Information Technology and the Curriculum: A Status Report

Evaluating the trends and existing models of integrating technology across the curriculum can inform planning on your campus

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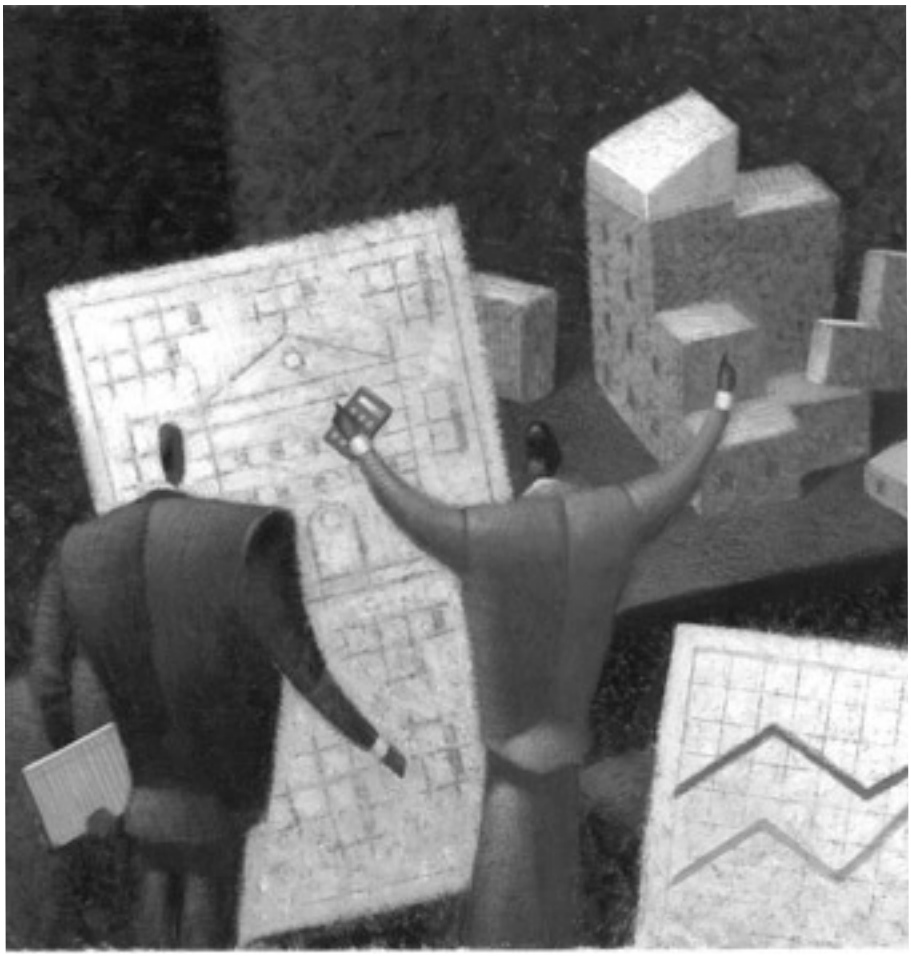
Information technology infuses all aspects of modern life, and the growth of digital information continues at an unprecedented rate. Widely influential documents, such as the National Research Council's *Being Fluent with Information Technology* and the American Library Association's *Information Literacy Competency Standards for Higher Education*, clearly outline what today's citizens need to know in terms of information technology and information literacy.[1,2] Colleges have invested heavily in campus IT infrastructures, and, for more than a decade, educational philosophy has emphasized learner-centered pedagogy, with learner-centered technology widely available at a majority of college campuses. Nonetheless, there remains a troubling gap between the promise and the reality of innovative instructional and learning practices in much of higher education in areas relating to technology and information.

The situation at Queens College, one of the colleges in the City University of New York (CUNY) system, parallels many of the trends demonstrated in the country at large. An urban campus serving a diverse community of nearly 17,000 students, Queens participates actively in the CUNY Online (asynchronous learning) initiative and is a leader in campus wireless computing access. Disparities in faculty use of technology have led to recent discussions as to how technology might be more effectively integrated into the teaching-learning process. An examination of trends and initiatives within higher education seemed likely to help inform our ongoing planning process.

This article discusses some of the challenges inherent in addressing the needs of 21st-century learners in terms of IT fluency and learner-centered pedagogy. The status of programs in information literacy instruction and Writing Across the Curriculum (WAC) are examined briefly as examples of initiatives that have grappled with some of these challenges and that are already commonplace on many campuses. The Technology Across the Curriculum (TAC) program at George Mason University, which builds on elements in these long-standing initiatives, is suggested as a model worthy of exploration, and other key elements characterizing successful initiatives are described.

