IT SERVICE FOR ACADEMIC UNITS: THREE PERSPECTIVES

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Three institutions vary greatly in the manner in which academic departments receive IT services. A central computer services unit provides the IT infrastructure at Messiah College, a small private Liberal Arts college, and works with the academic departments in budgeting and prioritization of projects. The School of Education at Cal State Los Angeles, a medium-large, urban, public, comprehensive university, has IT infrastructure and certain services provided by the central administration with one FTE IT technician to augment services. The Department of Chemistry & Biochemistry, at UCLA, a large urban public research university, provides much of its own IT infrastructure and services. Services and strategies are described, differences examined, and critical success factors are highlighted.
MESSIAH COLLEGE

Introduction and Background

Messiah College is a college of the liberal and applied arts and sciences located ten miles southwest of Harrisburg, Pennsylvania. It is a four year undergraduate institution with most of its 2,400 students living on campus. A wide variety of off-campus opportunities do exist, however, including a semester or year of study at Temple University.

Information technology resources have always been centralized for both academic and administrative computing. Like many other small colleges, IT services grew out of the Mathematical Sciences Department which at Messiah includes a computer science major. Early work in academic computing was primarily focused on meeting the needs of computer science majors; later it incorporated the Business and Engineering Departments, and then the rest of the campus.

Services Provided

For a small residential college, Messiah provides an environment rich in technological resources. The campus network backbone incorporates all academic and administrative buildings, the Learning Resources Center, and dormitories. Ethernet and Novell software are utilized in the system. In total, 10 computing labs provide easy access to over 200 microcomputers most of which have 386 or 486 processors. Many students bring their own computers and are able to access the network from their dorm rooms. For students who need more computing power, Pentium 120 MHz systems as well as SUN SPARCStation 20 machines are available in a special lab. In addition to computers in common labs, the IT staff supports many classrooms with 486 machines connected to local area networks and the campus backbone which are used with LCD panels in instruction. A faculty resource room also provides a place where new technology may be tried out by faculty and staff.

Software resources have grown tremendously in recent years as more faculty incorporate the use of technology in their teaching. Access to software through the networks comes through a common interface menu which is present at network login. Menu choices are given based on the level of access provided to the individual account as well as the lab from which the login was made. Because of excessive use of email and word processing from labs which includes our most powerful machines, access to some programs has been limited. Common software provided to most labs includes email (Pinemail for Students, HP Desk for faculty and staff), word processing, spreadsheet and database applications. Other programs for specific majors includes AutoCAD for Engineering, Lumena for Art, and Derive for Math. Faculty are also making more use of software which may come as part of adoption of a text for a course. Thus, Economics faculty may incorporate the use of an economic simulation, or a Sociology faculty member may use a database that is provided with the text in a research course.

Another major use of technology for the College has become the use of the Internet, and specifically browsing tools on the World Wide Web. Like many colleges, the first use of WWW was what has become commonly known as "surfing" where activity was not necessarily connected to a teaching or research agenda. While this type of activity still takes place and is seen to have value, several professors are using the Web as another way to gather data or information that can be incorporated into an academic assignment. Thus, it has become common for students to use the Web to locate home pages which may lead them to information used in a research paper, communicate with someone on a subject of interest, or use the Web in presenting a report to a class. For a campus far away from a large city or major university, the Web has become a very valuable resource.

Because of the number and variety of academic resources, along with a limited IT staff, technical and developmental assistance has been limited. It has been the approach of the IT staff, supported by the administration, to limit the microcomputer purchases to a single vendor (which may change every few years), and to restrict the variety of commonly used software packages available through the network.
In this process they have adopted a layered approach to support of machines and software. Simply put, there are three layers of support: machines and software that are considered the standard for the campus, machines and software that may have limited use for a particular department, and machines and resources that are not considered as part of the campus standard and receive limited or no support from the IT staff. The level of support determines whether the resource is able to be connected to the network, whether training and user support is offered, and whether maintenance and upgrades are supported. At this time, these decisions are made by the IT staff.

