with campus infrastructure as it is about providing the technology itself. For example, to what extent should the Smart classroom support the use of different kinds of devices that are provided by individual users? As another example, to what extent do the functions of the current set of tools need to evolve, such as ensuring wireless connectivity, or wireless projectors capable of receiving input from multiple digital devices.
2. Users vary in their sophistication with technology. Five years ago, the user base was very flat, with a large number of highly inexperienced users and a very small number of highly experienced users. The shape of the user base is now more like a pyramid, with a base of inexperienced users but a larger group of somewhat experienced users and a smaller but still sizable group of highly experienced users (many of whom are the students themselves).

As the use base changes, the campus should consider the following questions:

- a. To what extent should the campus support innovative uses of technology for teaching and learning in the classroom? In this new environment, innovation is highly likely. "Innovation" here is from the point of view of the instructor *and* the student. Instructors' use of the technology increasingly will be driven by instructional goals, rather than by basic technological affordances. They may be less likely to use presentational or lecture-based pedagogy and they will want their technology to support other approaches.
- b. To what extent should the campus support or constrain student use of technology in the classroom? Student uses of the technology increasingly will more likely be driven by their learning needs (or, in a negative view, their desire to accomplish other personal goals during class time). In other words, we are now seeing a context in which substantial innovation is not necessarily predictable, and, in some cases, not necessarily desirable. For example, technology may make students able to engage in activities not related to the classroom (such as text

messaging, web browsing, game playing) or that are academic violations (such as taking digital photos of tests).

3. Users expect technology to support multiple pedagogical approaches. Instructors are recognizing that lectures are not the only type of pedagogy enriched by technology, and the Smart classroom model could be examined for how well it supports different modes of teaching. Discussion, small group interaction, and in-class activities are other pedagogies that can be supported. This has implications for the *physical* elements of the Smart classroom model, such as desktop size (sufficient space for a laptop?), movable desks, or electrical outlets. It also has implications for equipment elements, such as whether to include printers, wireless access points, or wireless-enabled projectors.

B. Accomplishments to date – (These items respond to the specific items proposed in ITSP2002)

1. *Improved Access to Technology-Enhanced Instructional Facilities*
The last ITSP called for improvements in scheduling process effectiveness. A review was conducted in 2003, which resulted in the introduction of a new form for requesting a Smart classroom. This form allows Academic Scheduling to capture more complete information regarding technology needs and improves their ability to make optimal room assignments. Information about the scheduling process and use of this form are communicated through training sessions and is available on the web. At this point, the process appears to be well-understood and effective as evidenced by the high success rate in granting faculty requests for Smart classrooms. Remaining problems appear to be a function of demand for rooms outpacing supply.
2. *Improved User Support of Technology-Enhanced Instructional Facilities*
ITS began working with schools and colleges prior to the 2002 IT strategic plan to determine the most effective model for providing support for technology-enhanced instructional facilities. The Educational Technology Facilities Support (ETFS) function was launched in the fall of 2002. This ITS program provides both reactive and proactive support the technology installed or delivered to these facilities and to the faculty using them.
3. *Improved Equipment Support in Technology-Enhanced Instructional Facilities*
Significant strides have been made in standardizing the equipment in technology-enhanced instructional facilities and improving the user interface. These improvements make the technology more user-friendly and minimize the occurrence of user errors. The technology itself is also more reliable due to improvements in monitoring and the electronics. Systems are monitored remotely by engineers for problems and serviced proactively to reduce failures at inopportune times. Theft of data projectors has been reduced by employing security mounts and alarms. Losses due to data projector theft were among the highest on campus and are now negligible. Taken together, these changes have reduced the time and resources required to maintain hardware assets, thereby improving the return on investment.
4. *Development of Renewal and Replacement Schedules and Realistic Cost Models.* ITS developed comprehensive renewal and replacement schedules for technology-enhanced instructional facilities and a cost model that recognizes the

true costs associated with providing and maintaining computer labs that are used for teaching. This information drives current funding requests. For example, in spring 2006, an additional \$129,000 was allocated by the campus (Chancellor, Provost) to provide renewal and replacement for the currently installed base of Technology-Enhanced Facilities. Future cost models will include realignment and increase of technical resources in support of Smart technology.

5. *Confirmed High Demand for Technology-Enhanced Instructional Facilities.* To build on the work of the 2002 ITSP, efforts were made to determine the demand for Smart classrooms. Results of that effort reveal sufficient demand to warrant increasing the number of centrally scheduled Smart rooms to 80% of the central pool. This budget request was drafted by ITS, and approved in principle by the Faculty Advisory Committee for IT (FACE-IT) and the Chancellor's office. Funding has not yet been allocated, but this request is considered a top priority for the campus.

6. *Increased the number of Technology-Enhanced Instructional Facilities*

a. *Approval of the use of Student Computer Labs for Instructional Purposes*

The use of student fee-funded computer labs as instructional facilities was approved as a recognized practice, rather than an exception. Guidelines were established in 2003 to formalize this use and to ensure that it is equitable and sustainable. These guidelines limit the number of class meeting times per week in order to preserve student access to these resources. Facilities scheduling is done through ITS, providing oversight to improve compliance with these guidelines.

b. *Addition of buildings with technology-enhanced instructional facilities.*

Three new buildings have been added to the campus: ATLAS, Law, and Business. The principle applied to new construction of central classrooms was 100% Smart technology. This is appropriate due to the nature of the facilities. Overall the addition of the new building rooms (44) along with the original proposal of 80% coverage (136) gives 84% coverage of central rooms. Scheduling issues should decrease as the number of Smart classrooms increases.

C. Specific Recommendations

Generally, future efforts must protect the current investment while ensuring evolution and growth. As strategic planning recommendations, this list is intended as a mandate for tactical planning and implementation. (Items 1 and 2 are of equally high priority. Both should be considered necessary. Items 3 and 4 are ranked in order of funding priority.)

1. *Develop and commit to funding model that will sustain any Smart Classroom build-out.* The campus must make it a priority to protect this investment. This recommendation does not imply privileging the current Smart Classroom model in the build-out, as the model may change as a result of the use study. Timely renewal and replacement of the equipment in technology-enhanced spaces is critical to the success of this strategy. This equipment must be refreshed on a regular basis to ensure that it functions reliably; is supportable and maintainable; remains compatible with other technologies; remains

uniform across sites; and ensures ease-of-use. The model should also provide funds for regular assessment (measurement) of user satisfaction (with both equipment and staff support).

2. *Assess the current “Smart classroom” model, to determine if the model should be revised or adjusted.* The assessment should include systematic review and analysis (preferably a commissioned research study) of **actual classroom use of technology** by instructors and students in **multiple disciplines**, using **multiple pedagogical approaches**. Does a single configuration remain preferable, or should there be multiple configurations? If a single configuration, what should that include? If additional configurations are needed, under what conditions would each be used? The assessment should pay particular attention to any equipment currently used by instructors in an ad hoc manner, such as clickers, document cameras, RF devices, etc. The assessment should specify the decision criteria used to justify changes in configuration (possible examples are ease of use, standardization, reliability, innovation). The assessment should evaluate both positive *and negative* uses of technology in the classroom. The assessment should revisit and reconsider the decision to commit to a single Smart classroom configuration, versus alternatives such as multiple configurations, a “layered” configuration, or an adaptable configuration. Any revised model must have plans for sustainability and scalability.
3. *Develop resources (services, consultation, and guidelines) to advise academic departments that control non-centrally-scheduled technology enhanced facilities. Better leverage the resources of these facilities for improving campus use of educational technology.* Revise current policy and procedures to acknowledge the existence and demand for departmental controlled Smart facilities. Provide resources useful to departments that would help them improve their planning, administration, support, and renewal of these facilities. Establish appropriate guidelines for Facilities Management to follow in creation of these spaces. Establish guidelines establishing what would constitute adequate support and renewal & replacement funding for all Smart facilities built on campus. View department facilities as spaces likely to support distinct instances of instructional innovations (i.e., as innovation incubators), and systematically gather information on such innovations to inform campus IT planning (particularly for those stakeholders seeking to support effective use of educational technology).
4. *Add 30 new Smart classrooms.* Increase the number of existing centrally scheduled spaces to Smart classrooms from 106 (63%) to 136 (80%). Target buildings that have a disproportionately small number of Smart facilities today (e.g. Engineering, Duane, Education, Hale and Hellems). Ensure that 100% of the classrooms and lecture halls in newly constructed or renovated buildings are technology-enhanced to follow current established practice.

D. Resource Allocation (These refer to the estimated cost of the recommendations. They do not imply priority.)

Recommendations 1 & 4: High. There is a considerable cost associated with maintaining Smart classrooms. Costs include hardware replacement and maintenance,

support staff, and engineering functions. Continuing funding for existing Smart facilities exists, and a plan for the increase to 80% has been defined but is not yet funded. Changes to the Smart Classroom model that may result from the use study may necessitate additional ongoing funding (there is a chance the recommendations could reduce cost, but this is less likely). It is critical to note that costs for sustaining technology-enhanced facilities in the new buildings do not have a funding source. Without funding, these investments are at risk.

Recommendations 2 & 3: Low. These are costs of commissioning a study, developing materials and guidelines, and implementing procedures for campus units to follow.

