Chapter 1: Teaching & Learning with Academic Technology

The reports addressing Academic Technology encompass three areas: support for teachers and learners, teaching and learning spaces, and teaching and learning tools. Overall, this section of the Strategic Report emphasizes how IT and ITS on campus may best serve instructors and students by providing a wide variety of technology-related tools, support, and spaces both specific to disciplinary needs and widely shared across campus. The Academic Technology chapters also underscores the need for flexible tools and support mechanisms; assisting teaching and learning requires meeting a range of diverse needs and adopting a forward-looking perspective by anticipating the needs of future learners as well. Teaching and learning spaces, for example, must adapt to changes in learning styles and disciplinary demands.

The recommendations found in the reports concerning Academic Technology include high usability among newly adopted tools, effective support for diversity in teaching and learning, coordination of shared tools and spaces, and development of transparent processes in the selection, development, dissemination, communication, and governance surrounding teaching and learning tools, support, and spaces.
1.1 Support for Teachers and Learners

Major Issue: The growing presence of technology on campus and in the everyday lives of faculty and students presents new challenges and possibilities for providing support for teaching and learning. As the campus determines how best to move forward, a number of concerns should be considered, such as the need for: high-quality, easy-to-use tools that meet demonstrated teaching and learning needs; support for technology use that emphasizes teaching and learning; scalable and flexible support models that take into consideration needs that are different by discipline or unit and that may change over time; a better understanding of and ability to meet the support needs of students.

A. Background/Rationale

CU-Boulder faculty and students increasingly rely on technology tools and spaces for effective teaching and learning associated with face-to-face, online, and hybrid courses. In addition, students rely on those same tools and spaces for learning outside of their traditional academic programs. Effective use of technology relies on support models that address these issues while respecting disciplinary differences, and that are broadly and easily accessible to all faculty and students. Currently, that support is provided by a mix of central and decentralized units and efforts. Even as pockets of excellent support exist, the campus needs to make sure that technology support is consistently available across all units. In addition, that support must be flexible enough to meet needs that differ by discipline or with changes in pedagogical methods, understanding about learning, or technologies.

B. Accomplishments to Date

Various stakeholders across campus invest in structures to support the use of technology in teaching and learning. Investments in this support are made both centrally and locally. Examples of technology support structures with a teaching and learning focus include ASSETT, ALTEC, and iSTEM in Arts & Sciences, the Leeds School technology unit, Disability Services, and the Academic Technology unit of ITS. The campus also has a number of resources that specialize in supporting teaching and learning generally. The campus can leverage the expertise in these units to build out support that includes technology. Examples of these units include the University Libraries (which already has a significant technology focus), FTEP (Faculty Teaching Excellence Program), and GTP (Graduate Teacher Program). Overall, however, there is a lack of communication between and knowledge sharing among the many units providing this support. To ensure effective and sustainable support for teaching and learning with technology, more work needs to be done to inventory the support and services provided by and the service models in use within each of these units, and to increase communication and coordination among them.

Action Plan

A. Explicit Assumptions

The growing presence of technology on campus and in the everyday lives of faculty and students presents new challenges and possibilities for providing support for teaching & learning. Moving forward, a number of concerns should be considered:
1. Effective support assumes the presence of stable, high-quality, functional, and easy-to-use technology-related tools and spaces (some of the campus’s most critical tools do not meet this basic standard).
2. Effective support for technology in teaching and learning emphasizes support for teaching and learning over support for technology.
3. Effective support is aware of the changing needs of teachers and learners, of the ways those needs vary within different units, and adapts to those changes.
4. Students as learners have different needs than faculty. The campus must understand and meet the support needs of students.
5. The campus should leverage the expertise and knowledge of existing investments in locally- and centrally-provided support for teaching and learning with technology in ways that it does not do now.

**Strategic Principles.** These should guide campus decision-making in this area. They map roughly to the concerns above and will be used to structure the rest of this chapter.

1. **Usability is fundamental.** Any basic, centrally provided technology must work well, must be accessible, easy to use, and must meet pedagogical needs as defined by the teachers and learners themselves. The current version of CULearn (Blackboard’s CE 8), for example, does not work well, is not easy to use, and fails to meet many pedagogical needs. Support that exists to compensate for low usability of tools is an inefficient use of resources.

2. **Good support is driven by faculty and student’s academic needs.** Support needs vary across different disciplines and different sets of users. Decisions for how to structure and prioritize support should emerge from these needs. Support models, therefore, must be flexible and adaptable. Success should be measured primarily by meeting those needs, rather than by technology-centric factors such as adoption rates or help-center call volume.

3. **Good support scaffolds user learning.** Support models should scaffold users so that, over time, they no longer need support for a particular practice or tool. Incremental and accumulative gains are valuable and help support remain flexible and adaptable.

4. **Good support extends beyond the classroom.** The campus must support teaching and learning that takes place outside of the classroom. Traditional support emphasizes the course or classroom, which biases support toward faculty needs. Supporting students may often require something completely different. Supporting student needs is critical.

5. **Partnering is critical** Many units on campus currently provide some level of support for teaching and learning. Encouraging connections across these units can help them leverage existing resources, increasing efficiency and scalability without significant additional outlay. Partnerships can encourage pilots, local experimentation, and transdisciplinary projects. Also, through these conversations, central IT can make more informed decisions about what support gaps exist across campus and how to fill them (rather than duplicate existing resources).

**B. Specific Recommendations**

1. **Ensure usability of tools, systems, and spaces**
   - Adopt a set of usability guidelines centered on teaching and learning, to be applied to any technology tool currently used or being considered for campus-wide adoption. Use
the results to inform decisions about priorities for tool upgrades or replacements. Make the guidelines and resulting assessments available to the campus community.

- Replace CU Learn and improve the campus clickers/SRS tool. See chapters 1.2 and 1.3 for specific recommendations about spaces and tools.