Information and IT in Society

Although reports of an "information explosion" date back to at least the era of Vannevar Bush, the increasing abundance of information at the start of the new millennium seems daunting.[3] Lyman and Varian's 2003 study estimated that new stored information grew at a rate of approximately 30 percent annually between 1999 and 2002.[4] Most new information is stored in digital form, and an increasing percentage



of analog materials are being migrated from analog to digital. No wonder educators, librarians, researchers, futurists, and business and government leaders worry about our citizens' abilities to effectively deal with this expanding—and mostly digital—volume of information.

Use of the Internet is just one example of the influx of information technology into our daily lives. According to the Pew Internet and American Life Project, in December 2003 fully 63 percent of adult Americans and three-quarters of those aged 12 to 17 reported using the Internet.[5] Characteristic activities differ among various categories of users but typically include e-mail, information seeking, and electronic commerce.

Use of IT Among College Students

College students are especially frequent Internet users. Full-time college students in 2003 averaged 13.1 hours of weekly Internet use, with 84 percent accessing the Web at least daily, according to a study by Student Monitor.[6] Although 16 percent of students acquired their first computer during college, 83 percent obtained a PC before entering college, with 36 percent of those acquiring a PC prior to entering high school. Forty-three percent of students in 2003 felt that their computer skills were "far more or more proficient than the average student," up from 34 percent in the survey three years earlier.[7]

Ironically, this sense of comfort with some aspects of technology may lead students to overestimate their competence in searching for and evaluating information, as noted by Manuel and others.[8] Warnken perceptively addressed the potential gap between the availability or frequency of IT access and its effective, ethical, and legal use.[9] For example, only 26 percent of students in the Student Monitor survey believe that using unlicensed software "is unacceptable because it is actually stealing."[10]

Relevant issues include proper netiquette, intellectual property, and an understanding of the threats posed by malicious software such as worms and viruses. Effective and efficient information retrieval and management, as well as critical evaluation of electronic media, are among a host of essential key competencies. Students' positive self-assessment of computer skills exacerbates the challenge for faculty and librarians to effectively imbue students with the skills, concepts, and behaviors required for future success.

An additional caveat is that these student data reflect individuals in the traditional college-age population. The experiences of nontraditional and international students may differ substantially.[11] For instance, at the Queens College Graduate School of Library and Information Studies, many students enter the program to prepare for a second career. Even in a technology-intensive field such as librarianship, some students initially lack even an e-mail address or have relied on their children for computer assistance. This diversity of skill levels has led to two alternate sections for the required "Technology of Information" course, with students self-selecting a beginner versus advanced option.

Information Literacy and Fluency with IT

It is beyond the scope of this article to discuss the varying definitions of and controversies concerning information literacy compared to fluency with information technology (FIT). Both the National Research Council and the American Library Association acknowledged the essential inter-relatedness of their conceptual underpinnings and goals, however.[12,13] "Information fluency," defined as the confluence of critical thinking skills, computer literacy, and information literacy, is the phrase used by the Associated Colleges of the South, a consortium of 16 private liberal arts colleges and universities, to describe this set of interrelated concepts (http://www.colleges.org/percent7Eif/if_definition.html). Regardless of the terminology, the concepts and skills implied

by information fluency, information literacy, and FIT are essential to the future success of students and citizens.

From Teaching to Learning: Shifts in Pedagogy

Following (and perhaps even before) the publication of Barr and Tagg's influential 1995 article "From Teaching to Learning—A New Paradigm for Undergraduate Education," academics have discussed and often advocated a shift to learner-centered education.[14] This perspective acknowledges the value of active, constructivist learning; the potential differences in learning styles among individuals; and the importance of assessment to determine if learning outcomes have been achieved. The student is viewed not as a passive receptacle to absorb knowledge imparted by the professor but as an active participant in the learning process. The teacher's role is to design an appropriate learning environment, not just to cover the material. In short, the faculty member functions as a "guide on the side" rather than the "sage on the stage." Learner-centered pedagogy does not rule out lecturing but retains it as one of many approaches in the instructional toolkit, along with discussion, collaborative work, hands-on activities, and the use of learning technologies.

Effective educational technology can incorporate interactivity, self-paced and self-directed learning options, electronic communication and authoring tools, and varied presentations of information (text, audio, visuals, multimedia, simulation). Assessment options can include real-time feedback that permits the student to correct misconceptions and allows faculty insights into problems with the learning process.

Course management systems (CMSs) such as WebCT and Blackboard are particularly attractive examples of integrated learning-centered technology. These systems typically incorporate Web-based content delivery, electronic communication tools, and assessment capabilities in a coherent package that is relatively easy for both faculty and students to use.