E. Action Plan (short-term: 12 months; long term: 12-36 months)

Short Term:

1. Continue operation of existing Smart classroom R&R procedures (e.g., replace technology in existing spaces that are currently due).
2. Develop cost models, per Recommendation #1. Revise cost estimates to increase the existing number of Smart classrooms to 136, or 80% over the next 5 years, and integrate the newly constructed buildings into this plan. Revise cost estimates for technology renewal and replacement based on the revised number of Smart facilities.
3. Initiate a study to examine classroom use of technology to determine how the current model should evolve. Evaluate recommendations for changing the model.
4. Develop and implement methods to assess effectiveness of staff support of Smart facilities and alert ITS of problems (similar to system developed for continuous monitoring of equipment).
5. Begin to establish appropriate specifications with Facilities Management, and with Departments (when appropriate), to guide the creation of new instructional spaces, including the installation of technology. Finalize plans with Facilities Management to ensure adequate support for any Smart facilities they install for departments.
6. Begin to develop and provide resources for supporting departments with technology-enhanced facilities.
7. Work with Facilities to establish site priorities and develop a maintenance schedule.

Long Term:

8. Continue processes from Short-Term, as relevant or appropriate.
9. Implement changes recommended by study completed above (short term plans, point 3)
10. Secure funding to cover the difference between today's funding and what is needed to sustain a larger number of Smart facilities.
11. Build out 12 additional Smart classrooms per year to reach target of 80% within 5 years (contingent on funding approval). Establish appropriate specifications for the creation of new instructional spaces, including the installation of technology. Standardize support and renewal & replacement funding requirements.

Primary Person Responsible for Action

Bobby Schnabel, Vice Provost for Academic & Campus Technology

Evaluation of Achievement

1. More smart classrooms exist. Those built in 2007+ clearly and sufficiently reflect the revised smart classroom model.
2. Budgets and records of expenses to indicate effectiveness of cost models and sustainability of initiative.
3. Analysis of recorded number of scheduling conflicts, number of times courses could not be accommodated in preferred times, and number of times instructor was denied classroom with appropriate resources
4. Surveys of users in Smart facilities, assessing (a) satisfaction, (b) actual use, and (c) effect on teaching and learning.
5. Surveys of users of Department technology-enhanced facilities, assessing (a) satisfaction with campus support of facility (e.g., Facilities Management, ITS), (b) satisfaction with facility itself.
6. Database (or other easily accessible record) of classroom use of technology. Analysis of how often these records are used, and how well the information integrates into objectives of other ITSP initiatives.

1.2 New Technologies in Support of Learning

Major Issue: CU Boulder should develop a model for identifying, critically evaluating, and strategically supporting emerging web-based learning tools. This model should be adopted by faculty and support personnel as they consider technologies to employ in their teaching, research, and service work. A campus-wide committee should be formed to identify promising educational technologies, assessing their potential for adoption, and communicating their findings to the campus.

A. Background/Rationale

Educational technologies should be evaluated with a critical and creative eye, and they should be adopted if there is a reasonable expectation that they could support the university's core mission of promoting excellence in teaching, research, and service. A glance at *The Chronicle's* Information Technology section will give a reader a sense of how broadly higher education has adopted these technologies. Though many of these technologies are in use on our campus, too many of them do not benefit from a critical analysis of how they could be used to improve learning. Too many of these technologies follow the arc of fads and become hot topics for a brief time only to be discarded soon after.

While some technologies do become fads, there are information technologies that offer promise for adoption. Promising technologies are those that provide simulations of processes or ideas that might otherwise be difficult to envision; those that create collaborative spaces designed to build understanding and knowledge, and facilitate collaborative quantitative reasoning; and those that provide a means of basic productivity in communication and artifact exchange over time and over great distances. Many of these technologies have a presence on the Internet. By definition, then, these technologies often require widely available Internet access, server space, software, and computers at end-user's sites.

While the University has helped students and faculty members gain access to Internet technologies, more work remains. For example, we are currently witnessing a trend toward mobile and miniature computing devices (such as cell phones, blackberry devices, iPods, and very small computers) but it is not clear whether the university is ready to facilitate students and faculty members interacting with these devices.

Rogers (1995) descriptive model that defines five populations of technology adopters/users provides a helpful framework to identify faculty and their technology support needs. Rogers outlines the following spectrum: innovators, early adopters, early majority users, late majority users, and laggards. We are aware of the negative connotations associated with the term, "laggards," but include it as it is used widely in the field.

B. Accomplishments to Date

The campus has made much progress in building the infrastructure to support widespread use of web-based learning tools during classroom-based instruction. With recent funding from the Chancellor's office, 65% of the campus' generally-funded

classrooms will be equipped and renewed every three years with “smart” technology. This technology makes it possible to connect a laptop computer to a projector, and to play VHS-, DVD-, and CD ROM-media. It also allows cable TV to be displayed in the classroom. By the time this report is released, the campus will be well on its way to providing 100 Megabyte per second data connections in classrooms and faculty offices; and wireless network coverage over 80% of the generally-funded buildings. Also, the ATLAS building will be open and serving the general campus population with access to a variety of educational technologies. The ATLAS Center could become the educational technology “hub” of the campus where key organizations dealing with education and technology (Graduate Teacher Program, Faculty Teaching Excellence Program, ITS, and ATLAS) are all in the same space and thus more likely to collaborate.

The Distributed Academic Technology Coordinator (DATC) program is also a key agent of change in the adoption of educational technologies. The DATC program was created as a result of the 1998 IT Strategic Plan. It consists of 8 coordinators, one in each school and college. DATCs work alongside faculty one-on-one to help them learn to integrate technologies into their teaching, research, and creative works. DATCs tend to work with faculty who would be in the early adopter and early majority adopter populations.

The campus has made important strides in the maturity of the four-tier support model. This model now provides a scalable, efficient, and effective method of supporting desktop and laptop computers, classroom and computer lab technologies, and servers. However, more work needs to be done to increase the effectiveness and reach of this model. For example, not all classrooms have smart technology in them and not all classrooms are supported by an education technology facilities support (ETFS) person. A key area for investment in the future is in the enhancement of this support model.

The campus has matured in its support of learning management systems (see section 1.3 of this document). Currently the campus supports WebCT, Campus Edition, as its enterprise Learning Management System. The DATCs and other members of the four-tier support model are all available to assist faculty and students as they use this system to enhance their learning. Shortly after this report is released, the campus will have WebCT Campus Edition 6 available, which has an improved interface and enhanced features in the tools it offers. It is also a robust system that will allow the campus to expand the adoption of an LMS.

Other web-based learning tools are in use on campus today and several seem to hold promise for future adoption. For example faculty members currently create web sites with rich media content such as sound files, images, videos, and VR images. Faculty members also use web-based tools like ArtStor and Luna/Insight to let their students explore images. There is interest among the faculty today in exploring web-based technologies such as wikis, blogs, vlogs, pod casting, and e-portfolios. Some of these technologies are in use on campus already, but they have not yet been adopted in a widespread manner.

C. Specific Recommendations

Become a national leader in the assessment of emerging technology’s ability to shape student learning.

The campus should become a national leader in assessing emerging technologies, and particularly their ability to foster students’ learning. Given the ubiquity with which

information technologies proliferate on campus, and given the rapid change in function and scale of these technologies; the campus should not, over the next four years, set its sights on any particular technology, or even on categories of technologies. It should, however, develop a descriptive model that helps us understand how different populations of technology users could effectively use educational technologies. By using this model when considering technologies to support, the campus will more likely adopt technologies that will be effective in facilitating learning and that can be scaled to support faculty members and students across campus. This model could build upon Rogers' (1995) model for describing various populations of technology adopters, and it would benefit from an assumption that not all technologies will or should be adopted by all people.

Commission a campus-wide learning technology advisory group (a subcommittee of FACE-IT).

A campus-wide group should to be commissioned to build this model. This campus-wide group should consist of representatives from across the campus and it should include students and technology support staff. Such a group should identify emerging, new, and promising educational technologies, define them, identify and assess their potential to enhance student learning, and identify salient aspects of support. This group should also disseminate information about these technologies to IT support and academic units, and make recommendations for how IT staff and campus administrators can encourage faculty members to adopt these technologies. The committee should also make recommendations based on best practices, research, and studies of technology use on this campus. The committee should reach out to other educational technology organizations on campus such as FTEP, GTP, and Disability Services. And, in turn, each academic department should develop mechanisms to ensure communication with the proposed emerging technologies working group.

Address the chasm between early adopters and early majority populations.

It is important for this group to acknowledge that a chasm exists between technology users who would be categorized as early adopters and those characterized in the early majority (Moore, 2002). The current IT support model on campus appears to be focused mainly on the early majority and late majority adopter populations. While this is helpful, it is also important for that support model to also reach out to technology users at both ends of the adopter population distribution to better understand how to support them and the early and late majorities (Rogers, 1995). It is important for the campus to acknowledge the barriers to adoption in its IT support model—including barriers of accessibility to the technology infrastructure as well as resistance to change—that make it difficult for an innovation to be adopted by those in the early and late majorities.