2. **Align support with local and changing needs**
   - Many local programs successfully support teaching & learning with technology. Support these local successes, strengthen them by involving them in campus IT decision-making and policy discussions. Consider investing central resources to grow local programs.
   - Fund regular needs assessments of teaching and learning needs, conducted by support staff themselves. Use methods that provide these staff with first-hand knowledge of local needs and practices, i.e., focus groups, observations, and interviews rather than surveys. Share the results.
   - Fund regular evaluation and assessment of support services and resources, to better inform decisions about priorities and directions. Support change when data call for it.
   - Be sure that campus IT policies and support structures allow (and even encourage) risk-taking and experimentation, e.g., support for online learning outside of CU Learn, using wikis or social media. Consider reviving past or expanding present resources such as the Educational Technology House (formerly in Eaton Humanities), Academic Media Services (currently in the ATLAS Building) or grant programs (e.g., as formerly in ATLAS, and as currently in President’s Teaching and learning Collaborative, ASSETT and ALTEC) that encourage experimentation and adoption of educational technologies.
   - Invest in improved online learning resources and training opportunities for faculty, students, and staff.

3. **Provide better support for students**
   - Create new or redesign existing support models to address the specific needs of students, recognizing this may require more cost outlay to establish new support offerings (such as hardware and software support).
   - Consider student needs outside of the classroom. Re-examine any central support structure that artificially separates support (i.e., that supports *only* faculty or *only* students).
   - Invest in campus learning spaces that are student centered, such as Norlin Learning Commons, Center for Community, or the UMC.
   - Invest in tools that are student centered, such as eportfolios.
   - Engage student government in planning, decision-making, and implementation of new support models. Pursue recommendations to create a Student Technology Advisory Board.

4. **Facilitate effective support across campus through partnering**
   - Create a list of who provides teaching and learning support on campus, share the list and update it regularly. Provide mechanisms for programs to learn more about each other, and for them to partner with one another. Include programs with primary missions for supporting teaching and learning (with or without technology), such as the Libraries, FTEP, GTP, and STEM Learning Assistants program (School of Education).
   - Create a grant or incentive program to support or facilitate peer-to-peer mentoring or expertise-sharing in this area.
• Involve faculty and students more directly and regularly in decision making about how to provide support. This may mean participating on advisory committees, or holding formal managerial appointments in support structures.
• Re-examine technology support models currently funded by course and instructional fees. Look for potential to restructure the support models. Current fees may have been implemented when the technology teaching & learning environment was very different. Encourage low-cost models, such as peer learning (students or faculty learning from each other).

C. Long & Short Term Objectives/Timeline

Short Term (6-12 months). Change the conversation. Demonstrate a commitment to changing existing practices as needed and building an open conversation.

1. **Ensure usability of centrally provided tools, systems, and spaces**
   • Implement critical tool replacements (CULearn) and improvements (clickers/SRS)
   • Establish structures to regularly gather and disseminate data on usability.
   • Ensure accessibility (508 compliance) of new and existing tools through work with Disability Services and the Procurement Service Center. Publicize requirements and practices that lead to equal access to information and technology for students and faculty. Improve faculty training in this area.

2. **Align central support with local and changing needs.**
   • Implement a variety of evaluation and assessment activities into central IT so that they are in a better position to understand needs (perhaps with ASSETT as a model).
   • Revive initiatives that put central staff, including those who support teaching and learning and those with more operational responsibilities for technology implementations, in direct conversation with faculty, academic staff, and students (and them with each other). A possible starting place is the FEET (Faculty Evaluating Emerging Technologies) idea, expanded to include academic staff and students.
   • Invest in pilot studies of new technologies, carried out by either central or local programs.
   • Research effective practices for supporting teaching and learning with technology, including practices of peer institutions.

3. **Provide better support for students**
   • Conduct a campus wide needs assessment and gap analysis with students to identify technology needs for learning. Share the results.
   • Involve students in governance of information technology and decisions and directions resulting from that assessment and analysis.
   • Evaluate centrally provided student training; change or augment with new tools and methods based on conclusions of evaluation.

4. **Facilitate effective support across campus through partnering**
   • Begin inventory of campus units providing support, including missions, activities, expertise, availability of resources, and areas of support. Share the results.
   • Convene support units in knowledge-sharing meetings, research and project presentations, and online communities. Determine effective methods for
communication and collaboration between these units. Consider ways to leverage joint resources to gain purchasing efficiencies, e.g., for software licenses.

- Involve a broad representation of campus stakeholders to oversee a cost study that investigates various means for funding campus-wide support.

**Long Term (1-3 years).** Create a support environment such that by 2015, CU-Boulder is recognized by students, faculty, and peer institutions as an exemplar for supporting teaching and learning with technology.

1. **For every central adoption of a new technology service or application on campus,** invest sufficient funds to ensure adequate user support. Determine on a case-by-case basis whether the investment should be in central programs, local programs, or both.

2. **Formally integrate usability into processes for adoption/upgrade of any centrally provided tool or space.** Form and disseminate usability guidelines for technology tools, systems, and spaces.

3. **Invest in teaching and learning support resources at a level equal to (or greater than) investments in spaces and tools.** The campus is understaffed with regard to personnel to support teaching and learning with technology. It is imperative that any plans for new tools and spaces include sufficient additional resources for additional teaching and learning support staff. And as more teaching and learning technologies are “lightweight” or “personal,” effective support requires an increase in staff, even when the campus is not adopting a new central technology.

4. **Create and nurture a collaborative support environment on campus.** Share results of assessment and evaluation efforts. Implement data-driven change. Ensure transparency in decisions about and funding of support for teaching and learning with technology. Eliminate artificial divisions that are based on resources, rather than on needs.

5. **Change how central support is provided by centering on identified cross-unit needs rather than separating support by discrete organizational units.** Match support to needs. The model that creates silos of support for different units is inefficient and does not leverage campus-wide opportunities. Avoid significant disparities among units with regard to support for teaching and learning. Avoid significant disparities between students and faculty support. Adopt a structure that is flexible and adaptable, so that it can change as needs change. Determining the specific structure to adopt should involve a discussion among campus stakeholders.

**D. Possible Risk**

No IT security risk is identified and/or associate with these recommendations.