Complementary developments include the growing number of Web-based learning modules developed by commercial publishers and by educational institutions and cooperative communities. Examples of the latter include MERLOT (http://www.merlot.org/), EdNA (Education Network Australia) Online (http://www.edna.edu.au/edna/ page1.html), and the SMETE Digital Library (http://www.smete.org/smete/), which emphasizes the teaching and learning of science, mathematics, engineering, and technology using electronic resources. The availability of such collective efforts reduces the burden on individual faculty members to develop their own activities and allows them to pick and choose from among an expanding palate of digitally-based learning objects.

Finally, one can hardly ignore the incredible resource potential of the ever-expanding numbers of digital library collections. Among several useful starting points are the Digital Library Foundation's Searchable Database of Public Access Collections (http://www.hti.umich.edu/cgi/b/bib/bib-idx?c=dlfcoll), the Association of Research Libraries' Digital Initiatives Database (http://db.arl.org/did/review.html), and the Inventory of Canadian Digital Initiatives (http://www.collectionscanada.ca/initiatives/index-e.html). Digital materials range from archival documents to valuable historical images to primary source materials from scientific field research. These collections may include specific learning activities or be used as unique online resources for faculty to develop their own learning initiatives.

Both information literacy and FIT assume the existence of a sound technological infrastructure as a prerequisite. Learner-centered instruction is not necessarily dependent on technology, but much of the well-designed technology available was developed with an emphasis on customization, flexibility, interactivity, feedback, and other attributes inherent in a learner-centered approach to education.

To be effective, such technology also requires reliable networks, universal access, and a sound IT infrastructure. While budget reductions suggest continuing challenges in sustaining IT functionality, the data suggest that in most cases these prerequisites have been well addressed on college campuses.

IT Infrastructure and Use

Colleges and universities have invested substantial sums in building solid technology infrastructures in all segments of the campus environment. These investments reflect not only perceived student and parental expectations but also the need to stay competitive with other institutions. The EDUCAUSE *Student Guide to Evaluating Information Technology on Campus* emphasizes the kinds of questions to ask about IT when selecting a college or university.[15]

A solid IT infrastructure is not necessary simply for a healthy level of student admissions and retention. As McCredie noted, "the strategic downside of not adopting transformational new technologies is extinction."[16] A competitive IT infrastructure is necessary to attract and retain talented faculty, succeed in the quest for outside funding, and meet the bureaucratic reporting needs of government and accrediting agencies.

Green's annual *Campus Computing Survey* indicates steady progress in the technology infrastructure in higher education since its inception in 1990.[17] Data from the fall 2003 questionnaire indicated widespread network access in faculty offices (98.9 percent), classrooms (85.9 percent), and dorms (83.5 percent) for the 559 reporting institutions, a cross-section of two- and four-year campuses in the United States. Wireless LANs were available on more than 75 percent of reporting campuses, with implementations planned at an additional 15 percent of reporting campuses over the next five years. Approximately 82 percent of campuses provided access to a CMS. Blackboard and WebCT predominated, with 40.4 percent and 32.8 percent of the CMS implementations, respectively.

Problems with Reaching IT Fluency Goals

In their book *Higher Education in the Digital Age*, Duderstadt, Atkins, and Van Houweling asserted that although information technology has affected nearly every segment of society—from corporations to governments—higher

education provides a stark contrast: "To date, the university stands apart, almost unique in its determination to moor itself to past traditions and practices, to insist on performing its core teaching activities much as it has in the past."[18] The lecture method is literally unchanged from its introduction centuries ago, and many technology innovations remain in limited use.

The available data to a large degree support their contentions regarding the use of IT within academe. The Green study, for example, reported relatively low use of computer-based classrooms/labs (32.1 percent of classes), course management tools for online course resources (33.6 percent), and Web pages for class materials (37.4 percent of classes).[19] With an average of 82 percent of campuses providing access to a CMS, this suggests a tremendous underutilization of an expensive campus investment. More encouraging signs include the incorporation of e-mail (in 71.8 percent of classes) and Internet resources (in 52.9 percent of classes). Given that e-mail is the most popular use of the Internet, followed closely by information seeking, these findings simply tend to parallel larger societal trends, however.[20]

A smaller-scale qualitative study at the University of Washington (UW) provides an additional perspective to consider in assessing the state of IT in at least one higher education learning environment.[21] Through multidisciplinary focus groups of approximately 100 faculty and students, UW's Program for Educational Transformation Through Technology expanded on a 2001 survey of faculty educational technology practices. Students emphasized their expectations for the integration of technology into their education and expressed concern that these expectations were not being met. Specific technologies considered important by students included course Web sites (perhaps mandatory for all classes); *effective* (emphasis added) faculty use of PowerPoint; discussion boards; e-mail as the primary mode of communication with faculty; and Web-based research resources. Other technologies and instructional methods valued by students included instant messaging, Microsoft Excel, the use of video clips to reinforce lecture material, and hands-on, self-paced, progressive learning opportunities.