Strategies

For the past ten years, the College administration and Trustees have given strong support to the development of IT resources on campus. This may well have come from their belief that such resources were vital to the College growing and providing quality education than calls from the faculty to increase resources. The direction for development of IT resources has continued to come from IT management who have stressed the development of hardware and network resources. One example of this was the recent construction of a 70,000 square foot academic building to house the Business, Mathematical Sciences and Engineering Departments. In the construction of this facility, a substantial investment was made to make the building ready to utilize technology whether it be in computer, science or engineering labs, classrooms, or faculty offices. In all the development of resources at the College, there has never been a charge-back system for the use of technology.

While the College is rich in IT resources their use in the instructional program has progressed slowly by the faculty at large. Like so many colleges of all sizes, the “first wave” of computer users wasted no time in seeing how the new technology could be used in the curriculum. At Messiah, this group included a few faculty mostly from the Math and Business Departments. The “second wave” introduced another dozen or so from a variety of disciplines who were mostly interested in how a particular software program might relate to a course that they taught. We are just now entering the "third wave" of users which could bring the total active user group of those who are seeking to incorporate some aspect of information technology into the classroom to a significant percentage of the total faculty.

Why has the number of active users among the faculty ranks been so slow to grow and make use of the substantial resources available on campus? Certainly many factors have contributed to this situation. Part is certainly attributed to the fact that the responsibility for developing IT resources came out of the Mathematical Sciences Department which was primarily interested in developing hardware and network resources. It is also partly due to the fact that there has never been a senior administrator responsible for IT as his or her primary focus. Another major factor is the limited input faculty have had in developing IT resources during the most substantial building years. These along with the absence of a strategic plan for academic computing has created an environment where there is strong hardware infrastructure from which to draw from, but where individual faculty must take the lead for the availability and use of software resources that they deem appropriate. In cases where their software is not available on the platform put in place by the IT staff, they are out of luck. For first and to some degree second wave users all this has been a manageable problem; yet, it represents a substantial problem for most others on the faculty.

Critical Success Factors

Former Times:

In their own way of thinking, the IT management and staff has always considered themselves to have had a “service orientation” to the users. Certainly their individual attention to faculty who came to them has allowed them to address specific needs of some faculty. Yet, the absence of an open and managed process for allocating resources has in the past made them appear more political than they perhaps deserved to be labeled. Service was seen as more a result of “making a deal” with IT management than as result of an open and fair process. The lack of any kind of evaluation instrument processed on a regular basis did not allow for user input as a group.
Prioritization of projects has been another weak area for IT management. Being run either through or with close collaboration with the Mathematical Sciences Department has made many faculty suspect. Certainly, evidence is clear that the best equipment has gone to the computer science labs. This perhaps is justified by the applications they are running in those labs; however, the fact that this is not decided as an open process has been a problem.

Another problem for IT staff has been that much of the current infrastructure has been developed during times when extra financial resources (e.g., with growth in the Freshman class) are available. Thus it has been difficult to build the infrastructure with a multi-year planned approach.

Finally, training and development has been difficult for IT staff as the number of students and faculty utilizing IT resources has grown while their staff has not.

Present Times:

In the past few years at the College, there has been a major shift in the management and delivery of IT resources to academic users. For the first time, the responsibility for IT has become independent of the Mathematical Sciences Department and has been placed with an individual who reports to the President. An active academic user committee is in the process of creating a strategic plan and will recommend prioritization of budget and IT projects on an ongoing basis. The governance document of the institution was changed so that the Associate Dean of the Faculty will, by position, chair this committee. This allows for focus on efforts to integrate IT into the curriculum. Budgeting is also being done on a multi-year basis where a special fund allows for maintenance and upgrades of hardware and software. Decisions have also been made to move to software packages for applications like email that will not necessitate training sessions. These are some of the factors that are contributing toward a successful approach for addressing user needs.