**E. Resource Allocation**

1. Many of the short-term recommendations require changing the priorities of existing IT staff as well as faculty, staff and student participation. Faculty will participate as part of their service assignment. Staff may need to have workloads reassigned. Student leadership can be engaged; modest incentives generally also increase participation rate.
2. Several items are low cost ($10,000 or less), assuming existing staff may be reassigned and student research assistants are employed.

3. Conducting assessments will be worthwhile only if the campus can respond adequately to the identified needs. An unrestricted fund would allow the campus to provide small grants or awards to respond quickly and flexibly to meet emerging needs. The use of these funds could be overseen (and perhaps awarded) by an advisory committee, furthering the involvement of campus stakeholders. Earlier intervention generally results in lower longer-term cost. The resources available should be on par with other campus-wide proposals, such as for CRCW awards or Outreach grants.

4. Investing in additional staff is the most critical component of providing effective teaching and learning support. It is also the most cost intensive, ranging from $8,000-10,000/year for undergraduate support to $80,000-100,000/year for professional support. The campus might call for proposals from units on campus, leveraging central funding with local funding. This would allow individual units to determine what kind of support they need, which may range from lower-cost options of student employees up to professionals. As identified in objective 7, any centrally provided resource must also fund adequate support.

F. Responsible Parties

1. Campus-wide Information Technology Advisory Committees (formed as a result of this overall strategic plan) to monitor overall implementation and ensure that progress is made toward achieving general goals.
2. Several items require the partnership and collaboration of the various units on campus that provide teaching and learning support. CIO and/or Chancellor should solicit broad initial participation.
3. The CIO and the Provost should solicit participation for a committee to review proposals for item 2, third bullet.

G. Evaluation

Evaluation of this plan is straightforward. Success can be measured by the change in perceptions and attitudes of (1) faculty, staff, and students, (2) staff of programs across campus that support teaching and learning. The recommendations of this plan aim to create an environment in which support can achieve excellence. As the technology environment changes over the next 5 years, other specific actions may emerge as equally effective. This evaluation mechanism allows the campus to remain flexible with regard to specific decisions that may be needed in the future.

A campus-wide committee with minority representation from technology-centered support units (whether central and local) should be formed. Using this plan as its guide, this committee should identify measurable indicators for assessing achieved success over time. The committee should determine a methodology for gathering and analyzing data on an annual or bi-annual basis. The committee should report the results of the study publicly to the campus. (An example of an existing committee with a similar charge is the Chancellor’s Committee on Women.)
Additional Information

Table 1: Partial list of high-level units providing support for teaching and learning with technology

<table>
<thead>
<tr>
<th>Name of Unit</th>
<th>Division</th>
<th>Tech Focus</th>
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<tbody>
<tr>
<td>Academic Technology</td>
<td>ITS</td>
<td>High</td>
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<tr>
<td>ALTEC (Anderson Language Technology Center)</td>
<td>Arts &amp; Sciences</td>
<td>High</td>
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<tr>
<td>ASSETT (A&amp;S Support of Education Through Technology)</td>
<td>Arts &amp; Sciences</td>
<td>High</td>
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<tr>
<td>ATLAS</td>
<td>Institute</td>
<td>High</td>
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<tr>
<td>Continuing Education and Professional Studies</td>
<td>Continuing Education</td>
<td>Medium</td>
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<tr>
<td>Disability Services</td>
<td>Student Affairs</td>
<td>Medium</td>
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<tr>
<td>FTEP (Faculty Teaching Excellence Program)</td>
<td>Faculty Affairs</td>
<td>Medium</td>
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<tr>
<td>GTP (Graduate Teacher Program)</td>
<td>Graduate School</td>
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<tr>
<td>iSTEM</td>
<td>Transdisciplinary</td>
<td>High</td>
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<tr>
<td>University Libraries</td>
<td>Libraries</td>
<td>Medium-High</td>
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Table 2: Schools, Colleges, and Departments with formal Support Staff for technology

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<tr>
<th>Name of Unit</th>
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<tr>
<td>Arts &amp; Sciences</td>
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<tr>
<td>ASSETT at college level</td>
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<tr>
<td>Dean's office, for advisors</td>
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<tr>
<td>ALTEC for language departments</td>
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<tr>
<td>Chemistry</td>
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<tr>
<td>Communication</td>
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<tr>
<td>Ecological and Evolutionary Biology</td>
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<tr>
<td>Film Studies</td>
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<tr>
<td>Geology</td>
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<tr>
<td>Molecular, Cellular, and Developmental Biology</td>
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<tr>
<td>Physics</td>
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<td>Psychology</td>
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<td>Architecture and Planning</td>
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<td>Business</td>
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<td>Education</td>
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<tr>
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<td>Music</td>
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<td>Music</td>
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List of Accessibility and 508 Compliance Resources
Campus standards on accessibility: http://www.colorado.edu/webcom/access/
Disability Services Resources:
http://www.colorado.edu/disabilityservices/facultyinfo.html or
http://www.colorado.edu/disabilityservices/handbook/handbook1.html
1.2 Providing Teaching & Learning Spaces

Major Issue: Teaching and learning spaces on campus must be equipped with technologies that support both the diverse teaching strategies used on campus, and the unique learning styles of students in the new millennium. Flagship 2030 and the Facilities Report of the Boulder Campus Master Plan have both laid out physical space expansion goals for the future, including increasing classrooms and large lecture halls, and discussing innovative solutions to large lecture hall needs by using advanced technologies to co-locate learners. These ideas may be insufficient for meeting the needs for smaller and more specialized learning spaces. Meeting these goals will require flexibility in programs and resources to adapt to changes in technologies and teaching needs across the campus.