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Faculty in this study also considered PowerPoint, discussion boards, and Web-based research important. More striking, however, were the faculty concerns about overcoming the barriers to implementation of these technologies into their curricula. Perceived barriers included their own lack of skill, equipment, and time. Further, the wide range of skill levels among faculty was viewed as hindering communication with departmental colleagues; many individuals simply did not feel comfortable with the culture of educational technology. Faculty perceptions reported in this study are particularly interesting in view of the strong emphasis at UW on faculty technology support through various components of its UWired initiative (http://www.washington.edu/uwired/projects/index.shtml).

IT funding continues to be a serious campus challenge according to both the "Fifth Annual EDUCAUSE Survey on IT Issues" and the Green study. However, "assisting faculty in integrating technology into instruction" was considered to be the single most important IT challenge (out of 10 options) over the next several years according to Green respondents (21.4 percent).[22] "Faculty development, support, and training" were similarly ranked 5 and 6, respectively, out of 10 of the top IT issues in the EDUCAUSE survey.[23] Given the competition from such areas as funding, security, administrative systems, and network maintenance, the placement of a relatively "soft" issue among the top 10 by EDUCAUSE respondents signals an acknowledgement of its importance in a time of burgeoning costs, technical complications, and rising expectations for technical infrastructure.

IT Use at Queens College

The General Education Task Force appointed by Queens College President James Muyskens in the spring of 2003 was charged to establish goals and definitions for general education and suggest procedures for the ongoing review and revision of general education programs and requirements. A working document in the spring of 2004 identified critical abilities that might be developed and reinforced throughout the curriculum. This document prompted

- reconsideration of a 2001 concept paper proposing a "Queens College Technology Across the Curriculum" initiative and
- the current review of IT-related initiatives that might help to inform the planning process.

The deliberations and initial reports of the task force were an impetus behind the spring 2004 discussions of an ad hoc group of faculty, librarians, and administrators seeking to promote greater use of technology in teaching and learning at the college. Selected units on campus—such as Geology, Library Science, the Honors Program, and various departments of languages and literatures—rely heavily on technology in their instructional activities. Many faculty are unaware of existing resources, however, or have not yet adopted technology into their teaching repertoire. The group sought to bring together technology early adopters to brainstorm ways to involve more of the faculty in these activities, as well as to consider ways to bring various competencies (such as electronic communication, teaching with technology, and information fluency) under one umbrella.

Disparate campus committees and offices are involved in a range of issues relating to teaching excellence, information technology, library resources,

and educational technology. Despite overlap and consultation among groups and individuals, differing administrative reporting structures limit the degree of coordination. The pending proposals of the Queens College General Education Task Force suggest a common framework to coordinate a more unified approach to the incorporation of technology in the teaching and learning process.

Information Literacy Instruction

At many institutions librarians have played a leadership role in the implementation of information literacy instruction programs, if not institution-wide, then at least centered within the library. Many such efforts effectively incorporate the use of IT in the instructional process while partnering with other key institutional stakeholders such as faculty, IT staff, and administrators.

The National Forum on Information Literacy maintains a detailed list of "Information Literacy Web Sites" that point out successful projects that could serve as potential models for other institutions, as well as many other useful resources.[24] The former include programs such as the interactive Texas Information Literacy Tutorial (TILT), SUNYConnect (State University of New York), the CSU Information Competence Initiative (California State University System), and UWired (University of Washington).

These examples are reinforced and extended by *Characteristics of Programs of Information Literacy that Illustrate Best Practices: A Guideline*, published by the American Library Association.[25] Developed in multiple phases with input from a wide range of professionals in higher education, the publication provides a useful roadmap for well-integrated information literacy instruction. The guideline emphasizes the importance of integrating information literacy into the curriculum; participation and collaboration among disciplinary faculty, librarians, administrators, teaching and learning specialists, and others; diverse approaches to teaching; and appropriate use of technology and other media resources. In addition, it stresses the importance of administrative and institutional support and of assessment and evaluation, among other key elements.