Conclusions

In some ways, one could argue that the College has failed to address the needs of many of its faculty and students in the past by focusing too much on the interests of a few faculty and spending too much time and resources on hardware purchases and network development. Yet, there have been benefits of a highly centralized approach in creating the campus infrastructure. The campus backbone, local area networks, labs, classrooms, and many other IT environments now provide a stable environment on which faculty and students may build.

The key critical success factors for the future will depend to what degree leadership and management for building on those resources comes from the broad group of academic users on campus, and to what degree senior management sees IT as a vital part of the College program. Should the focus shift from infrastructure to applications that address curriculum and research interests, then this small college will be able to offer something quite valuable to its students. If support is not there for this shift, either by senior administration or IT management, then IT resources will be underutilized and ineffective in addressing faculty and student needs, and substantial financial resources will have been wasted.
Introduction and Background

Cal State LA is a public, comprehensive, urban campus with just under 19,000 student headcount. The Graduate School of Education, one of six schools, has about 2,300 students. The Information Resources Management (IRM) division headed by a vice presidential level CIO has policy responsibility for all information technology projects in the university and provides the basic IT infrastructure for the campus. The office of Academic Technology Support (ATS), one of the IRM units, provides campus wide services to academic departments and has 34 full-time positions, six of which are located in various schools across the campus. Administrative computing is provided on an IBM ES9000, academic computing is supported by a network of Sun servers, a dedicated Unix based library system, a multi-processing Sun server with over 1,500 research databases, and a minisuper computer. All full-time faculty in the university have a networked computer on the desktop with access to both academic and administrative applications.

Services Provided

The Instructional Technology Support group contains 11 positions and provides administrative office, workstation maintenance, user, and technical support services. The Network Information Services group contains 9 positions and supports the Instructional Technology Center, small systems, and database administration. Four of the school based positions, including the one in the School of Education, are in the small systems area. The Network Operations group has 10 positions and provides systems development and network/distributed systems services. There are approximately 60 student assistants and half a dozen graduate assistants in the organization. The campus backbone is a FDDI network. There are 37 academic computing (three in the School of Education) and 10 experimental laboratories containing over 1,100 microcomputers across the campus. All of the student machines are 486 class or better; about 15 percent are Macintoshes. There are approximately 40 Sun workstations in the mix. An additional 600 faculty desktop machines are supported. About two-thirds of them are 486 or better class machines and the remainder are 386 class (again about 15 percent are Macintoshes). The laboratories are supported by distributed Sun servers and over 100 software packages are provided. All of the student machines have Netscape, access to a wide variety of CD-ROM and other bibliographic databases, the automated library system, and access to various network servers. There is a 72 port modem pool to support dial-in access. And an agreement with an Internet service provider for 60 hours per month at a nominal rate is available to all students.

Strategies

The centralized ATS staff provide overall planning and coordination for services and the network, negotiate site license agreements, maintain the servers, desktop machines and supported software, provide documentation and training, run the large general purpose laboratories, provide a server based email system, bulletin board, WWW, etc. (in general, support the basic infrastructure). The school based specialists provide direct support to the faculty, maintain local area networks, support software peculiar to a given laboratory, and assist in setting up the labs for special classes. CSLA has a policy of no charge back for academic services.

The IRM division was established in the mid-1980s and over a six year period installed the campus-wide network, expanded from about a dozen labs to almost 40, grew ATS from less than ten FTE positions to over 30, moved from a mainframe for academic support to the distributed client/server model, installed a new RDBMS based administrative system, and developed a strategic planning process for campus-wide IT. In the early 1990s, the California State University System experienced major funding cutbacks resulting in approximately a 30 per cent reduction in the IRM operating budget. Every effort was made to keep the academic support intact in ATS but some cuts were made and continued growth to keep up with the campus-wide expansion of information technology could not be maintained. Between spring 1994 and fall 1995, IT lab utilization increased by over 400 percent, library sessions increased from about 1,000 to 2,000 per day, in spring 1995 alone there was a net addition of 125 workstations on the network with no additional resources for ATS. Also in this time-frame, due to changes in administrative positions, ATS planning and coordination activities moved
from working closely with Academic Affairs and the academic deans to working almost exclusively with the academic deans.