Develop incentives and continue to invest in supports that enable faculty to integrate emerging technology into their teaching, research, and service endeavors.

The campus should **develop incentives** to reward faculty who take a critical, research-based approach to integrating educational technology. It should also **continue to invest** in the Graduate Teacher Program (GTP) to help it prepare graduate students, the next generation of the professoriate, to learn and teach with web-based technologies.

The campus administration should **leverage the Distributed Academic Technology Coordinators (DATCs)** to identify innovators, early-adopters, and those who do not adopt web-based learning tools. The DATCs should share their findings with the IT

support staff, so that the campus can benefit from the experience of people at either end of Rogers' adopter population model (Rogers 1995) and identify possible barriers to their adoption (e.g., issues of access and/or diversity). Because the DATCs are important agents of change, the two Arts and Sciences DATC positions that were lost in 2003 should be restored by the campus. That way each faculty member will have access to a DATC.

In order to **provide a stable environment and infrastructure for using web-based learning tools**, the campus must ensure campus-level funds are committed to make 80% of all classrooms "smart" and to provide 80% wireless coverage by 2008. In addition, the support for desktop computers (Desktop Support), classroom technology (ETFS), and servers (Managed Services) must be increased proportionally. The campus should also leverage the Libraries' ability to manage digital repositories related to some of these web-based tools used by faculty members.

D. Resource Allocation \$150,000

Because ITS has already put forth a request to the Chancellor for funding to increase the number of campus smart classrooms from 65% to 80%, that budget item won't be included in this area. Section 1.2 also addresses learning spaces on campus.

- \$7,500 per year to support the campus-wide committee in its efforts to travel to other campuses and conferences; to purchase hardware, software, and web-hosting services needed to support investigate technologies; and to provide incentives and rewards for faculty who adopt promising technologies.
- \$142,160 to restore two DATC positions to Arts and Sciences. This would be \$112,000 for salaries plus \$30,160 for benefits.

E. Action Plan

Short Term (one to two years):

The emerging technology advisory group should be commissioned and begin meeting January, 2007. The group develops a model and assessment criteria by June 2007.

Long Term (two to four years):

The advisory group develops its first dissemination in the form of a report to the campus by June, 2008. This report should describe how the group has fulfilled its charge. The advisory group should create and disseminate a robust framework for judging the value of educational technology and its impact on the mission of the university.

Support structures for desktop support, ETFS, and server support are adjusted to fit the expansion of smart classrooms and associated technologies on campus.

Training and incentives for faculty to use emerging technologies should be included in the campus' annual budget.

Specific Steps

1. The emerging technologies working group is formed with representation from across the campus. Representatives should be from academic units, IT support, and units interested in educational technologies. This group would be a sub-group of FACE-IT.

2. The group convenes and begins to work on a model for analyzing promising educational technologies, articulating the usefulness of those technologies, and identifying how they could best be supported on campus. Part of this effort involves becoming aware of research in this area.
3. At its outset, the group should consider the following promising technologies, but it should not be bound by this list, and in fact it should try to avoid riding the cycles of technology fads. This list appears to have some promise: for adoption in teaching and learning contexts: wikis, podcasts/vodcasts, 'blogs/'vlogs, virtual meetings, screen casting, grid computing, instant messaging, e-folios, augmented reality, clickers, social bookmarking, technologies that allow for collaborative quantitative reasoning, and technologies that facilitate the use of numerical techniques and modeling.
4. The group defines each of these technologies, posits how they may be useful in facilitating learning, and plans for assessing their use in pilots across campus.
5. The group evaluates the first round of pilots and puts together recommendations for support and for how the technologies could be used by faculty members across campus.
6. The group publishes a report on the first round of its work. This report includes a framework for describing how different faculty members and students on campus could adopt technologies and how those technologies could facilitate learning. The group also submits proposals for conference papers or articles based on their findings.
7. The group shares its findings with educational technology organizations such as ATLAS, ITS, FTEP, GTP, and Disability Services.
8. The group continues another cycle of research, identification of new technologies, analysis of technologies, piloting of technologies, assessment, and dissemination of findings.

Timeline

- 2006—Group is identified and commissioned
- 2007—Group meets and begins to develop a model and assessment criteria
- 2008—Group disseminates the first round of its finding to the campus and through conferences and articles. 2009—Group begins another round of research, identification of technologies, pilot testing of technologies, assessment, and dissemination of findings.

Primary Person Responsible

Bobby Schnabel, Vice Provost for Academic and Campus Technology

Evaluation of Achievement

The campus will know if we have been successful in this area if we see through existing faculty surveys of technology use, and through reports from DATCs, that the faculty are aware of the group's framework, that some faculty have piloted of emerging technologies, and that the potential impact of disseminating those technologies is documented. The campus will also conduct an exit survey of graduating seniors to find out what needs to be changed about educational technology support on campus. The campus will also know it has been successful if the group examines whether currently

supported technologies are facilitating learning. For example, have clickers made a measurable impact on learning?

The work of the group should be grounded in the literature on research on educational technology and it should be informed by best practices in place at our peer institutions and institutions we strive to imitate.

F. Sources

(2002) Moore, Geoffrey, *Crossing the Chasm: Marketing and Selling Disruptive Products to Mainstream Customers*. HarperBusiness, New York, NY.

(1995) Rogers, Everett, *Diffusion of Innovations: Fourth Edition*. The Free Press. New York, NY.

1.2.1 Campus Use of Technology-Enhanced Spaces

Major Issue: CU-Boulder should foster a culture of innovative and effective uses of technology-enhanced learning spaces. To do so, the campus should develop and implement a model of support, training, and shared governance for fostering that culture; leverage the success of and interest of faculty in departments and programs such as Communication, Science Education, and the ATLAS Institute; leverage the skills and networks of ITS' Distributed Academic Technology Coordinators; increase faculty participation in decisions about technology-enhanced learning spaces and faculty training in their use; provide tools to assist faculty in the assessment of their uses of educational technology spaces; and develop a sustainable model for support, renewal, and replacement of those spaces.

A. Background/Rationale

Recent surveys of faculty and instructors at the University of Colorado at Boulder indicate that a majority use in-class technologies:

- Approximately 75% of faculty use in-class technologies to project lecture notes or as a replacement for overheads.
- Approximately 70% use them for “beyond chalk” uses that include projection of websites, images, and simulations.²
- Graduate student teaching assistants use such technologies at only a slightly lower rate than faculty (63% for overhead replacement, 53% for “beyond chalk” uses). These rates are significantly higher than in 2001.³

Current uses, and the concurrent demand for the technology-enhanced spaces that enable them, are expected to expand and increase even further. The campus is responding by increasing the number of centrally-scheduled “smart” classrooms that include a media cabinet, VCR/DVD players, projectors, and Internet connections:

- There are currently 38 such classrooms smaller than 50 seats, with plans to increase to 83 total,
- 23 classrooms with between 50 and 149 seats (with plans to increase to 34 total), and
- 15 classrooms with 150 or more seats (with plans to increase to 19 total).⁴

Even with increased use, with some understanding of types of use across disciplines, and with localized success, innovation, and discussion about the use of technology-enhanced spaces, there is little understanding of how to foster effective use in a systemic and strategic manner. To do so, the campus should:

- Leverage the expertise and enthusiasm of departments and programs, including ITS' Distributed Academic Technology Coordinators, already engaged in innovation in and discussion about educational technologies to gain a better understanding of current and potential uses;

² See <http://www.colorado.edu/vpact/itsp/data/faculty2005.htm> for full report.

³ Fifty-four percent of the faculty respondents to a 2001 survey used computer technology in class lectures and presentations. Of this group,

- 64% used PowerPoint
- 66% displayed web sites
- 19% presented using other software (often course- or discipline-specific)
- 18% projected digital video.

⁴ See Section 1.2 for a fuller discussion of the campus's strategic direction for the number of and technology in these “smart” classrooms.

- Concurrently address several aspects of the use of technology-enhanced spaces: tools, uses (included training and support), and assessment; and
- Increase faculty participation in discussion and shared governance of technology-enhanced spaces.

The following table conceptualizes those aspects and potential methods for seeing change and improvement in the uses of technology-enhanced spaces:

Aspects of Use of Technology-Enhanced Spaces	Methods for Progress
<p><i>“Tools,” including</i></p> <ul style="list-style-type: none"> • hardware • software • furniture configurations 	A new FACE-IT sub-committee to increase shared governance in decisions about spaces
<p><i>“Use” of in-class technologies</i></p> <ul style="list-style-type: none"> • integrating technology, pedagogy, and discipline • considering social and cultural impacts • training and support 	Lecture series Master classes & “open lab” times Leveraged use of DATCs FACE-IT sub-committee or other technology committee
<p><i>“Assessment” of use</i></p> <ul style="list-style-type: none"> • reflection (FRPA) • do-it-yourself outcomes assessment 	FACE-IT sub-committee to consider integration with FRPA Development and dissemination of assessment “toolkits”

B. Accomplishments to Date

The campus is already a leader in the area of use of technology enhanced spaces. It has:

- Longitudinal data about faculty use of in-class technologies;
- A cadre of Distributed Academic Technology Coordinators already supporting faculty use of in-class technologies and engaged in thoughtful exploration of continued innovation and study in this area; and
- Several departments such as the ATLAS Institute, Communication, and Science Education (Physics) actively and explicitly engaged in discussions and pilots that address both innovative uses of in-class technologies as well as disciplinary pedagogical issues.