A. Background/Rationale

CU-Boulder is an outstanding research-intensive and comprehensive teaching university. It should have teaching and learning spaces and technologies that match those of comparable universities. Making appropriate and forward-looking investments in these areas is consistent with two core initiatives in Flagship 2030: (1) enhancing education and scholarship and (2) investing in the tools for success. link:flagship2030/coreinitiatives It also will help with many key flagship initiatives link:flagship2030/flagshipinitiatives, including establishing more residential colleges and programs and offering all students customized and experiential learning programs. The latter initiative in particular can be enhanced with appropriate technologies for learning and distributing knowledge, as well as help distinguish an education on the Boulder campus from the growing availability of distance education. Additionally, the facilities task force report of the emerging Boulder Campus Master Plan calls for further investments in technology in existing classrooms, at least one more very large classroom with technology to transmit lectures to satellite rooms, while the east campus task force report envisions that area to be a full academic campus with teaching and learning rooms (http://www.colorado.edu/masterplan/taskforces/index.html). In making such improvements, planners should be aware of the considerable heterogeneity that exists in needs for spaces of varying sizes and technological capabilities.

We see a four-pronged set of issues for IT planning. First, it is important to continue to upgrade existing spaces to achieve near-universal coverage of Smart (media equipped classroom with at least a screen, digital projector, room controller SP panel, DVD/VHS or other video playback

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<td>Arts &amp; Sciences ASSETT at college level Dean’s office, for advisors ALTEC for language departments Chemistry Communication Ecological and Evolutionary Biology Film Studies Geology Molecular, Cellular, and Developmental Biology Physics</td>
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technology, campus cable TV, sound system. The basic technologies installed evolve over time as the technologies and needs change.) or similar new technologies. This should be done at least in centrally scheduled facilities, though the need extends also to department-controlled spaces. In this regard, currently 136 of 182 centrally scheduled classrooms are Smart, while demand for such facilities grows rapidly. Second, ITS needs to work closely with campus planners and facilities management to ensure that new teaching and learning spaces are appropriately equipped. Third, as new spaces are constructed or existing spaces are renovated, attention should be paid to the heterogeneous teaching and learning needs of faculty and students soon to arrive on campus. Perhaps most significant is the increasing usage by students of IT-equipped commons rooms, such as those in libraries and RAPs, and smaller team rooms. Thus, planning of physical spaces needs to evolve to meet both changing demands for learning environments and emerging philosophies for teaching in groups. Fourth, the existing model for centralized procurement of teaching and research software is not sufficiently flexible to meet the rapidly changing needs of a number of units. A more responsive model in terms of monitoring needs and pricing for access would help support learning, particularly by undergraduate and graduate students undertaking research projects.

B. Accomplishments to Date

ITS has made significant investments in upgrading classrooms to Smart status, though the work is not complete. Technology space demands are increasing at a faster rate than the funding and resources can build them. Campus has made it a priority to fund additions of smart classrooms with temporary funding over the last 2 years. Campus has been adding facilities at a rapid pace, with a need to continue over the next 3 years to reach the goals. With these additions, we have been creating a renewal and replacement burden for the campus that will only be met with continuing funds commitments.

Large lecture hall technology models have been changing and evolving during the capital construction boom on the Boulder campus. There has been more of a focus on providing technology that is easy to use, which can operate without attendant support, and puts the tools in the hands of the instructor. Distance learning has been included as a goal in all program plans, and capabilities have been installed in most of the new construction projects in large halls or classrooms (recent ones include Leeds, ATLAS, Visual Arts). Our model for large lecture halls has evolved to meet the new demands. We need further refinement in physical room design evolution to meet changing demands on space.

All capital construction projects have been planning 100% Smart technology in classrooms they provide. This is a positive trend that helps us meet our goal of equipping more rooms with technology on campus. There are support model and long term campus renewal and replacement considerations to address with this planning.

Space design in teaching and learning computing labs and classrooms is also evolving. Students like big, open spaces to work in groups and alone, with food and ability to interact and take a break. There is still a need for quiet library style spaces as well. Community spaces for interaction are becoming more popular, with new commons style spaces packed with users well into the evening hours. As spaces are renewed on the regular cycle, they are adapting to the newly defined needs. We have installed new commons style arrangements in labs in Norlin Learning Commons, UMC, ALTEC in Hellems, Education, ATLAS, RAPs, Leeds and have more requests pending.
Students find the team rooms (a small, enclosed technology equipped group work room with at least an LCD panel to project content, a controller, and audio reinforcement) to be very useful for their work. All of these group study rooms are popular and heavily scheduled. We need more of these on campus.

**Action Plan**

**A. Explicit Assumptions**

"Millennial learners" and other new students will be increasingly familiar with a broad and rapidly changing array of information technologies for engaging in communication, social networking, information searches, and studying and working. Although these students are likely to arrive with laptops and mobile devices, usage patterns to date indicate that some desktop labs need to remain, with a range of technologies available. Faculty and students are likely to expect more than passive access to IT in classrooms and other learning spaces, placing an emphasis on interoperability and capacity within each space. Much of this capacity will operate through wireless means, putting a premium on consistency of signals to avoid work disruptions. Demand is growing for three types of jointly used spaces: commons areas with internet and networking access (and amenities such as food and beverages), team rooms for student collaboration, and small spaces for specific uses, such as audio or video recording, and videoconferencing.

In addressing such demands, flexibility is one key approach: we cannot predict all changes in technology and use patterns. Neither can we satisfy every possible teaching and learning demand for technology in every space, in part because these needs are sometimes in conflict. Governance is another key issue: an inclusive body needs to be charged with setting priorities, continually evaluating needs for space upgrades, and allocating scarce resources. Information is another requirement: faculty should have access to knowledge about best practices at similar universities, by broad discipline.

**Accessibility Issues:** The task force sees no particular issue regarding access for disabled persons other than urging facilities management to ensure such access is provided when rooms are built and renovated. Our Divisional standards documents already specify requirements around ADA accessible podiums and technology within the space.

**Sustainability Issues:** The task force recommends additional investments in Smart (SMT) rooms and a significant increase in the number of electrical convenience outlets in classrooms and commons rooms, which could raise long term electricity demand. Additional video and audio transmission capacity could do the same to both electrical service and network bandwidth/availability.