A fall 1995 faculty survey conducted by the Academic Senate showed that from 101 respondents, approximately 60 percent were somewhat or very satisfied with the Scholars Work Environment\(^1\) (the common interface on all networked machines which provides access to the various resources) versus about 31 percent who were somewhat or very dissatisfied. A question regarding Scholars Mail (the server based email system) showed about 46 percent of on-campus users somewhat or very satisfied versus 42 percent somewhat or very dissatisfied (n=112). The same question from 85 off-campus users showed about 24 percent somewhat or very satisfied versus 53 percent somewhat or very dissatisfied. Some 55 percent of on-campus Macintosh users were unhappy with Scholars Mail and 59 percent of off-campus Macintosh users were dissatisfied to some degree. Of 104 on-campus respondents, 60 percent indicated occasional or frequent problems encountered in the last quarter. And of 80 off-campus users, 62.5 percent reflected some level of problem occurrence in the last quarter.

Critical Success Factors

During the initial years of IRM as the network grew, additional resources were able to be allocated to support the growth. Also, during this period of time, significant efforts were employed to persuade faculty to increase the use of information technology in the classroom. When the budget crisis hit, despite the fact that ATS was cut less than any other part of IRM, it could not keep up with the continued need for more and more services (even though resources were reduced, the growth curve having been built for several years did not level off). Indeed, it is feasible that the budget cuts may have accelerated the use of technology by faculty and students as new and sometimes dramatic resources became available on the Internet.

The early success of SWE led to the development of a client/server based email system designed to be integrated into SWE. For a variety of reasons, it did not provide the same level of service as other email systems with which it was compared--this was especially so for off-campus and Macintosh users.

Conclusions

The IRM division and the ATS unit developed a faculty and student oriented posture over a several year period. That led to the establishment of an expectation level that could not be fully maintained when state resources were significantly reduced. The situation is made even more difficult since the growth in faculty and student usage has continued to increase while ATS resources have remained level at best.

UCLA DEPARTMENT OF CHEMISTRY & BIOCHEMISTRY

Introduction and Background

The UCLA Department of Chemistry and Biochemistry, ranking ninth in the nation, is comprised of 47 faculty, 15 emeriti (with 10 in residence), 61+ FTE administrative/departmental support staff (83 headcount), 71 research staff, 69 post graduate students, 1,188 graduate students, 2,659 undergraduate majors and 150 TA appointments. Annually, the Department provides lectures for up to 10,000 students from the campus and holds instructional chemistry labs for 7,000. This $31M operation is funded through state funds, university funds, various gifts and donations and annual contract and grant research funding of over $11M. Of the $31M, $2.5M can be considered "operating funds" for the ongoing support of departmental staff and support salaries, administration, and instruction.

Organizationally, the Department is managed by the Chair, Vice Chair, Executive Committee and Chief Administrative Officer (CAO). Comprising the support infrastructure of the Department are Offices of Personnel, Business, Mail and Information, Graduate and Undergraduate Offices, Chemical and Research Equipment Storerooms, Receiving, Machine Shop, Glass Shop, Micro Computing and Electronics Shop, Computer Services, Mass Spectroscopy Lab, NMR Lab, X-ray Lab, and support units for the various Instructional Labs.

Four years ago, the California state budget began to have a very negative impact on the departmental level budgets at UCLA. During the ensuing years, over $800K was cut from the operating funds of Chemistry and Biochemistry. A proactive and realistic departmental budget required a thorough review of all expenditures and management strategies. Each item was reviewed, sub-budgets for each of the various units was instigated for management by the personnel directly responsible for each unit. This process necessitated the layoff of many personnel; however, at the same time it was recognized we could not operate in a "computer vacuum" and new workstations and software, better LANs, and email packages were purchased or employed. Faculty were given one-time departmental allocations of $1500 each to buy additional computers or peripherals to accommodate for the loss in secretarial staff.

