Technology Initiatives and Organizational Change: Higher Education in a Networked World

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Abstract

The American system of higher education has been challenged in recent years as confidence in educational institutions has eroded. The public perception appears to be that the values and preferences of research universities, in particular, have become disconnected form the ethics and needs of society at large. This has produced demands from governing boards and funding agencies for more accountability and productivity. Furthermore, universities are perceived as failing to prepare students to live and work in a global world, as engaging in studies that are out of harmony with contemporary society, and as neglecting to empower students though involving them in a dynamic relevant learning process.

In response to this environment Virginia Tech developed an ambitious technology program called the Instructional Development Initiative (IDI) that proposes "to transform the academic lives of all students and faculty and change the nature of teaching and learning . . . ." Substantial resources were committed to provide faculty members with the necessary equipment and skills. With the focus on faculty and electronically enhanced courseware less thought has been given and few resources are devoted to devising a coherent, strategic plan and online presence for electronic services (marketing, library, bookstore, faculty instructional technology support).

We will describe two technology initiatives---Virginia Tech Online (VTO) and the Scholarly Communications Project (SCP) that are the result of self-organizing, collaborative work by information systems/library personnel, and academic faculty members. These seek to supply electronic support services currently lacking and to take advantage of the network's capacity to reach the global community. VTOnline serves as a single point of contact for all computer-mediated instruction, administrative, and information services that are available at Virginia Tech over the Internet. The SCP publishes electronic journals and international newspapers, experiments in scholarly electronic communications, and works with the university community to provide training, archiving, and electronic reserve service, in short access to library resources for extended campus learners.

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INTRODUCTION

[title slide 1]

The American system of higher education has been challenged in recent years as confidence in educational institutions has eroded. The public perception appears to be that the values and preferences of research universities, in particular, have become disconnected from the ethics and the needs of society at large. This perceived disconnection has manifested itself in a media focus on, among other things, the quality and relevance of undergraduate education. In turn, the media attention has produced demands from governing boards and funding agencies for more accountability and productivity. Furthermore, universities are perceived as failing to prepare students to live and work in a global world, as engaging in studies that are out of harmony with contemporary society, and as failing to empower students through involving them in a dynamic, relevant learning process.

Some critics argue that there is an opportunity for universities to restructure themselves through the use of digital technology into vital organizations which will enhance student learning and meet the challenges of the 21st century. Imagine a revolution in the way members of the university community teach and learn, in the way they access, transfer, and communicate information that will profoundly alter the world of higher education. More importantly, through the use of technology higher education will accommodate the educational requirements of an increasingly diverse and expanding global student population.

THE INSTRUCTIONAL DEVELOPMENT INITIATIVE *[slide 2]*

Virginia Polytechnic Institute and State University (Virginia Tech) is a land-grant and research university located in southwest Virginia with a student population of approximately

24,000. The university employs 1640 full-time, tenure track faculty and 4,000 staff members.

Media Services, formerly called the Learning Resources Center, has existed since the early 1970s, and the Center for Excellence in Undergraduate Teaching was established in the early 1990s to foster instructional excellence and innovation. Recently, the Center for Innovation in Learning (CIL) was established and endowed with substantial funds to support the development of online courses and to provide an infrastructure, technical support, and assessment of results in targeted curricular areas. CIL also serves as an umbrella for coordinating communications and developing partnerships focused on integrating technology in learning.

Despite these resources and innumerable directives from Virginia's higher education oversight agency, the State Council of Higher Education in Virginia, to use technology to increase productivity of administrative and teaching processes and to emphasize extended campus initiatives, there was, until the mid-nineties, little evidence of interest among faculty members in non-traditional teaching methodologies. In 1993, the Vice President for Information Systems and the University Provost jointly proposed an Instructional Development Initiative (IDI) and subsequently centrally funded it to redress this situation. From the outset, the goals of the IDI **[footnote 1 here?]** had three components:

[slides 3-5]

IDI Goal 1: Faculty Development

[slide 3]

The IDI provides the opportunity for all faculty in the University to participate in this faculty development program. Its overarching goal is to motivate teaching faculty members to investigate, create, and utilize alternative instructional strategies.

Participants who complete the IDI program receive state-of-the-art instructional technology, the training to use it, and the motivation to collaborate with their colleagues in leveraging instructional technology in their courses.

IDI Goal 2: Student Access

[slide 4]

Advise all students about their investments in computer technology to maximize its usefulness during their college

careers. All students who do not have their own personal computers will have better **[adequate?]** access to computing resources and to computer labs for accessing specialized software that is unique to disciplinary areas such as Perseus, Mathematica, and Daedalus. (*In the future all incoming students will be required to own a computer.)*

Students receive network-based training materials to ensure that they have a basic foundation in the use of computing and instructional technology resources.

IDI Goal 3: Course Development

[slide 5]

Faculty receive support to develop network accessible courseware and instruction.