**Specific Assumptions**

- Support (face to face, online, video, etc) for all recommendations must be considered a priority.
- Ongoing funding for renewal and replacement of recommended space tools and hardware: must consider the long term implications of the implementations when approving campus projects.
- Assumption: a governance body will exist to provide high level prioritization. Should include students, IT, faculty, and administrative governance.
• Assumption is new developments that come out of the recommendations shall, everywhere possible; conform to Section 508 and campus accessibility standards.
• Flagship 2030 vision, along with Facilities Master Planning guidelines should provide the framework for IT space decisions and priorities.
• All faculty and students need access to the best space and technology to facilitate their teaching and learning styles. Best practices should be applied relative to other similar-sized research Universities.
• We cannot fully future-proof our spaces for anything that might come up in the future, nor can we satisfy every possible teaching and learning demand for technology, because they are often in direct conflict with each other.
• Spaces will be continually evaluated and revised, new priorities set by the governance body selected.
• Despite increase in student use/ownership of technology (especially laptops), some desktop labs will continue to be necessary.
• This group is not attempting to reflect the potential needs of Conference Services, an auxiliary unit that will be using some of these spaces. They have not traditionally provided financial support for the rooms they use, and oftentimes they deliver their own set of Audio Visual equipment.

B. Specific Recommendation

• A better governance system should be developed that will help set priorities for allocating resources across needs and among emerging technologies to support teaching and learning. This model should include representation from faculty and students along with technology experts.
• Continue investments to increase the number and percentage of smart classrooms of all sizes, while consulting with faculty members about whether particular rooms may be better served without Smart technology.
• Develop more spaces for collaboration among students, and between students and faculty in technology and information use. Examples include commons rooms, RAP great rooms, and team rooms that offer connectivity and workspace.
• Consider providing ample convenience outlets for all new capital construction, and also undertake a retrofitting analysis in older existing teaching and learning spaces. ITS needs to work closely with facilities management on technology choice and installation in infrastructure renovation projects.
• Due to the increasing proliferation of wireless devices operating on many frequencies and technical specifications, all new campus construction and renovation projects should take account of all wireless technologies that are likely to be present, and should adapt designs as needed to minimize interference within teaching and learning spaces. This must include consideration for wireless/mobile communication to all spaces in the building, including but not limited to radio frequencies commonly used by police/fire/life safety personnel and support staff. Addressing this problem will require extended communication during planning phases of facilities projects.
• There appear to be sharply increasing specialized audio and video needs across campus for individual and team recording of research results and creative work by both students and faculty. The campus needs to provide more small, private, and sound proofed spaces, which could be located in both academic and residential buildings.
• There is considerable variation among departments in their needs for and uses of teaching-oriented computer labs but at this time there is no consensus that such labs can be eliminated in favor of relying on student-provided laptops and devices. This heterogeneity
implies that ITS should coordinate closely with departments regarding their continued needs in this area. Greater availability and access to application software could reduce some space requirements and provide more flexible and dynamic learning spaces.

- The current IT procurement model regarding department-controlled spaces is ad hoc and needs reconsideration. Left to their own devices, the departments with more limited resources cannot invest in the technologies needed to support their teaching and learning mission. A more centralized funding model should help support provisioning of standard and emerging technologies in all classroom spaces, including departmental locations. Campus should promote more shared, multifunctional, cross-departmental environments where space is limited.

- A key function of ITS is to provide software for teaching and learning spaces. The governance body recommended above should actively work with units to understand their evolving needs for centrally purchased software and how it is delivered to student machines, computer labs and department spaces. Some effective approaches would be software Enterprise License Management (ELMs – tools such as e-academy to manage distribution and tracking of institutionally purchased software licenses), and/or keyed, virtual delivery of software and shared licensing on an enterprise level for all of campus to use.

- There is an increased demand for shared centralized server space and a shared computing canvas for teaching and learning, integrated with research. One useful example would be development of virtual spaces for students and faculty to meet and work.

- Central scheduling of classrooms and especially computer teaching labs is sometimes inefficient in terms of class sizes and time allocation. While central scheduling is important to retain flexibility, schedulers and ITS should coordinate better with departments on their needs. A task force should be commissioned with stakeholders to develop an action plan to improve space scheduling. This analysis should take into account the needs of all stakeholders, including Central/Academic scheduling, Non-Academic Scheduling (UMC), departmental facility scheduling, and ITS facility scheduling.

- Determine how spaces can support dynamic learning environments that provide more flexibility and respond to both student driven needs and creative faculty inspired learning environments. Consider implementing more models such as highly interactive virtual environments (HIVEs), peer-to-peer informal learning, clusters, individual work spaces, external work support for off campus, outside, traveling, etc.

C. Long & Short Term Objectives/Timeline

Short term: Organize an appropriate governance model to begin setting priorities and improve coordination with room schedulers and unit heads. This will be an ongoing activity. Survey or otherwise take stock of whether and how units finance technology needs in the spaces they control, along with needs for centrally purchased software. In addition:

- Address “quick win” policy and standards recommendations.
- Continue smart-classroom upgrades.
- Implement requirement for RF wireless interference analysis and additional convenience outlets into new construction standards documents.
  Timeline: AY 2010-11.

Long term: Develop means by which the governance unit can interact more fully with facilities management and the Boulder Campus Planning Commission on technology investments and technical constraints in outfitting teaching and learning spaces in new buildings, RAPs, and common rooms. Investigate the need for small spaces and team rooms
equipped with audio/video technology and work with specialized units (e.g., Film Studies, Music, Art & Art History, and Architecture and Planning) on their requirements.

- Begin conversation around creating funding model for all classrooms
- Create centralized storage/virtual workspace/shared canvas
- Engage scheduling task force to discuss and formulate a plan for better centralized scheduling of all teaching and learning spaces.
  
  Timeline: ongoing from summer 2011.

D. Possible Risk

- Becoming tied into particular technologies that may become quickly outdated, a problem that is best addressed by flexibility in resources and planning and foresight by ITS and governance unit.
- Security issues regarding confidential data and records may accompany greater reliance on centralized software servers. Service cost viability will likely be a dynamic attribute of the service. Perceptions about the value of the service and the ability to adjust to market changes
- Classroom emerging technologies such as classroom capture will have security implications for the storage and publishing of the content.
- Increasing requests for 24/7 spaces to study have an impact on student safety and their need for services such as nightwalk/ride and cameras and phones in rooms.

