

UT College of Natural Sciences

Information Technology Vision Plan

2008-2009

Note to the reader: This report is intended to be read on-line. Hyperlinks located throughout the document provide access to in-depth information, narratives of specific projects, and photographs of facilities located on the College of Natural Sciences web site.

Overview of Facilities

The [College of Natural Sciences](#) is expansive. On the main campus, we occupy thirteen buildings and have a presence in seven more. Our facilities include [McDonald Observatory](#), [Lady Bird Johnson Wildflower Center](#), [Texas Memorial Museum](#), [Brackenridge Field Lab](#), and the [Marine Sciences Institute](#). All of our facilities enrich the educational experience of our students.

Technology Classrooms

The College of Natural Sciences has 54 general purpose classrooms, all with standardized teaching technology. Additionally, departments have more than 33 classrooms and seminar rooms, most of which are equipped with standardized technology. Web resources: [inventory of general purpose classrooms](#) and [inventory of departmental classrooms](#).

Computer Labs

The College of Natural Sciences has 31 computer labs with about 750 computers. Of these, four labs (WEL 2.302, RLM 7.306, ESB 101, and ESB 103) having a total of 177 computers are open to every UT student, regardless of major and current coursework. Web resource: [inventory of computer labs](#).

Science Labs

Students experience what they learn in the classroom in the college's more than 75 teaching labs, most of which include information technology. Computers are used to control scientific equipment, gather and analyze experimental data, and create and print lab reports. Web resource: [inventory of science labs](#).

Wired and Wireless Network

The College of Natural Sciences has the largest 802.11g (54Mbps) wireless network on campus, covering virtually 100% of its dozen buildings on main campus. More than 20 telecom closets filled with networking electronics provide 10/100 and gigE wired networking to classrooms, laboratories, and offices. Web resource: [network overview](#).

Specialized Facilities

Several departments, as well as the dean's office, have multimedia labs offering students access to high-end computers with specialized software, large format printers, color printers, and scanners. Most departments run their own servers, providing web space, file storage, and e-mail to students.

Maintaining Facilities

The College of Natural Sciences has been entrusted with millions of dollars of student fee money over the last decade, and we are dedicated to protecting that investment for the benefit of current and future students. Maintaining instructional facilities and repairing/replacing equipment as it ages is a huge expense.

Some examples: The college places more than 1,000 computers in front of students. With a four year life cycle, 250 must be replaced each year at a cost of around \$300,000. The college has more than 100 LCD projectors in its technology classrooms and science labs. Replacing aging projectors at a cost of \$4,000 each costs \$100,000 a year. Replacing projector lamps when they burn out costs more than \$50,000 per year.

The college funds two full-time staff and 25 student assistants to maintain its classrooms. We employ off-campus specialists to clean the fabrics and floors in our rooms, remove gum and food stains, and repair and repaint when needed. Web resources: [Classroom Maintenance and User Support Team](#)

Innovation

In addition to maintaining its existing facilities, the College of Natural Sciences uses ITAC funds to support innovative uses of information technology in its instructional programs. The college has leapfrogged traditional Podcasting and provided its students with recorded lectures that include multiple video windows in addition to audio. Students can now watch a recording of their instructor working a math or science problem on a document camera while listening to the explanation. Web resource: [Lectures on Demand](#)

Technology is enriching the experience of students in science labs. Cameras attached to microscopes allow the instructor to project the image from any microscope onto the projection screen for viewing and discussion by the entire class. Scientific equipment now interfaces directly with computers, so students in labs can focus on learning instead of transcribing and graphing data.

Natural Sciences leads the university in the use of student response systems, which allow faculty to ask students questions during class to identify misunderstandings or miscommunications. Every general purpose classroom is equipped with a radio frequency student response system from eInstruction.

Information technology provided with ITAC funds plays an important part in several innovative programs in our college, including the [Freshman Research Initiative](#), [UTeach](#), and the [Division of Statistics and Scientific Computation](#).

New Initiative: “Free” (Student Fee Funded) Printing

Over the years, students have regularly expressed concerns over the cost of ITS provided printing. This fall ITS raised their rates to 11 cents per page, explaining that they were not making a profit: it actually costs them this much to provide printing. The College of Natural Sciences did a study showing that we could provide printing at a fraction of this cost. In fact, we could provide it so cheaply that we could use student fee money to fund limited “free” printing. At an estimated cost of one cent per page for consumables (*i.e.*, paper and toner), we can fund one million pages in a lab for only \$10,000. Students would have to pay ITS \$110,000 for the same number of pages. Because our labs are proctored, we do not have to hire staff to look after the printers. And, the cost of high speed printers is dropping rapidly.

A decision was made to offer students limited “free” printing in all Natural Science labs as of September 1, 2007. Page quotas are set by the individual departments and are usually determined by the number of courses in the department in which the student is enrolled. We emphasize that we are providing free printing not just to Natural Sciences majors but to students from across campus who use our labs. In addition to free black-and-white printing in computer labs, we provide free color printing in science labs, where color is required for lab reports. And, we provide students who are doing research posters with free large format color printing.