Unfortunately, the *National Information Literacy Survey* conducted by the Association of College and Research Libraries and the American Association of Higher Education suggests that—as with the status of the "learning paradigm" across campuses in general—there is a gap between the best practices espoused in the guideline and actual implementation of information literacy instruction throughout academe. The survey reported widespread familiarity with the American Library Association's *Standards for Information Literacy Competency for Higher Education* but noted that most respondents were just beginning to develop programs.[26]

Writing Across the Curriculum Initiatives

The idea of integrating themes or activities "across the curriculum" is hardly limited to information literacy. Varied examples of such programs include

- "Critical Thinking" (http://www.kcmetro.cc.mo.us/longview/ctac/toc.htm),
- "Blogging" (http://mywebspace.quinnipiac.edu/PHastings/bac.html),
- "Language and Learning"(http://www.sfasu.edu/lalac/),
- "Mathematics" (http://www.unr.edu/mathcenter/mac/), and, of course,
- "Writing Across the Curriculum" (see, for example, <http://owl.english.purdue.edu/handouts/WAC/> and <http:// www.mala.bc.ca/www/wac/wac.htm>).

Writing Across the Curriculum programs are particularly strong examples of instruction integrated across the curriculum, well entrenched at a wide range of higher education institutions. Like information literacy or library instruction, Writing Across the Curriculum programs have been around for at least 30 years. McLeod's 1989 survey of postsecondary institutions in the United States and Canada identified 418 institutions with such programs, or 38 percent of the respondents. She noted, "This seems a remarkable number, considering that just a decade ago, only a handful of such programs existed. Writing across the curriculum is clearly alive and well, and just as clearly, is still growing as a movement."[27]

In a follow-up study, Miraglia and McLeod observed that "Since that time, and even as we write, WAC programs are still being born, and the landscape continues to be dynamic."[28] Examining those programs that have endured since the initial survey, the authors found them more likely to be characterized by continuing administrative support and funding, broad faculty support, and strong, consistent leadership compared to shorter-lived programs. Further, they reported an apparent openness to cooperating with other educational movements, such as critical thinking, learning communities, and computers across the curriculum, which might contribute to their success.

George Mason University's TAC: A Possible Model

The Technology Across the Curriculum (TAC) program at George Mason University (http://www.educause.edu/AwardWinners/1358) builds on principles embodied in both information literacy instruction and Writing Across the Curriculum models. The program was a recipient of the annual EDUCAUSE Award for Systemic Progress in Teaching and Learning, and an article focusing on components of the program was recognized as the winner of the 2001 *EDUCAUSE Quarterly* Contribution of the Year Award (http://www.educause.edu/EDUCAUSEQuarterlyContributionoftheYearAward/768). An extensive and up-to-date Web site provides detailed insights into the workings of the program (http://cas.gmu.edu/tac/). Examination of this highly recognized model helps illustrate how efforts to integrate technology into the institutional culture of higher education can be introduced or conceptualized.

George Mason's TAC program is a collaborative effort between the College of Arts and Sciences and various units of

the Division of Instructional and Technology Support Services (DoIT). Its mission is to promote effective uses of technology to enhance learning and to ensure that the university's liberal arts students develop a high degree of fluency in information technology.[29] Modeled after the university's Writing Across the Curriculum initiative, the program is organized around a framework of 10 core IT goals, including electronic collaboration, presentations, online research and evaluation, quantitative analysis, graphical representation, and legal and ethical issues in IT.

Developed with input from faculty, students, technology specialists, and potential employers, the goals identify both basic and advanced levels of proficiency. They guide curricular development within general education courses (basic skills), and faculty follow them in submitting proposals for technology-enhanced assignments for specific higher-level courses.

Detailed grids on the TAC Web site illustrate the incorporation of specific IT skills within divisions and departments and facilitate tracking progress. Profiles of funded proposals by year provide descriptions of technology-related assignments, targeted goals, assessment mechanisms, and, in some cases, assignment examples. Other features of the program Web site include an "impact" summary page of participation by year (students, courses, departments, faculty), a year-by-year calendar detailing program highlights by month, and a detailed description of the Multi-Level Assessment Plan. The diversity of assessment measures is exemplary, facilitating both quantitative and qualitative means to gauge success.

Agee and Holisky identified five elements that differentiate the TAC program from prior instructional technology efforts at George Mason University: "ongoing support, support focused on course development, use of technology for learning, coordination of faculty efforts, and a clearer connection between faculty initiatives and the university support structure."[30] Other key elements include adequacy of funding, especially as part of the base budget; an emphasis on student use of technology for learning (rather than faculty use of technology for teaching); and the sequencing of technology-enhanced activities, so faculty can design assignments with the expectation that students will build on previously developed skill sets.

Consider which elements are most important in characterizing successful programs versus which might be the easiest to target when starting out.