E. Resource Allocation

The cost of these recommendations is expected to be very high.

Funding for increasing quantities of Smart classrooms, and continued support for renewal and replacement of these rooms is in excess of $500k annually. This funding has been allocated on a temporary basis for the past two years. Continued funding of this service has been a top priority for the campus, so the funding stream is likely to continue.

Cost for supplemental power outlets within buildings is a large number that depends on many factors. This should be considered during program plan phase of construction projects for inclusion in the program plan funding requests. For campus building renovation projects such as Ketchum, this should also be a standard consideration.

Computing labs managed by ITS are funded through student fees ($1.8M), and have a continuing funding source identified. Future planning for efforts such as software delivery to campus and student devices should be considered a component of the student fee budgeting process, with supplemental funds to support staff and faculty use requested as needed from general campus fund. Justification of these initiatives should include an analysis of central campus savings that would occur by not distributing funds to departments, but rather applying common good principles.

Modifying campus standards documentation will have minimal (less than $5k) costs associated for professional services to develop and create the Divisional documents with campus collaboration.
There will be a significant cost associated with creation of a new, shared canvas virtual space for campus to use as a community. This is, in effect, developing a database hosting service, which requires analysis, development and some investment in hardware and software or cloud based services. This cost is expected to be approximately $80k. It is important to note, many ITSP chapters such as developing rich collaboration tools have a similar request, so funding planning should account for the shared nature of this request.

Developing a new funding model for ALL classrooms could have a significant cost. There are approximately 500 (280 are supported by ITS) spaces on campus that are used for instructional purposes (many are not Smart rooms). Properly supporting the technology installations, and funding for renewal and replacement and additional staffing resources could be significant. We would expect a need for increasing staffing levels by 4 FTE to provide central support of these spaces in a common good model, with standard smart technologies installed. The cost for appropriate renewal support of these spaces is significant, in the $300k-450k range if all are made smart. This need will be further developed and funding amounts honed as part of the recommendation to switch to a central funding model.

Central scheduling improvements cost would be in the $30k-50k range, for analysis services and development of new tools or workflow processes.

F. Responsible Parties

ITS, Campus-wide Governance Group, Boulder Campus Planning Commission, Facilities Management, Central scheduling, Campus CFO, and all department stakeholders.

G. Evaluation

- Statistics of classroom equipment deliveries to spaces that are not Smart should reduce over time as upgrades are completed. This could improve resource utilization for the campus as a whole.
- Academic assessments of usage of technology in spaces. A continual evaluation of the current suite of technologies and its perceived value to the University Teaching and Learning mission.
- Cost savings analyses for providing technologies centrally or in a standards based fashion.
1.3 Offering Teaching & Learning Tools

Major Issue: While the campus needs to focus on delivering and supporting specific teaching and learning tools, the half-life of a list of promising teaching and learning tools is very short. A more lasting and strategic improvement can be made over the next four years, however, by improving processes for identifying, exploring, testing, and communicating about teaching and learning tools to be supported by campus.

A. Background/Rationale

One attribute of the world of teaching and learning tools is the rapid change and growth in the tools available to assist people in teaching and in learning. Another attribute is some support is best provided centrally while other support is best provided locally. The campus needs to consider this, as well as how best to vet teaching and learning tools through a process of selecting, testing, and evaluating tools and services by faculty and students. Many campus constituents are not included in user testing processes currently. Also, communication about support for teaching and learning tools on campus is neither uniformly received nor understood by key constituents across campus. And, there are not enough resources on campus for supporting the use of technologies.

All of this occurs amid a general milieu of concern about safety of data, FERPA considerations, copyright concerns, and concerns about storage of large data or media sets. Given this, our committee thinks there should be a comprehensive campus-level effort to provide guidance to the campus about the best tools for specific jobs, about legal considerations, and prearranged "cloud"-based tools that have been vetted by a university contract.

Our committee identified lists of teaching and learning tools that we think need to be addressed, which can be found below in section B. We identified a process for identifying those technologies, having faculty and students review them and posit uses for them; and a process that includes user testing those technologies before they are widely deployed. Visual collaboration and rich media is a recurring theme in this chapter. This is an emerging areas for growth. In addition, lecture capture tools, classroom capture tools, rich collaboration (Skype, WebEx) with shared whiteboard space, visual access to all media are all important areas to address.

B. Accomplishments to Date

Even though the campus faces declining state funding, teaching and learning technologies have been adopted at a certain level across our campus. For example, nearly every CU Boulder student has at least one class on CULearn, the campus' learning management system. However, much more thorough and deeper adoption has occurred in pockets across campus. For example in Physics, much work has been done with student response systems (clickers), with online simulations (see http://phet.colorado.edu/index.php), and with lecture capture systems.

Our campus has benefited from the recently completed Flagship 2030 strategic plan, which produced a number of initiatives that the campus should keep in mind as it provides support for teaching and learning tools.
Looking back to the last IT strategic plan, which was created in 2006 we can see that progress toward a number of initiatives related to teaching and learning tools was mixed. For example, very little work has been done on evolving the model of smart classroom support to account for multiple levels of user sophistication with technology and multiple pedagogical approaches. Also, the campus did not establish the Faculty Evaluating Emerging Technologies (or FEET) committee. And little work has been done to foster a culture of innovative and effective uses of technology-enhanced learning spaces.

**Action Plan**

**C. Explicit Assumptions**

Assumptions that we made about teaching and learning tools include that lists of tools are less central to this strategic plan than describing an ecology that is supportive of effective tool adoption. Also we assume the disruptive state of change in tools applied to teaching and learning situations will be able to be addressed. Further we assume that the campus will find it important to invest in the 2030 initiative as well as in tools used in support of teaching and learning over the next four years. We assume the campus will be willing to both invest in centrally supported, widely adopted technologies; as well as locally supported niche technologies. We assume that over the next four years faculty will be recognized for work they do in integrating teaching and learning tools into their curricula. And the campus will evaluate each new educational tool that will be supported. And finally, we assume that the campus should fund accessibility of any video technologies that are adopted. For example captioning of video is required when hard-of-hearing students will be viewing that video.