Serving the Entire University

Student fee money spent by the College of Natural Sciences benefits not only science and math majors, but students and faculty from across the university. Faculty from outside our college teach in our general purpose classrooms, using the teaching technology and taking advantage of our help desk. Student organizations regularly use our auditoriums in the evenings and on weekend. Virtually every undergraduate will visit our science labs and computer labs when they take the math and science courses required for their degree. We even operate special laboratories for students from other colleges, such as physics labs for engineering majors and a chemistry lab for nursing students. Our student study areas, wireless network, and joint-use computer labs are resources for every student on campus.

Synergy of Multiple Funding Sources

The College of Natural Sciences combines revenue from multiple student fees (including the ITAC fee, the CNS IT fee, and the CNS Equipment Fee) to accomplish projects that would have once been impossible. For every dollar of ITAC funding received, the college invests more than \$1.50 of its own IT fees.

ITAC provides the A/V technology in classrooms that are renovated using other fees. ITAC provides the computers that control scientific instruments in renovated teaching labs. ITAC provides the high-speed wireless networking in newly created student study area. Web resources: [renovation of Welch Hall auditoriums](#), [renovation of introductory Biology labs in Painter](#), [creation of student study areas](#).

Noteworthy 2007-2008 Expenditures

Our 2007-2008 ITAC funds are being spent largely as outlined in our 2007-2008 vision plan. While it is impractical to list every item purchased with last year's ITAC funds, a few large projects are worth mentioning.

- Standardized A/V technology was added to six departmental classrooms, conference rooms, and teaching labs located in five buildings.
- Two 40-seat computer classrooms were created in ACA, the new portable building recently installed on the parking lot behind Woolrich Laboratories. When not in use by classes, these rooms will serve as computer labs open to all students at the university.
- All computers in student computer labs in the department of Mathematics and the department of Chemistry & Biochemistry were replaced with machines offering dual core processors, two gigabytes of memory, CD and DVD burning capability, and 19-in-1 media card readers.
- Late this coming spring, the college's first server room for instructional computing will open on the second floor of the Biomedical Engineering Building. This room will provide a secure and highly reliable home for servers which host instructional applications in the college.
- In conjunction with offering "free" student printing, the college has upgraded its printing capabilities with new black-and-white, color, and wide format printers in many departments.

Specific Funding Requests for 2008-2009

IT for Newly Created Biological Sciences Labs: \$150,000

As a result of the demolition of ESB, fourteen new undergraduate teaching labs in the School of Biological Sciences will come on-line over the next year: six in Painter Hall, three in Bio Labs, and five in the Biomedical Engineering Building. We will equip these labs with standard technology, including A/V systems and the ability to capture and project images from microscopes. Many labs will also be computer-equipped.

Software Licenses: \$90,000

As hardware prices fall, the cost of software licenses increases. We pay \$16,000 a year for a Mathematica site license, so that every student taking our courses can install this software on their computer. The software that interfaces with a single type of scientific instrument in an undergraduate lab can cost \$10,000. We teach courses that require students to use special purpose software, including statistical analysis programs and

Adobe software. Since the university does not have a site license for much of this software, we pay per computer in our labs to provide this software to our students.

Replacement of Aging Computers: \$300,000

One quarter of our approximately 1,000 computers in computer labs, science labs, and technology classrooms need replacement each year. We budget \$1,250 for each PC and \$1,300 for each Apple.

“Free” Student Printing: \$25,000

We offer student fee funded black-and-white printing in our general purpose computer labs, color printing in science labs where it is required to produce lab reports, and poster printing for students creating research posters. We save students thousands of dollars by providing this service at a fraction of the cost that ITS charges.

Network Upgrades and Expansion: \$250,000

By virtue of our size, the College of Natural Sciences has the largest wired and wireless network on campus. Each year we must replace about one fifth of our network electronics and expand our network to meet growing demands. We expect to replace aging electronics in several buildings next year including Welch Hall and the Marine Sciences facilities in Port Aransas. Each switch costs about \$3,000 and each wireless access point costs about \$1,000.

Servers, Storage, and Backup: \$150,000

In addition to the computers in our general purpose labs, we contribute to the cost of departmental servers used for instruction: web servers, file servers, database servers, mail servers, etc. The systems serve up class related information, allow students to apply for jobs, scholarships, and awards, and move email between students and faculty. We also contribute to the systems that back up the data on these servers.

Existing Technology Classrooms: Upgrades and Operation: \$250,000

Each year, we must replace about one quarter of the more than 100 LCD projectors in our classrooms. We also replace microphones, control systems, touch screens, VCR/DVD players, etc. And, each year we use hundreds of projector bulbs and thousands of batteries.

Special Programs: \$110,000

The College of Natural Sciences has expanded in recent years to include new initiatives and programs, including the Freshman Research Initiative, the Division of Statistics and Scientific Computation, the Wildflower Research Center, and the UTeach teacher preparation program. The college now supports the instructional IT needs of all these programs, including desktop computing, servers, and software.