C. Specific Recommendations

- Establish a sub-committee of FACE-IT to address issues of numbers of technology-enhanced classrooms (see “tools,” above)
- Establish a sub-committee of FACE-IT to integrate personal and outcomes assessment into FRPA (see “use,” above)
- Develop lecture series and master classes to establish and foster community of practice around the use of technology-enhanced spaces
- Develop toolkit for faculty for do-it-yourself outcomes assessment
- Develop strategic communication plan
implement master classes series and/or open-houses to showcase innovative “classes in action”

D. Resource Allocation: \$10,000 (GRA and funding for master classes & lecture series)

- a. Staff in the Office of Academic and Campus Technology will be responsible for establishing FACE-IT sub-committees, working with departments and programs to inventory and communicate efforts, developing a strategic communication plan for technology-enhanced spaces, and establishing lecture series and master classes in the ATLAS Building.
- b. Some funding (\$10,000) will be necessary for the lecture series, master classes (food and modest honorarium only) and assessment toolkits (graduate student research assistant)

E. Action Plan

Short Term (fall semester 2006):

- Commission a new sub-committee of FACE-IT to consider model of shared governance for technology-enhanced spaces.
- Commission a new sub-committee of FACE-IT to consider ways to integrate assessment of educational technology use into FRPA. This sub-committee could be the same as the one investigating shared governance models.
- Pilot lecture series, plan master classes
- Undertake research for development of self-assessment toolkits

Long Term (spring semester 2007):

- Pilot master classes
- Pilot self-assessment toolkits

Primary Person Responsible: Deborah Keyek-Franssen, Office of Academic and Campus Technology

Evaluation of Achievement

- Faculty attendance at lecture series increases over time in number and breadth of disciplines, departments, and programs represented
- Evaluation of lecture series and master classes
- Evaluation of self-assessment toolkits

1.2.2 Clickers in Classrooms

Major Issue: The use of "clickers" (electronic student feedback in lecture) at CU-Boulder is widespread and growing; the use of multiple clicker types and lack of centralized organization and support are leading to a chaotic and costly situation; the campus needs to adopt a single clicker type which is fully supported by ITS.

A. Background/Rationale

The use of electronic student feedback systems in lecture (clickers) began in the Physics and Astronomy Departments in the spring of 2002. Since then, use of this popular teaching tool has grown steadily: currently, at least 5000 students in 50 classes and 8 departments at CU-Boulder use clickers each semester.

Clickers are here to stay. The effectiveness of clickers as a learning tool, especially in large freshmen classes, has been well-established by studies at CU-Boulder and elsewhere. When used properly, clickers provide essential feedback both to the instructor and to the student, and they can transform the student from a passive and anonymous scribe into a visible and actively-engaged learner. The number of faculty wishing to use clickers has increased every semester for the last 4 years.

The use of clickers is currently limited by classroom availability and cost issues. The most-widely used clicker system at CU, made by HITT Inc., requires expensive installation and maintenance, with an initial department investment of about \$15 to \$50 per seat for the room wiring. The HITT system was originally chosen because it was the least expensive *for the student*, with student-purchased clickers costing about \$35 each. At present, individual departments shoulder the cost of installation and maintenance. There is no centralized organization or support. Some departments, such as Music and Humanities, want to use clickers but are currently stopped by the cost.

These cost issues are driving some departments to adopt different clicker types. A new wireless clicker technology, using radio-frequency (RF), has recently been developed, and this new RF technology requires *no* permanent room wiring. The installation costs of the RF system are so low that some departments have already adopted their use. The use of multiple clicker types on campus has led to a chaotic situation that is very costly to students. Currently, some students have to buy 3 different clicker types – an extremely unpopular and potentially explosive state of affairs.

Alternatives to clickers are not attractive as a campus-wide solution. Possible alternatives are web-based feedback systems using existing student-owned hardware, such as cell phones, PDAs, or laptops. A recent study (Lowry, 2005) shows that these systems are significantly more expensive than clickers and are likely to be unworkable due to the diverse nature of student-owned devices.

Clickers are a tool. Like any tool, clickers can be used badly or well, and they certainly require extra work on the part of faculty. The purpose of this document is not to promote or recommend the use of clickers, but rather to recognize and support the already large and growing demand for this technology at CU Boulder.

Our long-term expectation is that clicker use, if properly supported, will greatly expand and eventually will include most students at CU-Boulder. Thus, it is essential that a centralized support and organizational structure be created to assist faculty who wish to use this important technology.

B. Accomplishments to Date

CU-Boulder is among the nation's leaders in the use of this innovative and effective classroom technology. There are only 1 or 2 other campuses *in the world* (U.Mass. Amherst and Purdue) where clickers are more widely used. There is considerable local expertise among the CU faculty in the proper use of this new learning tool. The popularity and visibility among students and faculty of this technology are already well-established. There is no need for consensus building on this issue: there is overwhelming faculty consensus on the need for standardization of and support for clicker use.

The CU faculty who have carefully studied the impact of clicker use include:

- Michele Jackson and April Trees, of the Dept of Communication, used carefully-designed student surveys to assess clicker use in many departments (<http://comm.colorado.edu/mjackson/clickerreport.htm>).
- Douglas Duncan of the Astronomy Dept. wrote an instructor's manual "Clickers in the Classroom", Addison-Wesley(2005).
- Carl Wieman (who has recently started the Science Education Project) and Kathy Perkins, both from Physics, are in the midst of a long-term study of the effect of classroom reform on student attitudes about learning and science.

Specific Recommendation

The campus should standardize to a single clicker type. This standard clicker system will be one of the new RF types, will be fully supported by ITS, and will be made available in all centrally-scheduled smart classrooms on campus. (Other clicker types cannot be forbidden, but they will receive no institutional support.)

The final choice for standard clicker type will be based on

- reliability, ease-of-use, PC & Mac compatibility
- cost to students and to CU
- architectural compatibility with existing campus infrastructure
- congruence with CU Bookstore process, procedures, and policies

C. Resource Allocation

Cost of project: Medium.

- Hardware components: currently, these costs should be relatively low due to aggressive promotional opportunities by the companies supplying the receivers. Although it is unknown what the longer term pricing structure for clicker systems will be, market competition is expected to keep hardware prices low.
- Startup costs: Development for Portal additional \$20k. There are no ongoing operational costs as it would be incorporated into existing services. There are potential redevelopment costs as technology changes.

- Resource allocation: no infrastructure changes will need to be done in the current Smart rooms to accommodate use of the system. In particular, the previously-anticipated need for a second LCD projector is no longer required.
- Support and Training: this cost is the largest factor. There are approximately 136 Smart Classrooms that will use clickers, with the potential for more. Clickers could potentially be used in non Smart Classrooms as well, which would have another set of support concerns.

D. Action Plan

Short Term: Choose a single clicker system.

Long Term: Develop the support and training for faculty to ensure relatively painless clicker use, and the develop the software for centralized registration.

Specific Steps

- A faculty committee will choose the clicker type, based on classroom experience, and in close cooperation with ITS.
- ITS will be commissioned and funded to provide support and repair of the standard clicker system through the Helpdesk, the DATCs, and on-site support.
- ITS will also be commissioned to provide frequent "use of hardware" training sessions for faculty and staff.
- Other units on campus, such as FTEP and the new Science Education Project, will be commissioned to provide regular training sessions in the *pedagogical* use of clickers.
- There should be a single, centralized clicker registration function in CUConnect, with the clicker ID integrated into student identity and available to applications and instructors. This will enormously simplify clicker registration logistics from the faculty standpoint and will likely accelerate adoption. It will also discourage clicker theft and ensure return of lost clickers to their owners.
- Once clickers are standardized, it is likely that they will become so widely-used that virtually all students need them. In that event, there should be universal clicker distribution to all incoming freshmen, with costs covered by a technology fee. This will help contain costs, and ease faculty concerns about the financial-burden to their students.

Timeline

- Fall 2006 and Spring 2007, large-scale classroom testing of candidate clicker types
- Fall 2007, full campus deployment of clicker hardware and support

Primary Person Responsible

ITS Architecture Group for program oversight. Clicker committee for review and consultation.

Evaluation of Achievement

The final measure of success will be whether use of clickers continues to grow among the faculty and whether student response is positive. Clicker-use will expand only if

faculty observe a positive impact in the classroom and only if clickers are easy-to-use and relatively trouble-free.

End-of-semester surveys will be used to monitor student attitudes toward clicker use, while interviews of instructors will assess ease-of-use issues among faculty.

Carl Wieman's Science Education Project is supporting ongoing studies to evaluate the success of clicker use in several science departments.

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1.3 Learning Management Systems

Major Issue: A Learning Management System is an important tool that can leverage information technology to improve the teaching and learning mission of the campus. Therefore, the campus should provide a feature-rich Learning Management System, and support it in a robust way so that it can be used to implement innovative pedagogical methods in an online environment. If the campus does not provide such a system, it will miss an opportunity to improve learning within and beyond the traditional boundaries of the classroom experience.