Assumptions about governance as well as policy and legal implications of teaching and learning tools include that the campus will be able to invest in improved methods of governance, communication, and user testing. Further, we assume that the policy and legal questions of how to respond to an environment where free and powerful tools are available outside of the campus will be addressed.

Assumptions about recommendations from the last strategic plan are that the campus will continue to work on those initiatives outlined in the 2006 planning process that were never implemented fully.

**D. Specific Recommendation**

This committee discussed a wide range of recommendations for improving the support for the tools used in teaching and learning. Overarching themes that emerged from our discussion were that the campus should look at support models from other universities; that technologies should be easy to use and compatible with a variety of other technologies; they should conform to standards; that we should have a "one start shopping" portal for access to technologies; and we should have a single point of help for technologies.

The campus needs to establish a formal system of governance over the support for educational technologies, programs to encourage faculty to test new tools, and a process for testing technologies and services across the board during project phases.

This committee would like to see phase-out dates for each centrally-supported technology, so that technologies that have outlived their usefulness can be retired. We would like to see faculty
course questionnaires (FCQs) incorporate some measure of educational technology use. We would also like to see the campus provide incentives for faculty to use educational technologies. More detailed recommendations follow.

Support Visual Interactivity
Because the creation, manipulation, and dissemination of video is so central to the direction teaching and learning technologies are developing; and because of the high cost of travel; technologies that employ video are likely to have a large impact on teaching on our campus. The campus should increase support for using video in learning contexts. This includes adding or enhancing services for videoconferencing, web conferencing, streaming media, downloading rich media, media capture in learning spaces (i.e. recording classroom activities, such as lectures), and video as students' scholarly work.

Part of the support for visual interactivity includes increasing existing support for advising faculty members about copyright, especially as it pertains to rich media assets. For example the campus should provide a means for giving faculty members advice on the TEACH act and Fair use. The copyright web site is a start in this direction, but providing a person who can give advice would be even better.

Support File Storage and Sharing
Because increased adoption of rich media formats are important for teaching and learning, it is very important that our faculty members and students have a much larger capacity for storing and sharing files. Any plan for a storage service needs to incorporate aggressive growth in capacity every year. This service should also provide for a variety of means of sharing files, including the ability to share files with colleagues outside of CU-Boulder. The goal in providing this service should be to make data storage be as widely used (and as useful) as email.

Support Widely-Adopted and Discipline-Specific Technologies
This committee would like to see continued central support for those technologies that are already widely adopted across campus as well as new support for technologies that have been adopted in local pockets. A number of educational technologies, perhaps the majority of them, are adopted by many disciplines. Examples include learning management systems, DVDs, blogs, wikis, etc. And this campus has attempted to provide support for some of these technologies.

More work remains on many fronts, however. For example in rich media dissemination, the campus does not have a solution for streaming media or for rich media downloading. At the time of this report, a service like iTunes U appears to have that capability and is a likely candidate for adoption. So it is important for the campus to continue to work in this area. Also more work remains in the learning management system space. We would like to see support for the Enterprise 2.0 model for a learning management system. This model shifts the learning management system from being a stand-alone monolith to a more open framework that allows the user experience to be much more flexible and to grow organically.

While central support is important, it is just as important for the campus to provide support for technologies that are adopted by only a few disciplines. Some disciplines adopt technologies early that will later be adopted campus-wide. For example clickers were first adopted by Physics faculty, and they spread the word about them. Once enough departments adopt a technology, it may make sense for the campus to provide centralized support of this technology.
Some educational technologies seem to have a niche in particular disciplines and will likely never reach a critical mass for central support. The campus should recognize this and put resources in place to support those more local technologies. Examples include Smart Boards, which seem to be used primarily in Education.

**Improve Communication about Technological Services Available Across Campus**

Many campus services that provide support for tools for teaching and learning are not widely known across campus. This committee would like to see an increased effort by the campus to advertise and market these services. One-time email messages are not sufficient. Nor is a quiet post on a web page about a service. What is needed are increased resources and efforts aimed at multiple channels of communication and multiple audiences. This information should be simple and it should be pushed to faculty and students on a somewhat regular basis. ITS should provide a glossary defining what it means by various terms it uses. For example, what is ITS' definition of a smart classroom? What is ITS definition of a media capture service? The campus should assemble and widely communicate about a portfolio of supported, recommended, or used teaching and learning tools. This could include a graphical roadmap of educational technology tools and services.

Faculty members should be able to get personal tutoring on a system from resources such as Academic Technology Consultants (formerly DATCs), student assistants (for simpler requests), and possibly a lead-technical faculty member in the department. Although ITS and the Faculty Teaching Excellence Program hold workshops, it is still efficient to reach out to faculty who don’t attend them.

The campus should also improve communication about support for accessing libraries resources and it should provide a central service for software licenses so that CU-Boulder can get better licensing rates.

**Improve Processes for Selecting & Testing Technological Services Offered to Campus**

When the campus rolls out technological services, there is not enough rigor around the design, selection, and user-testing of those services (including the technologies themselves at the heart of the services). Services rolled out by ITS should be user-tested more rigorously before being rolled out. This should include reaching out to other campus IT units and academic units for pilot deployments where faculty and students are studied as they use the service. Some effort should be made to establish standards for supported technologies.

The campus should re-commission the Faculty Examining Emerging Technologies (FEET) group called for in the previous strategic plan. Instead of it being a committee, however, we recommend that it be a loose network of faculty who agree to examine a technology and students and faculty who vote for technologies to be examined. The campus needs to provide people and funding to support this group.

The campus should also provide a sandbox space and virtual space for any faculty member to explore technologies they might want to adopt. As part of the agreement for using this space, the faculty member should agree to provide feedback to ITS on their impressions of the usefulness of the technologies.

**Expand and Enhance Existing Support for Faculty Who Want to Use Technologies**

The faculty needs even more resources for one-on-one support for using technologies. This includes more support that the Academic Technology Consultants (formerly DATCs) provide. It
also includes faculty-to-faculty and graduate student-to-graduate student mentoring in using technologies. This would imply providing more support to the FTEP and the graduate teacher program (GTP) for mentoring. Also provide support for faculty who want to go deep into learning a technology that is not traditionally supported (i.e. learning a database or programming language).