Services Provided

Central computing at UCLA is supported by the Office of Academic Computing (OAC) serving the research community and Administrative Information Services (AIS) charged with only central administrative system development--not departmental. Therefore, it is incumbent on the Department of Chemistry and Biochemistry to operate its own IT infrastructure. The Department maintains a 180-node Ethernet computer network with two interfaces to a CISCO router, and an 18-node Token-Ring network. Internally the Ethernet network is further split into multiple bridged and brouted segments to minimize the traffic. TCP/IP, DECNET, AppleTalk, and IPX/SPX protocols are supported on the Ethernet network and only IPX/SPX on the TokenRing/Novell 3.11 network. The departmental networking is centered around four LANNET LET-36 Intelligent Hubs with multi-channel (4 Ethernet, 3 FDDI/TokenRing, and 2Gbps Hi-Speed) backplanes. The LET-36 Hubs containing segment-switchable 10-BaseT modules, Bouters, FOIRL modules and Terminal Servers are SNMP-compliant and are managed through MultiMan Network Management System. Networked computer equipment is manufactured by Apple, IBM, HP, SGI, Sun FPS (Cray) and other vendors. In addition to the standard TCP/IP applications, there is a Client-Server Electronic Mail system (Eudora 2.1.2), a departmental Gopher server, and a World-Wide Web service using Netscape. This infrastructure serves over 400 networked Apple Macintosh, IBM PC and compatibles, Unix workstations and servers, and VAX workstations distributed between faculty and staff offices, research labs, teaching labs, shops and service areas. By and large, the Department is considered to be a “Macintosh shop.”

All members of the Department--students, staff and faculty--have access to email, WWW, Gopher and FTP servers. The WWW for Chemistry (accessed 1,000 times daily from around the world) includes complete descriptions of each faculty member’s research, course listings, departmental calendars, and hundreds of other chemistry resources. The most common software and user interfaces used in the Department include: DOS/MS Windows, MacOS/Finder, Unix/X-Window System; Informix Databases, Netscape, Qualcomm Eudora, Access, MS Word, Excel, FilemakerPro, PowerPoint, and ChemDraw. Online scheduling packages such as Now-Up-To-Date are just being evaluated and tested.

Technical assistance is provided by two service units: (1) The Microcomputer & Electronics Shop (3 FTE) is responsible for PC and compatible machine set-ups and initial training, repair, maintenance and upgrades as well as laying cable for LANs and hookups to the LAN/backbone. Services are recharged by a labor hour rate plus materials: extramural user rate of $62/hour and subsidized departmental rates of $56/hour (urgent request) and $46/hour (standard requests). (2) Computer Services (2.5 FTE, led by a Ph.D. in Chemistry) provides ongoing consultation, documentation, connectivity, assistance with program crashes, etc. For these services, the faculty members are charged based on their “use” of computers. Most faculty are considered “small” users and charged $650/year while a very few computational chemists pay $1250/year. For specific assistance on new
projects, recharge rates are set at $115/hour for extramural users and the subsidized rate of $75/hour for internal departmental users.

It is important to note that the departmental administration budget is also charged the same rates as are the research contracts and grants for assistance with administrative and instructional computing.

**Instructional Computing:**

Several courses in the Department are oriented toward teaching students about computing in general and specifically about various applications of computers in Chemistry such as the complete computer-based series of "lectures" (ChemTV=AE) developed for the second year Organic Series. There are both advanced undergraduate and graduate level classes dealing exclusively with Computational Chemistry (Chemistry 125 and 245). The Department maintains the Chemical Calculations with Computers (C3) Laboratory with 26 microcomputers for use by undergraduate students taking any of the Chemistry courses. This laboratory offers software for Molecular Modeling, NMR Data Processing, Technical Document Preparation, etc. A suite of programs on the VAX/VMS cluster was developed to assist with Student Data Entry, Grading, and Enrollment in all lower division undergraduate laboratories.