A. Background/Rationale

Learning Management Systems (LMSes) have been widely accepted by universities and supported at the enterprise level by universities around the world. One rationale for their use is they provide a means of extending occasions for learning into an online space. This opens the possibility for learning to occur at a distance and outside the time normally devoted for classroom interaction. A typical LMS will include web-accessible tools for allowing students and faculty members to exchange artifacts, facilitate interaction, and assess student progress.

There are a variety of commercial LMS options available to universities. Examples include WebCT/Blackboard, eCollege, Desire2Learn, Angel, Elluminate, as well as open source options such as Sakai and Moodle. CU Boulder has a centrally-supported LMS (WebCT) as well as other LMSes hosted by vendors or individual departments. For example, the School of Law uses The West Education Network (TWEN), which is hosted by WestLaw Corporation and integrated with the Lexis-Nexis database; one faculty member in the College of Engineering hosts Moodle, an open-source LMS, on his server; and the Center for Advanced Engineering and Technology Education (CAETE) program has arrangements with eCollege to host some of their courses. The College of Architecture and Planning has a presence on both the CU Boulder and Denver campuses, and so their faculty use both WebCT and BlackBoard. Blackboard has recently acquired WebCT, and they intend to merge both LMSes into a single LMS probably after the period covered by this strategic plan.

B. Accomplishments to date

CU Boulder has had a centrally-supported commercial LMS (WebCT) since the late 1990s. The first LMS was a home-grown suite of web tools for announcements and quizzes called Course Builder. In 1999 WebCT became the centrally-supported system and began with 71 courses. By 2006 it had grown to 772 courses. The campus has examined other LMS systems as well. For example, the campus joined the Sakai community source LMS project and ITS held a pilot of Sakai in the fall of 2005. As a result of that pilot, ITS decided to not adopt Sakai in the near term, but instead to look at Sakai later if it becomes a more mature product.

C. Specific Recommendations

- 1. The campus should select a centrally-supported LMS through an investigative and deliberative process including the input of major stakeholders*

CU-Boulder should commission a group of LMS stakeholders (students, faculty, and IT support staff) to carefully analyze the teaching and learning activities faculty members would like to engage in online, and to examine how well available LMSes can support these activities. This group would be a subgroup of the existing Faculty Advisory Committee to IT (FACE-IT). This group should gather input from representative groups of students, and from various campus governance groups, such as the Boulder Faculty Assembly and the Council of Assistant and Associate Deans. This group would recommend to the campus Chief Information Officer an LMS that meets the needs of constituents surveyed, that is quickly comprehensible and easy to use, and that can be centrally-managed and supported. This LMS should be sufficient to meet the needs of roughly 80% of the classes offered through LMSes on campus. Funds should be budgeted for an enterprise-wide LMS that is robust enough to support this many classes.

Because there are a variety of LMSes available (some of which are customized to specific disciplines) and because there are a variety of requirements for LMSes across campus, it is difficult for the campus to meet the demands of the roughly 20% of remaining courses. For example, in the Law School, Lexis/Nexis so tightly integrates its proprietary database with its TWEN LMS that Law faculty members are convinced that adopting another LMS would be a step backwards for them in usability and effectiveness. Therefore, CU Boulder should devote central resources to support one LMS that is available to everyone, and allow other LMSes to be used so long as they don't compete for central resources.

2. The centrally-supported LMS should be integrated with other enterprise systems and with third-party tools that enhance the LMS.

The LMS should be integrated with other enterprise systems (such as the student information system), Libraries' systems, and other systems that hold digital learning assets. The entire cost of ownership, training, and support of the LMS should be considered in recommending a system to adopt.

Many LMSes provide means for passing information between an LMS and other third-party products such as electronic portfolios, plagiarism checkers, quiz creation tools, and tools for creating simulations. ITS employees and faculty members should watch for the third-party tools that become commercially available and that can "plug into" the LMS. They should then work with faculty members and students who use the LMS to ensure the appropriate third-party tools are considered for adoption and support on campus. The campus should provide resources to purchase, test, and evaluate these tools. This will allow the functions provided by the LMS to be expanded.

3. The centrally-supported LMS should facilitate both the delivery of traditional (SIS-listed) courses as well as non-traditional interactions such as research collaborations, trainings, and non-semester-based classes.

The central LMS should support the delivery of year-long courses as well as semester-based courses. The LMS should have a consistent look and feel across the various types of courses taught on it. The LMS should allow for traditional courses (i.e. those listed in the SIS) but also for less-traditional uses such as non-course instruction and research collaborations. The system should allow for collaborations within the LMS that

are not semester-based. For this non-SIS use, faculty should apply to a review panel of faculty members and IT staff proposing how they would like to use the LMS.

4. Faculty support for the centrally-supported LMS should be improved

ITS should increase its efforts to gather faculty input on the LMS. Communication to faculty about changes in the LMS could be improved. For example, a 'blog might be a useful mechanism. Additionally informational e-mails sent to all instructional faculty members would be a good tool. While one-on-one help for faculty is currently available through the Distributed Academic Technology Coordinators (DATCs), this form of assistance should be expanded and strengthened. DATC support for the Social Sciences and Natural Science divisions of Arts and Sciences should be restored. The DATCs should help faculty learn methods of instructional design, how to teach effectively through the LMS, and on how to manage a class online. Support for the faculty should be managed by keeping in mind that the needs of the faculty vary. Some element of faculty support should include a faculty-helping-faculty and faculty mentoring model like the Faculty Teaching Excellence Program uses. The campus should provide incentives in the form of monetary rewards for faculty members who are using the LMS in innovative ways

Online support materials for the LMS should be improved. Some ideas the committee had were to provide provide support for users on the LMS login page. Also a best-practices web site could be created by the DATCs and faculty members where discipline-based LMS course templates from other institutions and from CU Boulder could be made available. This site could include a series of online courses so that faculty members could review those courses to get ideas for teaching online. This site could also contain tips from the DATCs and faculty on best practices for teaching online. The campus should establish an online forum to allow faculty members to exchange messages and conduct web conferences with one another to facilitate cross-disciplinary interaction.

Training for faculty members could be improved to include a module where experienced faculty members give workshops to other faculty members (especially new faculty members) on how to use the LMS. This would be similar to the model used by the FTEP summer institute.

A campus-wide forum should be established to help faculty members exchange ideas for using the LMS. This would be similar to the Teaching with Technology conference, but focused on the campus level.

5. Student support for the centrally-managed LMS should be improved

Support for students using WebCT should be increased. Online materials should be developed, including a student guide that shows students how to use the LMS.

D. Resource Allocation: Low = \$12,500; High = \$562,500

Low would include first two items. High would include all seven items.

- Funds for testing and evaluating third party tools: \$2,500 per year
- Campus-wide forum for exchanging ideas: \$10,000 per year.
- Monetary rewards for innovative teaching through the LMS: \$10,000 per year

- Funds for faculty-training-faculty in the form of course releases: \$20,000 per year
- Funds for two additional DATC positions (included in the budget of section 1.2)
- Funds for acquiring a new LMS including server, operating system, storage, and personnel to test and integrate it into the campus enterprise support system: \$300,000. This figure is based roughly on the amount spent to adopt WebCT CE 6.
- Ongoing funds for an enterprise-wide LMS license: \$220,000. This would include \$170,000 for the license (for comparison's sake, WebCT would charge \$170,000 for a license for their enterprise LMS). This would also include funds for an add-on electronic portfolio (\$50,000). For comparison, WebCT currently charges \$51,000 for their add-on electronic portfolio. An electronic portfolio is a mode of allowing students and faculty members to keep track of their work across their time at CU Boulder. It allows them to provide self-reflective descriptions of their work, peer reviews of their work, and instructor reviews.

E. Action Plan

Short Term: The campus commissions a committee to investigate a centrally-managed LMS. The LMS is integrated closely with other campus systems. Support for Non-SIS use of the LMS is created. Faculty support is improved.

Long Term: The LMS is integrated with the four-campus SIS. Adoption of the LMS is widespread among faculty and is used in a variety of ways to improve learning. This includes using the LMS to facilitate online interactions among research groups and other learning communities.

Specific Steps

1. The campus commissions a committee (possibly a subgroup of FACE-IT) to investigate and deliberate on a centrally-managed LMS. The committee reviews the field of LMSes available and gathers user requirements.
2. A faculty communication plan for the centrally-managed LMS is created and implemented.
3. Faculty support is improved through
 - Communication technologies like an LMS 'blog
 - Best practices data from peer institutions
 - An increase in peer-to-peer faculty mentoring and teaching
 - Online support improved including documentation and an online forum for exchanging ideas.
4. Student documentation for the centrally-managed LMS is improved.
5. Non-SIS courses are hosted on the centrally-managed LMS. This includes courses that aren't bound to a traditional semester, courses that are taught for no credit, and research collaborations.
6. The campus restores two DATC positions to support the Social Sciences and Natural Sciences divisions of Arts and Sciences
7. The committee recommends to the CIO an LMS to be centrally-supported by the chancellor's office. Funds are set aside to license and run the LMS.
8. Funds are set aside to evaluate third-party tools. The most promising tools are selected by DATCs and faculty, and are made available to individual faculty members to use with the centrally-managed LMS

9. An annual campus-wide faculty forum is established like the Teaching with Technology conference.
10. The centrally-managed LMS becomes integrated with Libraries' and digital asset management systems. The LMS also continues to be integrated with SIS, except for the non-SIS uses of the LMS.