The campus should investigate the following technologies, which may have an impact on teaching and learning: augmented reality, integrated technology, mobile technologies, virtualization of applications, and three-dimensional video capture and television.

**Continue to Support the Following Technologies**
The committee feels that the following technologies are fruitful for ongoing support: Learning management systems, clickers, email and calendaring systems, web pages for faculty and staff, (including wikis and 'blogs), social networking applications, plagiarism detectors, projectors, labs including allowing classes to teach there, digital projectors, videoconferencing, and virtual private network connectivity to campus services.

**Add Support for the Following Technologies**
The campus should consider adding support for the following technologies over the next four years: streaming media; smart boards; document cameras; campus calendaring system and integration; web conferencing (for example WebEx); secure exam-taking software (for example Exam Soft); classroom lecture capture; web-based conferencing; conferencing systems to support other communities such as universities, non-profits, and businesses; web 2.0-based learning management system; improved search engine for the www.colorado.edu site; increased data storage; security options that would allow outsiders to access campus resources; mobile technologies including compatibility among mobile devices; push technologies; web content management; iTunesU; lock-down software for browser use in class; software for verifying identities and protecting identities; and wireless printing.

**Long & Short Term Objectives/Timeline:**

**Year 1:** Continue to work on the 2006 recommendations from Chapter 1 of the IT Strategic Plan — Timeline: 1 year. Continue to develop (and market) the "one start" shopping model of HELP, web resources, and portal — Timeline: 1 year. Establish a process for phasing out dates for centrally supported technologies — Timeline: 1 year. Improve communication about technological services available to the campus — Timeline: 1 year.

**Year 2:** Improve processes for selecting and user-testing technological services to be offered to the campus — Timeline: 2 years

**Year 3:** Establish criteria for recognizing faculty members' use of educational technologies and implement a program to recognize them — Timeline: 3 years
Expand support for, and services in, visual interactivity, file storage and sharing, widely adopted technologies, and discipline-specific technologies — Timeline: 3 years

**Year 4:** Expand and enhance existing support for faculty members who want to use technologies — Timeline: finished in 4 years.

**Possible Risk**
This committee identified a number of risks inherent in adopting (and not adopting) the recommendations in this chapter. These include funding risks, communication risks, cultural
risks, and support risks. Our support risks are divided into analysis risks, and vendor-related risks.

**Funding Risks**
Funding risks include the ability of the campus to implement the suggestions described in this chapter may be negatively impacted if enrollment changes dramatically. If the campus adopts certain teaching and learning tools, there may be hidden costs (open source, service contracts, maintenance fees).

**Communication Risks**
Communication risks include the possibility of messages sent not being received and understood by campus constituents.

**Cultural Risks**
Cultural risks include unanticipated consequences from the adoption of a new teaching and learning tool. For example, adopting a learning management system may lock us into working with an ecology of third party vendors that interface with the primary LMS vendor. For example, once you are invested in the world of Blackboard, their SafeAssign tool makes sense financially, but it may not be the best tool to use. Another cultural risk is a backlash against a teaching and learning tool if it was not vetted appropriately ahead of time. A further risk is that some technologies might be used in ways that could bring harm to users. For example if Excel files are kept on unprotected hard drives, FERPA data may be exposed to people who want to steal that data.

**Analysis Risks**
Analysis risks include that the campus may inadequately assess campus need, and thus "miss the boat" with tools it supports. That is it may pick the wrong tool for the wrong audience or situation. Additionally, the campus may over- or underestimate the need that supported tools are envisioned to meet. Without a careful analysis of tools to be supported, the campus may end up with duplicated tools or redundant tools being supported.

**Vendor-Related Risks**
Vendor-related risks include that the campus may find it attractive to purchase licenses from third party vendors and then find itself not able to be as flexible with the tools provided by that vendor. The campus may settle on one or two vendors and find that those vendors have too much control over our budget outlay or services to the campus. Conversely, the campus may work with too many vendors and find that it’s ability to manage relationships with vendors is strained. Vendors may discontinue support or force us on an upgrade path that isn't ideal for the campus. Finally, vendors may change direction in the services they provide, thus leaving us with fewer attractive reasons for working with them.

**Resource Allocation**
Cost of the project: This committee did not feel it had the knowledge of resources that would be needed to implement its recommendations.

**Responsible Parties**
The AVC for IT and CIO should establish a Technology Advisory Group (TAG) that reports to the CIO for the purposes of advising ITS on technology policy, investment, and support. The TAG should be comprised of faculty and staff who have both expertise and interest in using
technology. The TAG’s charge should be to provide advice regarding the development and implementation of coherent, efficient policies that support both the innovative uses of technologies as well as effective dissemination and implementation of established technologies. All constituencies on campus are responsible for effective implementation of technologies to support research, teaching, and service mission of this campus. So the AVC for IT office should provide support to assist these constituencies in assessing the effectiveness of their technology support programs.

**Evaluation**

Evaluating the recommendations listed here is very important. A coherent approach to evaluate any technology policies, processes, or tools should consider:
(a) the quality and appropriateness of an adopted technology,
(b) the quality and impact of its dissemination, and the
(c) the impact of the technology on outcomes (e.g., student learning, faculty research, work productivity, and/or service/outreach).

We encourage the campus to develop incentives as well as specific measures that promote faculty and departments to evaluate more effectively and systematically the use of technology to support student learning.

The campus should establish a function to evaluate the effectiveness of teaching and learning tools. This should be applied to tools being considered before adoption (see the recommendation from the 2006 ITSP on the Faculty Evaluating Emerging Technologies (FEET) group.

This function should also be applied to tools and services being supported currently. Findings from this function should be shared with the entire campus and should be a major source of input for the IT governance group and the various groups on campus who are involved with faculty development. Just as importantly, findings from this function should be used as input by campus-level program managers in deciding which tools and services will be retired and which ones will be launched.