**Research Computing:**

A number of research groups within the Department are actively involved in Computational Chemistry. These groups utilize both local computing resources as well as those proved by UCLA Office of Academic Computing (OAC) and NSF Supercomputing Centers. In addition to microcomputers, workstations, and superminis available to some groups, the Department’s VAX cluster which consists of six VAX processors supports over 200 faculty and postdoctoral/graduate student users. Most users of the VAX cluster are involved in writing custom applications, accessing networked resources, and communication. Departmental computers control the operation of instrumentation in X-ray Diffraction and Mass Spectrometry Laboratories. Industry-standard RISC workstations are used for consoles for the recent generation of the NMR spectrometers allowing for remote data processing using the X-Window system.

**Administrative Computing:**

Through the campus backbone, the Department participates in the university supported online administrative systems of Personnel, Finance, Contract and Grant Management, Purchasing, ASAP (post audit transfer of funds), and Student Information Systems.

Internally, the Department has had for many years its own self-written recharge program to charge contracts and grants or faculty for the various departmental shops and sales services. Tapes from this system then are sent to the campus financial system for input. In the last four years, each and every administrative desk has received a Mac Centris or IIsi with Word, Excel, and Eudora as baseline functions. To some degree, this has allowed the Administrative Office internally to automate personnel action changes with the faculty by attaching files through Eudora email connections. This same capability will allow faculty to have monthly updates of grant financial reports. Excel has also given the Department the capability to develop a complete budget system (shadow) combining all operational funds and dispersing them to the various shops and offices for internal management.

Additional technical software assistance is provided by a single administrative staff member for the entire department. The programmer who serves as DSA for the Department to the Central Administrative Systems, also has ongoing responsibility for training Business and Personnel Office staff.
Service Strategies

Lacking specifically identified funding from outside the department for computerization, it is nonetheless the belief of the departmental management that Chemistry and Biochemistry can not maintain its national standing without the very best in computer support. The Department has been considered a leader on the campus in computing for well over a decade when the internal VAX based administrative/research systems were written and because of the early dedication to a user friendly Macintosh environment. Central university administrative systems (which prefer IBM PCs) have been requested and are finding ways to support Chemistry’s Macintosh environment [however reluctantly] for the institutionally mandated online systems. As central systems improve over time and some reengineering takes place, there will be less need for the shadow systems currently in place. Internally, the WWW technology can be leveraged to make a greater variety of information related to administrative functions available to all faculty staff and students such as recharge rates and actual use of Chemistry shops and services by individual contracts and grants.

In addition to equipment and accessibility, the ease of computing is of paramount importance--therefore, it is critical to continually employ better software such as Eudora email, new user training materials and to make information more readily available through client-server technology.

Since the recent past has needed to focus on administrative development, it is now the departmental priority to upgrade instructional computing. The C3 Laboratory, for instance, has not been able to upgrade its computers for three years. Additionally better programming off the VAX system and onto the Informix will assist the grading and chemistry experiment results reporting currently in place in the instructional laboratories especially in the First Year Laboratory Courses. Upper Division students using Beckman DU 650 Spectrophotometers would be better served if these were on-line speeding up grading time and providing more time to repeat experiments that have not worked and to achieve quality data. Graphing programs such as Igor need to be programmed to facilitate instruction so that students will be better able to analyze the results of their data. Students have been given their own email accounts, yet, there is a need for continued expansion of this capability. Currently a new project in development called Virtual Office Hours (using WWW) is having a significant impact on the communication capability between faculty and students.

Serving the research effort will continue to be a major strategy focus. Improving services such as migrating research databases and applications off older less reliable and costly systems such as the VAX is needed. The Department must continue to be dedicated to supporting the academic endeavors described by one of our leading research chemist as simply “four things”: (1) Number one is manuscript preparation using a variety of software, graphics, and computational programs; (2) Communication (which he says is beginning to push number one) in a world where collaborators may be in places such as Crete and Moscow which have “notoriously unreliable postal service” by having not only instantaneous email, but also exchanging the formatted manuscripts; (3) Teaching, possibly using extensive video animation, and communicating with the students via the recent development of the Virtual Office Hours project; and, (4) Research data acquisition. While this researcher and others like him are completely conversant with the software they are using, they feel absolutely dependent on the high quality of network connections and hardware support the Department provides.