IDI facilitates the development of electronic libraries of scholarly materials supporting designated courses. Improved classroom and presentation facilities support faculty efforts to introduce new technologies into core curriculum courses. [1]

Within the Instructional Development Initiative, the Faculty Development Institute has received the most support and is a continuing program. All faculty members can attend intensive training sessions at the end of which they receive new workstations loaded with software with which they have had hands-on experience.

With the focus on faculty and their electronically enhanced courseware, less emphasis has been given to an almost more difficult challenge--devising a coherent, strategic plan and an online presence for electronic support services such as marketing, library, bookstore, and student services. Today we will describe two technology initiatives that support the IDI goals that were developed outside the usual organizational mechanisms by people who recognized a need and organized themselves in response.

THE VIRGINIA TECH EXPERIENCE: VTO AND SCP *[slide 6]*

Virginia Tech Online (VTO) and the Scholarly Communications Project (SCP) are two technology initiatives that are the result of self-organizing, collaborative work by information systems and library personnel with administrative and academic faculty members. Each initiative seeks to supply

electronic support services previously lacking and to take advantage of the network's capacity to reach the global community. The first, the Scholarly Communications Project, publishes electronic journals and international newspapers, experiments in scholarly electronic communications, and works with the university community to provide information, archiving, and electronic reserve services--in short, access to digital library resources for local as well as extended campus users. The second, VTOnline, serves as a single point of contact for all computer-mediated instructional, administrative, and information services that are available at Virginia Tech over the Internet.

SCHOLARLY COMMUNICATIONS PROJECT

[slide 7]

The Scholarly Communications Project developed from a 1988 request by a Virginia Tech faculty member to begin a new scholarly journal and another request by an administrator to establish a university press. It was envisioned that the university could use a rapidly maturing technology base to accomplish both a place where new scholarly works could be published but without the capital outlay that would be required to begin a print-based publishing operation. Since the would-be faculty editors were not necessarily the ones well versed in the technology, there existed an obvious need for support services. In addition, there was the need to define what were electronic journals, and, perhaps more importantly, what will scholarly communications be in the future. Therefore, the SCP would also be a place to experiment with the technology to produce online scholarship in new and developing formats.

Initially, placed in Communications Network Systems , administrators in Information Systems and the University Libraries almost immediately moved the Scholarly Communications Project into the library. Here strong technical support from the Library Automation Department would combine with user-friendly services, initially directed to faculty-editors and later to new online readers. From the beginning the staff associated with the Scholarly Communications Project and the faculty and staff at the university who requested their support, have determined what experiments to conduct, resolved

questions arising from the user community, addressed issues raised by the technology, and determined how to meet the needs of the users and clientele.

SCP has participated in a variety of partnerships with units and individuals within the university community to produce unique online resources that are well suited to networks and digital libraries. Through partnerships with over a dozen faculty members on and off campus, SCP publishes and archives electronic journals. It designed both an electronic reserve system that hosts online class materials and a unique and growing digital image database. It has collaborated with regional and international producers to provide online access to news reports. In partnership with the Graduate School, SCP developed and implemented procedures for online student submission of theses and dissertations resulting in permanent archiving and timely public access to approved graduate research. Through the Scholarly Communications Project, Virginia Tech has demonstrated some of the ways libraries, both independently and through collaboration, improve their services and increase the wealth and quality of information, creatively using existing staff and evolving technologies.

ELECTRONIC JOURNALS

[slide 8 SCP ejs]

From that first request in 1988 grew the electronic-only *Journal of the International Academy of Hospitality Research.* Word spread informally that the Scholarly Communications Project would work with faculty to put their ideas about an electronic journal into practical applications and now many of our editors are now accustomed to sending SCP a set of files at the same time they send a set to the print shop. One editor had retained a four-year diskette back file of all paper issues so that the SCP was able to include those with the newest online issues, adding the HTML tags and linking the citations in the articles to their references, linking the citations between articles within the journal, and later linking citations to other electronic journals. Since electronic journals were a relatively new concept, we left it up to the editors to define their online journals, and one unique result is the *Journal of Fluids Engineering*, an aggregate of raw

data (called a databank) upon which research described in the print journal articles is based.

Many of the faculty editors want to do more than develop a Web-presence for their journals. They also see themselves in educational roles with their subscribers, giving them a reason to use the Internet and the Web. They have goals similar to the library's in that they want to provide, not only access to information, but also the knowledge to conduct further online research independently.

At SCP we want it to be very easy for our faculty editors to publish electronically and we don't want to curb anyone's creative instincts nor limit the potential of their electronic journal, so SCP has very loose guidelines for editors. While many electronic journals are not very 'experimental' anymore in that they are print journals online, there is a noticeable increase in the level of technological expertise among our newer faculty editors. They no longer want to know which word processor we'd like them to use, they want to know if we will accept PDF files in addition to HTML. Would we like the graphics imbedded in text of the articles or should they be separate files? If so, would we be responsible for making sure the links are in place and working? Would we accept an issue of the journal as one PDF file as well as each article in a separate file? Electronic journal editors have, not only a much better understanding of the capabilities of the technology, but they continue to view the library in its role to support learning.