Timeline

- AY 2006-2007: Steps 1 and 2
- AY 2007-2008: Steps 3, 4, 5, 6, and 7
- AY 2008-2009: Steps 8, 9, and 10
- AY 2009-2010: Evaluation of steps 1 to 10.

Primary Person Responsible

Bobby Schnabel, Vice Provost for Academic & Campus Technology

Evaluation of Achievement

We will know we have been successful if in four years:

- Faculty members report that they have a centrally-managed LMS that meets their needs and that they had a say in selecting it.
- Faculty members are able to quickly locate online materials telling them about best practices for teaching online and providing them with online templates and course examples.
- The centrally-supported LMS is integrated with other enterprise systems and it allows plug-ins from third parties.
- There is an increase in non-SIS use of the centrally-supported LMS.
- Two additional DATCs are in place; one to support the Social Sciences division, and one to support the Natural Sciences division of Arts and Sciences.
- An annual faculty forum for exchanging best practices has been implemented.
- We are able to demonstrate an improvement in students' learning experiences online.

These elements could be measured through faculty surveys, verifications of the above items, and through incorporating an assessment mechanism in some courses taught online.

1.4 Research Computing

Major Issue: CU-Boulder should facilitate local research computing in research institutes and academic research departments; investigate and provide collaborative initiatives where appropriate; minimize the effort needed to discover and implement operational solutions; and improve communications with researchers to increase awareness of the potential research opportunities of using National Lambda Rail and I2 network capabilities.

A. Background/Rationale

CU-Boulder features world-renowned research departments and institutes, many of which rely on high performance computing for intensive data analysis and simulations. Several units and individual researchers rely on access to national supercomputing sites; others have built clusters of processors to meet their high performance computing needs. Currently, there are no communication channels between the Office of the CIO/ITS and directors, chairs, IT system administrators, or individual researchers about the opportunities afforded by initiatives such as the National Lambda Rail or I2, or about the operational solutions that could be realized by collaborative partnerships between campus units with similar computing needs. In addition, a lack of coordinate between IT system administrators in research departments and institutes means that IT support staff often implement multiple instances of local solutions to common problems, unnecessarily “reinventing the wheel.”

B. Accomplishments to Date

Establishing a culture of collaboration around the issues of high performance computing has already begun through the establishment of regular meetings between ITS directors and the IT system administrators and directors in research institutes and departments.

C. Specific Recommendations

- Support and facilitate research computing that is locally-supported in institutes and academic research departments, in part through the creation of a forum for research computing that includes department chairs, institute and research group directors.
- Provide opportunities for collaborative solutions for high performance computing needs to maximize the effectiveness of solutions for multiple departments and minimize duplication of efforts across campus.
- Leverage the knowledge and connections of the Office of the CIO and the Vice Chancellor for Research to investigate opportunities for collaborative research computing across departments, programs, and institutes.
- Establish a culture of collaboration between ITS and multiple partners, as well as process and support structures, to minimize the effort needed by any one department to implement operational solutions by increasing awareness of and replication of existing solutions on campus or elsewhere, and to influence the direction and effectiveness of department or institute IT architecture and security.
- Research and investigate the potential of developing a pilot for a High-Throughput Computing (HTC) facility, possibly based upon the Condor Project model (see <http://www.cs.wisc.edu/condor/> for more details).
- Research and investigate the possibility of developing an institutional resource for high-volume research data storage and access.

D. Resource Allocation: \$50,000

.5 FTE for additional ITS staff to develop a pilot service based upon HTC architecture in collaboration with a small number of researchers from academic units. Goals of the pilot are to understand the value of developing a HTC facility by prototyping a model service that could potentially be scaled to meet broader campus academic research demands. Ideally the campus would commit to a two year pilot to allow adequate time for a solid assessment of the service.

E. Action Plan

Short Term (one to two years):

- Continue discussions between ITS and institute and research department IT staff.
- Develop and implement strategic communication plan for raising awareness of directors, chairs, IT staff, and researchers and encouraging campus collaborations in the area of high performance research computing.
- Conduct research about campus and other solutions, local and national opportunities.
- Prototype a HTC resource, possibly based upon the Condor project model. This includes development of the resource as well as assessing the research potential of such a resource with an academic research partner, such as Chemistry or Physics.

Primary Person Responsible

Bobby Schnabel, Vice Provost for Academic and Campus Technology

Evaluation of Achievement

- Surveys of directors, chairs, IT staff, and researchers of institutes and departments to show increased awareness of campus and other operational solutions for research computing needs, of opportunities for collaborative solutions on campus, of local and national research computing resources.
- Tracking of research computing collaborations to show an increase in number per year and in total over the next four years.

1.5 Digital Asset Management Systems and Institutional Repositories

Major Issues: CU-Boulder should develop a model and process for the acquisition, storage, access, and management of digital assets, including images, audio, video, data, learning objects, and the intellectual output of the CU community; the campus should continue with its current digital asset management systems (DAMS), including the campus-wide use and support of the Luna Insight and ARTstor databases; the campus should take steps to create an institutional repository (IR) to store, manage, preserve, and provide access to the intellectual output of the CU community.

A. Overall Background/Rationale

Faculty and students are showing an increased demand for the access to, storage, and management of a wide range of digital assets, including images, audio, video, data, learning objects, and the intellectual output of the CU community. The campus is at risk for replicating the compartmentalization and limited access to existing analog collections as they become digitized, and as new digital assets are created or acquired. CU-Boulder needs to coordinate efforts across asset-type for this and several other reasons: to avoid duplication of efforts by academic departments and other stakeholders; to realize economies of scale with hardware and software acquisition, as well as data entry; to standardize authentication and authorization processes and metadata across different digital asset projects; and to integrate present and future digital asset management systems and collections.

By modeling a portfolio of digital asset projects, the campus will position itself to reduce the compartmentalization of collections, and increase the probability of seamless access to digital assets, be they image, audio, video, or other digital objects. As the campus develops a broad model of digital asset management, it must also foster a broad culture about, and an awareness of, the existence and effective use of institutional repositories and their digital objects, and to recognize and anticipate pedagogical uses that would access multiple resources.

A holistic view of a range digital asset projects will allow multiple stakeholders to view how individual collections relate to one another across several spectra, including:

- The need for digital rights management (restricted and copyrighted assets versus open and/or campus-owned);
- The site of creation (outside the University versus inside);
- The process for cataloguing and display (by collection managers versus collaboratively by users throughout the CU community).

Developing a holistic model also will enable the campus to work toward an end-user experience that is seamless, even if the assets are stored and managed in a distributed manner across campus.

Two digital asset projects on campus, of two distinct types and described in separate sections below, are either underway or have enough momentum to begin. DAMS and IRs are similar in that they are both software platforms that provide a means to access, manage, and store a variety of digital media and data files. The primary difference between DAMS and IRs is that digital asset management systems are intended to

manage assets **owned** by the university that are generally purchased or acquired from sources **outside** of the university, whereas institutional repositories are a **set of services** that manage the acquisition and access to the intellectual output (i.e., research papers, theses, dissertations, etc.) created by members **inside** the university. While DAMS can contain digital assets that may also reside in an IR, an IR would never contain assets that were purchased or created outside of the home institution. Another significant difference is that DAMS are generally dependent on professional staff to acquire, catalog, and enter the digital assets into the system, whereas the digital content contained in institutional repositories is directly input by the content's creator, generally a faculty member or student. The majority of DAMS include a suite of presentation tools for use in classroom instruction (which function similar to PowerPoint), while most IRs do not include classroom presentation tools. It should be noted that, at this time, no single software platform has emerged that will accommodate all of the services and functionality requirements of both digital asset management and institutional repository projects.

As these two projects continue, representatives from each, along with faculty and with staff from ITS and the CIO's office will begin development of a broader model for implementation of future projects that will leverage the successes of the two underway.

B. Accomplishments to date

Significant work has been completed on the campus's digital asset management project; the institutional repository project is poised to begin.

C. Specific Recommendation

In addition to continuing (DAMS) and beginning (IR) current projects, the campus will develop a holistic model for implementing and integrating future digital asset and repository projects.

D. Resource Allocation

Cost of the project: little or no impact for development of model; costs for DAMS and IR included in their respective sections below.

E. Action Plan

Short Term: Develop and create model; secure stakeholder buy-in

Long Term: Monitor effectiveness of new model

Specific Steps:

- Establish working group with representation from current DAMS and IR projects, ITS, and the Vice Provost for Academic & Campus Technology Office
- Conduct focus groups to determine current and potential need for digital collections
- Research peer institutions to determine if effective practices for integrating wide varieties of digital and institutional assets exist
- Develop model

Timeline:

- Fall 2006: establish working group, peer institution research
- Spring 2007: focus groups
- Summer 2007: develop model

Primary Persons Responsible:

Bobby Schnabel, Vice Provost for Academic & Campus Technology

Evaluation of Achievement:

Review of model during the Fall of 2007 conducted by DAM and IR project leads and FACE-IT.