Total of above: \$1,325,000

Special funds requested for innovation (proposal attached): \$253,000

Request for Funding for IT Innovation to Support Student Learning

The QUEST Learning and Assessment System

This year the College of Natural Sciences began a multi-year project to replace a heavily-used but antiquated system often referred to as “the homework service”. In use for over a decade, the homework service allowed faculty to create assignments and exams from a library of questions and students to receive and submit assignments on-line. An evaluation of the homework service revealed that while it provided valuable functionality, it was built using obsolete technology and could not be maintained or enhanced. The decision was made to start from scratch and create a new system with enhanced functionality that could serve the entire university. This system is called the Quest Learning and Assessment System (or, simply, Quest).

Current Quest Features

Quest is already one of the best software systems of its type in the world. It currently offers the following features:

The Database

The Quest database contains more than 50,000 problems in the areas of Physics, Mathematics, Chemistry, and Biological Sciences, developed by some of the finest teachers at the University of Texas. These problems have been refined over the years, resulting in clearly and concisely stated problems that accurately assess the student’s knowledge. “Bad” problems are reported by faculty and students, and they are either revised or removed from the database.

The Problems

The statement of a problem may contain any number of “variables” which are replaced by randomly generated values when the problem is used. This allows the system to generate infinitely many versions of a problem. Each student receives a unique assignment or exam containing problems of the same type and difficulty, but with different answers. Knowing other students’ answers to problems is of no value to a student; students must solve the problems for themselves. The system automatically calculates the correct answer for every version of a problem.

The Student Interface

A web-based student interface allows students to retrieve homework assignments, to input their solutions to problems, and to receive their scores on assignments and exams. While Quest maintains student grades, it is intended to complement, not replace, a course management system. Students can view the correct answers to problems after the due date and can see a detailed explanation of how to work a problem, allowing them to learn from the system.

The Faculty Interface

A web-based faculty interface allows instructors to generate homework assignments and exams for their students. Problems are tagged with descriptive keywords for easy searching and

retrieval. Tags can also indicate the difficulty of the problem or the estimated amount of time required to solve the problem. Designated faculty can create new problems or revise existing problems. Questions can be described in the TeX language, which allows mathematical notation, tables of data, and complex figures, or in the English language for questions that don't require the power of TeX.

Student Benefits of the Quest System

1. Students can retrieve and submit assignments at their convenience from any computer.
2. The overall quality of problems presented to students is increased, preventing students from wasting their time on flawed or ambiguous problems.
3. Students can know their grade immediately after an assignment is submitted instead of waiting days for a TA to grade the assignment.
4. After the due date of an assignment, students can view the correct answers and explanations of how to solve the problems.
5. TA's are freed from tedious grading, giving them more time to help students learn the material.
6. By eliminating the copying of answers, students' grades better reflect their true knowledge of the course material. A significant source of academic dishonesty is eliminated.
7. Students can practice working problems to prepare for an exam.
8. Students can receive their exam grades the same day they take their exam and can view correct answers and explanations at their convenience.
9. At the discretion of the instructor, students can receive partial credit on multiple choice problems – by being given more than one chance to solve a problem correctly.

Planned Features

Expanded Question Formats

Quest currently supports multiple choice and numeric answer questions. In the future we will support questions whose answers are free responses comprised of English words or algebraic equations. The difficulty, of course, is automating the grading of such answers since there may be multiple, equivalent correct responses.

Support for Student Response Systems

Quest will support a variety of handheld devices with keypads, allowing students to take in-class quizzes and exams using Quest instead of the traditional bubble sheets. Since problems can be graded instantly by Quest, students – at the discretion of the instructor – could be allowed to rework a problem which they missed and receive partial credit.

Creation of Testing Centers

Nighttime exams, often required in large, multi-section classes, could be replaced by students taking their exams on-line in a proctored testing center. Since questions can be randomized, all students in a course need not take exams together. Students would have the convenience of taking an exam at any time during a window specified by their instructor. Competition to use large auditoriums during evenings would lessen.

Linking Quest with Outside Content

Publishers are increasingly making textbooks and supporting materials available in electronic form. We plan to provide the ability to link problems in Quest to such materials, giving students the ability to get help with problems they find difficult. More efficient learning will take place when students do homework assignments.

Diagnostic Testing

Students entering UT from high school often lack adequate preparation in math and science. We will make available learning modules and diagnostic tests that can be used to monitor student progress before they take freshman courses at UT.

2008-2009 Proposed Budget

Continued progress on Quest requires computer hardware, programming and support staff, and faculty time to expand the database.

One full-time programmer to design and implement enhancements to the Quest system	\$ 75,000
One full-time staff member to administer the system, to provide help desk support to faculty and students, and to manage the content of the database	\$ 50,000
Computer servers: redundant front-end web/app servers, redundant back-end database servers, a development server, and associated networking hardware	\$ 48,000
Summer support for faculty to develop question banks for new courses and support for graduate students to assist them	\$ 80,000
TOTAL BUDGET	\$253,000