DoIT reorganized existing units to create a more effective IT support unit (http://cas.gmu.edu/tac/support/index.html), which appears to have played an essential part in the success of this initiative as well. Key components of DoIT include an Instructional Resource Center (with detailed how-to guides and multimedia resources posted on its Web site), a Technology Assistants Program (to assist faculty), and a Student Technology Assistance and Resource Center (to assist students with skills needed for TAC assignments).

Getting Started

Impressive as the TAC program at George Mason undoubtedly is, for many other campuses seeking to develop such a program, the process is likely to seem challenging—if not completely out of reach. Table 1 summarizes specific features that characterize some of the more successful initiatives in information literacy instruction, Writing Across the Curriculum, and Technology Across the Curriculum.[31–33] Remember that many of these elements did not spring forth full-blown on their respective campuses; any such comprehensive institutional program is typically developed in stages over time. The various components of a program might be introduced incrementally, with these characteristics suggesting a blueprint for elements to include.

In examining the table, notice at least two discrete components: those pertaining to process (how to initiate and maintain a program) and those relevant to the substantive characteristics of these initiatives (pedagogy, integration, use of technology). Both are clearly important to a fully integrated initiative but from a tactical standpoint might be approached somewhat differently. For example, consider which elements are most important in characterizing successful programs versus which might be the easiest to target when starting out. The two are not necessarily the same, and practical considerations might require focusing on what can be done (such as small experiments in student-centered, active learning) before embarking on what could be done in an ideal world (a full-scale initiative).

An outside force—such as accrediting agencies or a multi-campus system—might impel initial planning efforts. At City University of New York (CUNY), the system's executive vice president for academic affairs invited proposals for selected campuses to participate in a general education pilot project in the spring of 2003. Such models as Writing Across the Curriculum, freshman learning communities, IT initiatives,

and teacher-preparation programs were specifically suggested to campus presidents as possible vehicles for reorganizing often disconnected degree requirements, and up to $50,000 was provided to participating campuses in support of the planning process.

At Queens College, the general education pilot project was instrumental in prompting the initial ad hoc discussions regarding the role of technology on campus. Alternatively, the "self-study" report typically required for reaccreditation by regional or professional accrediting agencies could act as a springboard for the development of planning documents that incorporate the role of technology in the teaching and learning process at either the institutional or departmental level. At George Mason University, corporate leaders and state legislators lobbied for graduates capable of functioning well in a high-technology environment.[34] Whatever the impetus, references to best practices in the field can help in the conceptualization and development of similar initiatives.

A consistent process theme across programs is broad-based participation, collaboration, and communication. Seeking to involve as many relevant stakeholders in planning and goal-setting as possible is essential to developing a broad sense of ownership of the project, as is true in any institution-wide planning initiative. This could involve a tricky balancing act of top-down and bottom-up leadership. Academic leaders must articulate an overall vision emphasizing an appreciation of technology's role in learning and take steps to ensure ongoing funding, adequate staffing, and support. Remember, though, that faculty, IT staff, librarians, educational technologists, and students will be closest to the ultimate implementation of technology in the teaching and learning process. They are likely to have the clearest appreciation of the opportunities and roadblocks that will ultimately determine any project's outcome. In addition, working within an existing local governance structure—engaging department chairs, relevant committees, and other campus leaders—is nec-

Table 1

IT Initiatives: Guidelines for Success

Category	Characteristics
Mission, goals, and objectives; planning	■ Broad participation—campus and community ■ Input solicited from key community stakeholders ■ Goals: measurable, regularly evaluated and reviewed, consistent with institutional goals ■ Established priorities and resources ■ Strategies of implementation and adaptation ■ Formal and informal communication
Administration/ institutional support	■ Strong, consistent leadership ■ Ongoing funding ■ Appropriate staffing ■ Collaboration encouraged ■ Achievement and participation rewards ■ Broad-based awareness and support
Integration with curriculum	■ Emphasis on student learning ■ Local governance structures ensure institution-wide implementation ■ Competencies by discipline and course level ■ Appropriate sequencing ■ Participating programs/courses identified
Collaboration	■ Broad-based participation (level, discipline, role) throughout
Pedagogy	■ Student-centered, active learning ■ Diversity of approaches ■ Technology integrated ■ Openness to innovation ■ Builds on existing knowledge ■ Linked to coursework and real-world experience
Staff	■ Faculty, librarians, IT staff, administrators, etc. ■ Adequate in number and skills ■ Systematic and continuing professional development; release time provided ■ Serve as role models/advocates ■ Regular evaluations
Support and instruction (faculty, staff, and students)	■ Diversity of delivery mechanisms and support structures ■ Assessment: identify unmet needs and support effectiveness ■ Creative targeting of groups to maximize support staff effectiveness
Assessment	■ Course, department, program, faculty, and students ■ Short-term and longitudinal ■ Process as well as product ■ Variety of outcome measures (qualitative and quantitative) ■ Integrate with planning, goal-setting, and program administration
Outreach/ communication	■ To a broad variety of constituencies ■ Various media ■ Share information with others ■ Celebrate success

essary so that the program is viewed as integral to institutional operations.