Critical Success Factors and Conclusion

A proactive service orientation, maintenance of creative problem solving units, and strong backing for the computer support staff are absolutely critical to successful systems implementation. The Department can not afford to ignore the computing program and must do whatever is in its power financially to make the systems more available and more easily utilized by its clientele. Recent developmental work was essentially planned and carried out under the direction of the Chair, the CAO and the lead Programmer in consultation with various departmental units and faculty. While such initiatives as those enumerated above are good, there must be a sustained overview of policy and planning conducted by a departmental committee representing an integration of research, instruction and administrative computing interests. At the beginning of the major budget cuts to the Department, a Computer Committee was put in place to review systems from both the administrative and research perspectives; however, this committee enjoyed only about one and a half years of good use except for
some ongoing review of recharges. It is suggested that this committee be reconvened on an ongoing basis with responsibility to strategize on future system implementations which are in the continued best interest of the Department.²

GENERAL SUMMARY AND CONCLUSIONS

Common Critical Success Factors

_A service orientation:_ In sometimes very different ways all three organizations have emphasized a customer and service orientation. What is perceived as a service orientation depends very much on the culture and past expectation level of the campus.

_Currency of the IT infrastructure:_ All the institutions have made significant on-going efforts to maintain an up-to-date IT infrastructure which enables faculty and students to have access to networked desktop machines, common software, the Internet, and other IT resources available through the campus or regional networks. It is absolutely clear that such an infrastructure is crucial for the utilization of IT in the classroom.

_A prioritization process:_ Again in very different ways each unit has developed a prioritization process that reflects the culture of the place and allows the most needed services to be given the highest priorities. It is important that not only this occur but also that _perceived_ priorities be taken into consideration and dealt with in the user community.

_On-going education, training, and support for the individual:_ Each of the organizations has done this to varying degrees. There is a direct correlation between the level of support for activities of this type and the on-going level of satisfaction demonstrated by the user community.

_Change management:_ As the infrastructure matures, the external environment exerts pressures, and the expectation level evolves, IT management must adjust and realign strategies to meet new and perceived needs if it is to receive good marks from faculty and students. Once more, it is as important to deal with perceptions as it is to react to reality.

_Standardization:_ Each IT unit has initiated a set of standards which enhances ease of use, decreases maintenance efforts, lessons training, and enables the infrastructure to be more easily upgraded. This strategy is one not easily put into place in an academic environment but when established it seems to be valued by almost all.

_A steady stream of on-going funding:_ This is inherent from all of the above. It is not a given in many IT environments. Often allocations are made for one specific thing without regard for other consequences, or cuts in one area are made without regard for the impact elsewhere. If the infrastructure is expanded but support services are not, the result will probably be a perception from the user community that support services have been reduced.

² Gratitude is given to the following individuals from the UCLA Department of Chemistry and Biochemistry: Max Kopelevich, Programmer IV, for the explicit system descriptions herein and to Professors Christopher S. Foote and Kendall N. Houk and Academic Coordinators Marian Dietrich and John Mouser for evaluative remarks.
Conclusion

Goodman, Sproull and associates have said “...that technology is a socially constructed reality. This means that individuals or groups assign meaning to technology, which in turn provides direction for selecting information, retaining information, and making inferences about the relationship between technology and the environment. This socially constructed model is critical in understanding the use of a new technology, changes in processes or outcomes, and subsequent modification of the technology.”3 It is the belief of these authors that the validity of this statement is illustrated by the examples contained in this paper.

Certainly there are physical things that must be done if an institution is to have an IT infrastructure that is well regarded by its faculty and students. However, the physical infrastructure alone will not bring satisfaction to the users of it. Attention must be paid not only to the services offered on how to use the infrastructure but also to the organizational culture and climate in which the infrastructure is utilized. Too often those of us in IT management roles do not pay enough attention to the socially constructed reality of the technology we supply.

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