1.5.1 Digital Repositories: Digital Asset Management Systems (DAMS)

Major Issues: As implementations of multiple digital collections in Luna Insight software proceed at CU-Boulder, several related projects are underway. These include establishing the means of authentication and authorization for controlled access to collections; the formulation of standards for digitization, metadata, and preservation; and the creation of the University of Colorado Digital Library web site. Future issues include examining the culture and costs of long-term technical support for digital archives; identifying digital collections across the university, as well as their IT infrastructure and support needs; and determining the feasibility of federated searches across collections in different software platforms.

A. Background/Rationale

Prior to 2004, multiple digital collection silos had been created in CU colleges, departments, museums, and libraries, utilizing different databases that did not interoperate nor provide the ability to perform cross-collection searches. To address the problem, the Boulder campus took the lead in establishing a CU system-wide Digital Asset Management committee in May 2004.

With a focus on digital images, the committee investigated digital content. To address the immediate need for a critical mass of copyright-compliant digital images, the committee recommended system-wide subscriptions to ARTstor, an online database containing nearly 500,000 digital images of art, architecture, and other visual and material culture of interest to a broad range of disciplines in the humanities and social sciences. Because no single resource, including ARTstor, can meet all of the digital content needs required for teaching and scholarship, the committee recommended Luna Insight as the common software platform that units may purchase as they are ready to create, migrate, or publish the local digital collections (image, audio, video) that meet their missions and curricular needs.

Because CU's departments, libraries, and museums have differing missions, budgets, workflows, and IT support models, a single, centralized software implementation was not suitable to meet the unique needs of each of these units in a timely fashion. The committee selected Luna Insight in part for its flexible architecture that allows distributed

server implementations while simultaneously providing cross-collection search capabilities. This preserves autonomy among units, but the end-user experiences a single search interface.

B. Accomplishments to date

In October 2005, the President's Initiative Fund provided the archive capital fee for ARTstor at each CU campus. The libraries pay the annual access fees. The ARTstor rollout occurred in the spring 2006 semester, with publicity, library instruction, and departmental training workshops happening on all three campuses.

Two implementations of Luna Insight entered beta phase in February 2006. One resides in the UCB University Libraries, administered by their systems department. The other is a collaboration of three academic units on the Boulder and Denver campuses, with the shared server administered by the Managed Services and Consulting group of the Boulder ITS department. Digital Asset Management subcommittees are creating a University of Colorado Digital Library web site containing links to collections in Luna Insight, guidelines for creating digital collections, and links to ARTstor and other system-wide digital resources.

C. Specific Recommendation

The Digital Asset Management Committee will continue its work in the current implementations of Luna Insight and the creation of the University of Colorado Digital Library web site. Existing or new task groups should be assigned to address the issues of authentication and authorization; the culture, critical issues, and costs of long-term technical support and archival storage for academic units; identifying current and future digital collections across the university, as well as their IT infrastructure and support needs; and the possibility and feasibility for future federated searches across software platforms.

D. Resource Allocation

Cost of the project: there is little or no impact in the investigation stages. Departments and libraries currently shoulder the costs of Luna Insight and other software implementations and associated hardware expenses. Costs and responsibility for long-term archival storage of data from grant-funded projects are undetermined.

E. Action Plan

Short Term: Completion of current projects of the Digital Asset Management subcommittees, as listed in numbers 1 and 2 in the "Specific Steps" section below.

Long Term: Investigations by existing or new task groups of projects listed in numbers 3 through 6 in the "Specific Steps" section below.

Specific Steps:

1) Complete the current projects of the Digital Asset Management subcommittees that are assigned to address components of the CU Digital Library and its web site, including

- digitization and metadata standards, copyright guidelines, preservation best practices, and information about how to create collections in Luna Insight;
- 2) Determine and implement methods of authentication and authorization to control access to current and future digital collections, with system-wide coordination for digital resources that span all campuses;
 - 3) Examine the culture and costs of long term technical support as technology evolves and new systems are adopted, which includes identifying the unit(s) that will take charge of issues surrounding sustainability, migration, and the long-term storage of digital archives;
 - 4) Through focus groups and surveys, identify existing and potential digital collections across the university as well as their IT infrastructure and support needs;
 - 5) Assess the growing need for federated searches across a variety of software platforms, such as digital asset management systems and institutional repositories, and develop a strategy for future adoption.

Timeline:

Summer 2006

- Design and completion of University of Colorado Digital Library web site
- Methods of authentication and authorization for Luna Insight collections established and operational

Fall 2006

- University of Colorado Digital Library web site launched
- Rollout of current digital collections in Luna Insight; includes publicity, training, and instruction

Spring 2007

- Digitization and metadata standards completed

Spring 2007 to Fall 2009

- Identify the culture, critical issues, and costs of long-term technical support of digital archives
- Surveys and focus groups identify existing and potential digital collections appropriate for Luna Insight software, and the software needs of specialized collections requiring unique functionality
- Study feasibility of federated searches

Primary Person Responsible:

For libraries: James F. Williams, II, Dean of University Libraries

For academic units: Bobby Schnabel, Vice Provost for Academic and Campus Technology

Evaluation of Achievement:

The first part of the Digital Asset Management project will be successful if all items listed in 1 and 2 of the “Specific Steps” section are completed by May 2007. These include the launch of the University of Colorado Digital Library, with authentication and authorization methods in place for Luna Insight collections. Evaluation of the achievement of the remaining tasks listed in items 3 through 6 in the “Specific Steps” section will occur in the 2010 IT Strategic Plan.

1.5.2 Digital Repositories: Institutional Repositories (IR)

Major Issue: CU-Boulder needs to create an institutional repository (IR) to store, manage, preserve, and provide access to the intellectual output of the CU community.

A. Background/Rationale:

Escalating journal subscription costs, the slow dissemination of print-based research, and the pressing need for preservation of born digital research are all contributing to a crisis in scholarly communication. Universities around the country are responding to this crisis by creating institutional repositories, digital archives of the intellectual output (e.g. peer-reviewed articles, conference proceedings, data sets, research papers, electronic theses and dissertations) of an academic institution. In "Institutional Repositories: Essential Infrastructure for Scholarship in the Digital Age" (<http://www.arl.org/newsltr/226/ir.html>), Clifford Lynch describes the role of an IR:

"... [A] university-based institutional repository is a set of services that a university offers to the members of its community for the management and dissemination of digital materials created by the institution and its community members. It is most essentially an organizational commitment to the stewardship of these digital materials, including long-term preservation where appropriate, as well as organization and access or distribution. ... [A] mature and fully realized institutional repository will contain the intellectual works of faculty and students--both research and teaching materials--and also documentation of the activities of the institution itself in the form of records of events and performance and of the ongoing intellectual life of the institution. It will also house experimental and observational data captured by members of the institution that support their scholarly activities."

Institutional repositories benefit the academic community by providing broader access to research in a timely manner, raising scholars' visibility, and showcasing an institution's intellectual assets. IRs also serve a critical preservation function: safeguarding an institution's digital research output, including ancillary materials such as data sets.

Establishing an institutional repository requires a new paradigm. Traditionally, professional advancement is tied to publishing models in which authors relinquish copyrights. The academic community must advocate for the right to self-archive, encourage publishers to support open access initiatives (<http://www.soros.org/openaccess/read.shtml>), and consider alternate publication models when evaluating scholarly merit. At the local level, the university must establish the services, policies and architecture necessary to support self-archiving of research materials. Advocating for new publishing models and establishing the needed infrastructure will require the support and participation of the teaching faculty, librarians, and administrators.

B. Accomplishments to date

Building on its traditional role as the repository for print scholarship, University Libraries has taken the lead in laying the foundation for an institutional repository. The Dean of University Libraries is working with the Boulder Faculty Assembly to pass an Open Access Resolution which explicitly recommends the establishment of an institutional repository called CU Scholarship.

University Libraries is also working with other members of the Colorado Alliance of Research Libraries to evaluate IR software and investigate infrastructure issues. The Alliance's implementation team is close to completing a document with recommended directions and specific technical solutions.

C. Specific Recommendation

The campus will establish an institutional repository—CU Scholarship—to manage, provide access, and preserve the university's scholarly output. In partnership with the faculty, ITS, and administration, University Libraries will take the lead role in providing the necessary services and managing CU Scholarship.

D. Resource Allocation

Discussions about resource allocation and funding models are in the initial stages. However, the Alliance IR study suggests a medium impact (*20k-80k, as defined in the ITS-SP template*) on resource allocation. The business model will require start-up funds and on-going maintenance costs, no matter which platform is selected.

E. Action Plan

Short Term: Implement an institutional repository at the University of Colorado, Boulder.
 Long Term: Promote scholarly contributions to the IR; Assess the effectiveness of the IR's services, architecture, and policies, as well as its overall impact.

Specific Steps

- University Libraries is currently:
 - Investigating IR software and developing an implementation plan
 - Identifying needs for supporting architecture
- Establish a committee to:
 - Develop policies regarding the submission, management, and preservation of IR content
 - Work with faculty to raise awareness, address potential concerns, identify IR content, and establish simple and effective models for contributing scholarly materials to the IR

Timeline:

- 2007 Propose IR model to campus
- 2007-2008 Implement IR

Primary Person Responsible

James Williams, Dean of University Libraries

Evaluation of Achievement

Perform an assessment in 2009 to determine the effectiveness of CU Scholarship's services, architecture, and policies, as well as its overall impact.