Pulling these disparate forces together is most likely to be achieved by designating a dedicated team leader to serve as program champion and center of communication and collaboration. Such a leader must be given appropriate authority as well as responsibility, or the likelihood of success decreases markedly.

The challenge of recruiting these key players in the face of their many competing priorities and responsibilities is not trivial. This is where technology support, release time, rewards for participation and achievement, and the opportunity for professional development will play differing roles among the diverse participants likely to become involved. A one-size-fits-all approach is unlikely to be effective; asking faculty or staff what would be most appropriate for their respective needs will better enable the efficient application of resources.

Depending on the institution, a number of possible alternative (or concurrent) approaches could be considered initially. For example, a pilot project could focus on a specific department, program (such as first-year learning communities), or sequence of courses. The pilot could explore alternative pedagogical approaches to reaching specific technology competency objectives in the target group. Evaluation measures would identify specific areas of need for technology support (both for faculty and students) and then target resources and programs to meet those needs. Experiences gained in such a trial could then be applied on a larger scale to other sectors of the university.

Initial Steps at Queens College

A related challenge behind any IT-based learning initiative is building a partnership of leadership across units and disciplines, or even within departments, along with recognition of the value of integrating technology into the teaching and learning process. At the departmental level, this could take the form of course coordinators charged with overseeing multiple sections of highly subscribed courses. Faculty teaching basic and intermediate Spanish courses in the department of Hispanic Languages and Literatures at Queens College, for example, share a common Blackboard site developed by the course coordinator, Monica Casco. This ensures greater consistency in instruction, facilitates the orientation of adjunct faculty, and reduces the burden on individual faculty due to shared development of easily retrieved handouts and exercises. In addition, Casco serves as the first point-of-contact for technology assistance within the department.

"I am happy to be in a position where I can use my experience to help my colleagues with their technology questions," Casco commented. "Having another faculty member as a technology resource in our department reduces frustration and helps create an environment where people feel comfortable experimenting with new approaches to teaching."

In the college's Graduate School of Library and Information Studies (GSLIS), technology-based assignments in required core courses are designed to develop key skills that instructors can build on in more advanced courses. In addition, a departmental vote in support of Blackboard has resulted in its gradual implementation across most of the curriculum. Students now routinely expect Blackboard as an integral course component, creating interesting pressures for adoption on less technologically oriented faculty. Such gradual changes can help to create a technology-friendly environment where colleagues freely share ideas and teaching strategies.

Within the Queens College libraries, information literacy instructional efforts have emphasized participation in the Freshman Year Initiative, called FYI. This campus program is characterized by freshman learning communities, where subsets of first-year students take courses together and participate in outings to share learning experiences. Librarians work with FYI faculty to design appropriate learning sessions for students. As in Hispanic Languages and Literatures and the GSLIS, FYI and library faculty coordinators work to ensure consistency through common tools, the use of Blackboard, and frequent communication. Plans to include not just lecture but also hands-on practice for students using information resources are expected to lay the groundwork for potentially broader application through anticipated general education requirements, once the task force submits its full report.

Chief Librarian Sharon Bonk observed, "I see information literacy and information technology across the curriculum as complementary and reinforcing," while acknowledging the substantial need for technology support for both faculty and students to fully implement such a full-fledged initiative across the curriculum. Given budgetary realities, of course, technology support is not always allocated or sustained.

The value of cross-unit collaboration and coordination is important at the individual course or faculty level as well. Developing technology-intensive courses is easier when the instructor can consult with knowledgeable colleagues in the IT department during the planning phases to ensure that campus resources can support expected course activities. But the ability to communicate effectively about technology issues can be seriously hampered by lack of technical knowledge, as noted by faculty at the University of Washington.[35]

Building a broad-based knowledge or skill base that facilitates communication across technical boundaries is one means of addressing this challenge. Ideally, campus support structures provide the range of innovative technology expertise and assistance that characterize George Mason University. In reality, not all institutions are so fortunate. Creative approaches can be used to build a base of expertise and awareness among faculty and staff, a base that can function as a potential core for subsequent development of a more extensive campus program.

Despite limited dedicated educational technology staff, a workshop program at Queens involving volunteer faculty "technology gurus" has successfully trained dozens of faculty in such topics as the use of Microsoft Office, Blackboard, and digital media. One

advantage of faculty training faculty is that instructors can focus not just on the technical details of using a particular technology tool but also can discuss pedagogical tips and challenges.

Computer science students are available to assist faculty in specific course-development projects, and Web services staff can provide assistance in designing and understanding Web-related concepts. On the other hand, because faculty are used to being the experts, it can be a difficult adjustment for some to feel like beginners, whether assisted by IT staff, students, or faculty colleagues.

As on many other campuses, library faculty routinely offer discipline-specific faculty workshops on new electronic resources and services, along with instruction geared to students. Other approaches include grant-funded training initiatives such as the CUNY Online Project. Although limited in duration, this Sloan Foundation–funded initiative provided release time and online instruction in the development of asynchronous or hybrid courses throughout the university in return for faculty agreement to teach a course online. Participants were connected with colleagues throughout the CUNY system, creating useful networking opportunities of potentially enduring value. As previously noted, however, not all faculty are aware of these opportunities. Even Queens College would benefit from better publicizing existing support and instruction options.

Challenges and Conclusion

Such piecemeal efforts as conducted at Queens College hardly equal the robust, fully-integrated program that George Mason's TAC exemplifies. Not all campuses have the financial resources to initiate a funded proposal-based program for innovative course-related technology projects, or the extensive technical support of George Mason University's DoIT, both of which are hallmarks of the TAC program. Nonetheless, small-scale projects offer a useful way to test the feasibility of a greater emphasis on technology-enhanced learning on campus, provide useful demonstrations for other faculty, and identify potential key players for larger-scale initiatives.

As previously noted, many key elements are in place at Queens College and within higher education as a whole. Surveys suggest that most colleges and universities have a solid technology infrastructure, a growing number of faculty taking advantage of these resources, and students increasingly expecting that technology will have an integral role in their college education. Many campuses have long-standing programs in either a Writing Across the Curriculum or information literacy instruction. These potentially provide at least some key individuals with experience in developing integrated instructional programs and IT-related learning opportunities. Such individuals, along with those early adopters already using course management tools and computer-based classrooms, form a potential base for developing a more extensive campus program.

Such authors as Hagner and Buckley emphasized the importance of differentiating between early adopters and second-wave faculty, with each needing different reward and support structures. In particular, Buckley advocated "faculty development systems that are transformational enough to produce change in practice but scalable enough to achieve systemic change."[36] Starting small and building on early successes through an incremental process can reduce the negative repercussions of the occasional failure. Publicizing and celebrating individual faculty uses of technology might inspire others and encourage dialogue among disparate practitioners. Also, working to develop diverse approaches to instruction and support is more likely to aid those with different learning styles, time pressures, and levels of technical expertise.

Hagner also identified "five areas that affect levels of faculty engagement: training; grants and start-up resources; technical support; assessment; and communication."[37] Of these, he noted that none of the other four areas will have the desired outcome unless communication is handled well. Getting the word out—a process in which George Mason University has excelled—is among the most important attributes of a successful effort to implement a new technology-based learning environment.

With this in mind, one of the first proposals of the Queens College ad hoc technology group was the creation of a promotional video featuring faculty technology gurus from various disciplines. The video, to be narrated by the president, is scheduled for screening at the campus Fall Convocation. The objective is to highlight the availability of existing technology resources at Queens, provide examples of how technology resources can contribute to the learning environment, and raise awareness of the Education Technology Center's mission to assist faculty. Sue Henderson, executive assistant to the president and the convenor of the ad hoc group, explained, "The Center's focus is to make available new technologies (including training) as well as to respond to faculty demand for additional support or exploration of new technologies. The central goal is to enhance the learning experience."

Showcasing the potential of learning technology and the president's use of the "bully pulpit" are intended to develop campus interest in a more extensive initiative. The lessons of other integrated technology programs should prove extremely helpful as we move toward this goal. The challenge, of course, will be translating the blueprint into action. Extensive campus involvement in planning for the General Education Program has provided a forum for broad-based communication and collaboration among the many diverse elements of the campus community. Whether this collaboration can be extended to involve all relevant constituencies and to successfully embed technology in the learning process remains an open question.

Many—if not most—institutions of higher learning have the requisite building blocks to begin to realize the promise of technology-infused learning. We have the examples of best practices from pioneering initiatives for guidance. What we most need is a partnership of leadership capable of

assembling these constituent parts into a coherent, workable whole in the face of competing priorities. Such a partnership must involve faculty, librarians, IT staff, and academic leadership. Without this leadership, we will continue to aim high but miss because of a lack of clear focus concerning what to do with the tools we have on hand. ℯ

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