1.6 Student Mobile Computing

Major Issue: CU-Boulder needs to determine if a student laptop requirement or recommendation will enhance learning opportunities inside and outside of the classroom, and will be in the best interest of students; the campus must also determine what impact such a requirement or recommendation would have on teaching, faculty and student support, classroom facilities, and policy.

A. Background/Rationale

Upon the recommendation of the 1998 IT Strategic Plan, CU-Boulder commissioned a group of students, faculty, and staff to determine if the campus should have a computer ownership requirement or recommendation or neither for students. That group determined that it was in the best interest of students and the campus to strongly recommend that students bring a personal computer to campus with them, if this is financially feasible. At that time, student computer ownership was approximately 75%. Students could and still can increase the amount of their financial aid packages (primarily through loans) to cover the cost of a computer.

Beginning in 1997, the annual Resident Hall Advisor Survey has included questions about student computer ownership and use of campus computing and networking resources. Respondents to the survey are primarily freshmen. Longitudinal analysis of these and other student survey data shows a significant change in computer ownership over the past several years. Overall ownership rate has held steady at around 95-98%, while the percentage of students who own laptop computers has steadily increased to its current level of 75%. Few students, however, bring their laptops with them to class.

With laptop ownership already high, and with financial constraints restricting the funds that the campus could invest in laptop carts for in-class use, it is time for the campus to decide whether to leverage student computer ownership through a laptop requirement or recommendation.

B. Accomplishments to Date

In early summer 2006, orientation directors (primarily juniors and seniors) met to discuss the possibility of a laptop recommendation or requirement or neither for students. The group was decidedly against a requirement, because of the additional burden that could place on low-income students, but reached no firm conclusions about the benefits or disadvantages of a laptop recommendation.

ITS publishes a set of computer purchase recommendations for students, which could be used as purchase guidelines in the case of a laptop requirement or recommendation (see <http://www.colorado.edu/its/recommendations/machinesr.html>).

C. Specific Recommendations

- Establish a working group of students, faculty, and staff to determine if the campus should institute a laptop requirement or recommendation or neither; background research should include an evaluation of the benefits and disadvantages of laptops and other wireless mobile devices with respect to teaching and learning.

- Work with FACE-IT (and Legal Counsel, if necessary) to develop and communicate necessary policies or guidelines for students and faculty, including those to provide guidance about requiring laptops or restricting their use in classrooms, either with a requirement or recommendation in place, or in their absence (in the instance of locally requiring or restricting laptop use in classrooms).
- Work with ITS to determine impact of any requirement or recommendation on facilities and support.
- Track student computer ownership, as well as use of laptops in teaching and learning (both formal and informal learning, working with Directors in Student Affairs for evaluation of laptop use in informal learning).

D. Resource Allocation: none

CIO staff will conduct research and manage the process associated with determining if the campus should have a student laptop requirement or recommendation or neither and with communicating decisions to appropriate student, faculty, staff, and parent audiences.

E. Action Plan

Short Term (fall semester 2006):

- Commission working group of students (including UCSU and RHA representatives), faculty, and staff (including ITS and Student Affairs representatives)
- Undertake background research for working group
- Determine and communicate working group decisions to students, faculty, and governance groups

Long Term (spring semester 2007):

- Work with Admissions and Housing to communicate decision to incoming freshmen
- Work with faculty group and possibly Legal Counsel to determine and implement policy or guidelines (as appropriate)
- Work with ITS to determine and prepare for impact of decision on technology-enhanced facilities and centrally-provided support

Primary Person Responsible

Marin Stanek, Office of the CIO

Evaluation of Achievement

- Initial evaluation of the benefits and disadvantages of laptop and other wireless mobile computing devices with respect to teaching and learning prior to making any recommendations.
- Continued tracking of student computer ownership to determine impact of any recommendation or requirement on ownership rates
- Implementation of additional surveys of students and faculty to gauge use and effectiveness of laptops in teaching and formal learning. Any evaluation of laptop use should be part of a broader effort to evaluate technology use in learning and teaching overall (see section 1.6).

1.7 Assistive Technology

Major Issue: CU-Boulder should ensure the accessibility of all computer-based information technology and electronic information resources on campus through the integration of accessible computer stations into campus computing labs; the continued maintenance of current “satellite” stations; improved communication, procurement, training, and collaboration about accessibility issues.

A. Background/Rationale

Assistive technologies effectively lower barriers for students with disabilities and make campus resources accessible to them. Although CU-Boulder strives to meet the requirements of Section 508 of the Rehabilitation Act, which requires all federal agencies to make their information technologies accessible to people with disabilities, the campus lacks both a champion and a culture that would move the campus toward the full accessibility of technology and information resources. Instead, attempts to ensure accessibility are often characterized by adversarial relationships, rather than cooperative, leaving little energy and resources to influence vendors directly or through consortia.

Currently, students with disabilities have access to a few computing stations in the Assistive Technology lab and a few “satellite stations” in computer labs around campus that are equipped with the text enlargement, scanning, and screen reading capabilities and headphones needed for students with visual, physical, or learning disabilities. There is no formal process in place to guide procurement of new information technology applications to ensure that they are accessible, and little communication about availability or need for accessible technologies at the departmental level or in classrooms.

B. Accomplishments to Date

The campus continues to provide a base-level of assistive technologies in the Assistive Technology (AT) lab and at three sites around campus. A fourth site will be in the ATLAS Building, scheduled to open fall 2006 and a fifth station is being discussed for the new Wolf Law Building. The AT Lab is operated and staffed by Disability Services. Assistive technology satellite stations are jointly run by Disability Services and ITS, with improved communications between the two units over the past four years. The AT Lab continues to offer guest lectures and workshops on Web accessibility to classes on campus, when requested, particularly the Web design class at the business school. Brown bag seminars on “Making Web Pages Accessible,” have been discontinued because of lost staffing and increased workload at the AT Lab. However, the annual “Accessing Higher Ground,” a national conference hosted by CU-Boulder, affords campus IT professionals and web developers workshops for learning about assistive technologies and making information resources and web pages accessible to people with disabilities.

The campus’s Web Publishing Policy specifies that “all electronic publications, to the extent feasible, must be made accessible to people with disabilities,” yet this policy is not widely known or communicated on campus.

C. Specific Recommendations

- Integrate assistive technology and physically accessible computer stations into campus computer labs, while maintaining joint management between ITS and Disability Services.
- Develop a training module for supporting AT on standard and adaptive stations and integrate this training and support for AT into the 4-Tier IT support structure so that the ITS help desk can provide basic support for these applications.
- Continue to maintain existing, higher-end assistive technology stations, while exploring ways to better support the use of personally-owned devices.
- Explore the built-in accessibility tools native to MacOS (as long as headphones are available).
- Exploring possibility of providing laptops with accessibility software to students who need them as a supplement to other accessibility strategies
- Ensure the accessibility of web and IT resources, including
 - E-Reserves
 - WebMail
 - Clickers
 - WebCT and/or other learning management systems
 - Course materials
 - Computer classrooms (especially physical access)
- Establish accessibility standards for computer labs and classrooms. Publish these standards & guidelines on the UCB Web site.
- Work with national groups such as EDUCAUSE and CIO groups to influence vendors to produce high-quality products that are also accessible to people with disabilities.

D. Resource Allocation: \$35,000

.5 FTE for additional Disability Services staff for maintenance of satellite stations, development of strategic communication plan, development and implementation of evaluation plan, and joint development of procurement, testing, and training processes.

E. Action Plan

Short Term (one to two years):

- Identify a champion for assistive and accessible technologies from within the upper levels of the campus administration.
- Develop strategic communication plan to raise awareness of accessibility issues, noting the possibility that new technology adoption can have unintended and negative impacts for students with disabilities.
- Investigate models for integrating assistive technologies into or leveraging existing computer lab load sets.
- Develop evaluation plan to determine effectiveness of implementing recommendations.

Long Term (two to four years):

- Establish strong policy requiring accessibility of all information technologies and resources on campus and/or reasonable, appropriate, and adequate accommodations in cases where accessibility is unattainable.

- Galvanize national group to influence accessibility of information technologies at the vendor level.
- Consider participation in national consortiums, such as those coordinated by UIUC, to improve the accessibility of products such as WebCT. (<http://www.cita.uiuc.edu/collaborate/>).
- Establish a process for procurement, usability/accessibility “testing”, IT professional training (including both concepts and tools).

Primary Person Responsible

Bobby Schnabel, Vice Provost for Academic and Campus Technology

Evaluation of Achievement

- Usage data from satellite stations and accessibility features of stations in computer labs.
- Surveys of students who self-identify as users of assistive technologies show increased usage of and satisfaction with assistive technologies and improved accessibility of and satisfaction with other campus information resources and educational technologies.
- Surveys of ITS staff and departmental IT professionals show increase awareness and acceptance of assistive technologies and needs for making information and educational technologies accessible. In addition, tactical plans should reflect this increased awareness.