As a librarian in addition to being an electronic publisher, I do not to prescribe the attributes of an electronic journal but rather I encourage editors to think about their readers, current and potential, and what might be the best format, the best file size, the best online display for them. SCP works not only with Virginia Tech faculty but also faculty from other universities and with community and commercial-based enterprises. They tend to have the same motives as the faculty editors, that is to learn about the possibilities of the technology through practical applications, to educate their clientele, and to experiment. The SCP's philosophy is not to turn anyone away; we have a three part mission: to implement access to information through networked access, to experiment with new technologies, and to provide excellent library services.

STAFFING AT THE SCHOLARLY COMMUNICATIONS PROJECT *[slide 9]*

The Scholarly Communications Project's staff has always been small. Initially there were two half-time positions, the director (shared for three years with Technical Services) and a programmer/systems analyst shared with the Library Automation Department. Interdepartmental sharing of staff or resources was not standard operating procedure, but both staff members were accommodated in their new and evolving roles. In 1994/95 a third, half-time technical assistant was added which focused almost entirely on HTML tagging. This position, like the director's, also came from technical services as the need for data entry evaporated. In 1994 the director officially moved organizationally out of technical services to devote full-time to the Scholarly Communications Project.

Subsequently, the half-time technical assistant's position was upgraded from half- to full-time, in part because, first, online serial records completely replaced manual records and eliminated maintenance of dual formats. Secondly, library technical processing was de-emphasized partially due to an administrative goal to put more people on the front lines, that is at the reference desks and information service points, for increased personal interaction with library patrons. The gradual weaning of these two positions from traditional technical services is evidence of the changes technology has instigated in the organization. Further evidence is the 1996/97 upgrading of the then-vacant technical assistant's position to that of a programmer so that manual tasks such as file downloads and some HTML mark-up could be accomplished programmatically through in-house scripting.

Because SCP activities have increased steadily, while the staffing has not kept pace with the number of new resources it hosts, the experiments it runs, or with new teaching responsibilities, the Scholarly Communications Project has on only two occasions actually solicited new electronic resources to publish--Virginia news reports. We know many more faculty participate in scholarly journal editorial boards, but we are afraid of success. Therefore, we continue as we have done for seven

years and collaborate with faculty members that seek the support services of the Scholarly Communications Project.

While I have focused on electronic journals to this point and supplied only an indication of these activities, SCP has responded similarly when contacted by newspaper publishers or campus administrators who want to push the envelope with applied technology. Here are three additional examples: electronic theses and dissertations, regional news reports and international newspapers online, and the electronic reserve or online class materials.

ELECTRONIC THESES AND DISSERTATIONS

[slide 10 ETD homepage]

For hundreds of years libraries have stored and occasionally circulated the final products of graduate students' education, theses and dissertations. The Virginia Tech library has taken the initiative to improve access and to address concerns such as online archiving, unrestricted vs. limited access, and intellectual property. Though discussion began at Virginia Tech more than a decade ago, about twenty universities in the United States, Europe, and Australia are now establishing a Networked Digital Library of Theses and Dissertations. Their goals are many, including:

[slide 11]

- Collect, catalog, archive, and provide scholars with access to ETDs beyond the host academic community as a way for universities to learn about digital libraries.
- Increase technology and knowledge sharing so that graduate research results are more readily and completely available.
- Improve graduate education through more effective information sharing, including literature reviews and bibliographies.
- Teach graduate students about electronic publishing and digital libraries so that they can apply that knowledge through researching, building, and submitting their ETDs.

- Save students money producing their final research projects.
- Provide timely access to current research that is available all day, everyday; never checked, never overdue, never missing.
- Reduce the need for additional shelf space in university libraries and archives.
- Eliminate the need to bind, stamp, security strip, and label, as well as to circulate and reshelve materials so that libraries can serve more users without additional staff members.
- Provide unlimited browsing, searching, and linking to related works and resources on the Internet/Web.

In addition to these goals, preparing and sharing works in progress fits well with the increasingly popular tenets of asynchronous learning--the independence of time and place of the participants, the authors, the review committee, and the eventual readers. When electronic theses and dissertations are the accepted form of the terminal work, progress toward completion of graduate studies can continue even when a committee member leaves town on sabbatical, for example.

When the Virginia Tech Graduate School challenged the library to prepare for the inevitable arrival of ETDs, SCP developed the procedures and access mechanisms that lead to a working prototype in 1994. Today Virginia Tech has a constantly growing, secure archive that contains over 500 ETDs available on the Internet.

NEWS REPORTS

[slide 12 VA News homepage]

Enjoying the success of our first electronic journals, initial experiments with ETDs, and the migration from the Gopher to the Web, we sought the challenge to provide current regional news. This was viewed largely as an opportunity to improve existing library services since library patrons were reading news*papers*, accessing a manually prepared online index, and photocopying articles. This was an opportunity to

provide our university community as well as the then-new Blacksburg Electronic Village with timely access to local and regional news reports, programmatically indexed and searchable at all hours of the day and night from beyond the walls of the library and the physical boundaries of campus.

To expand the popular news resource was relatively easy. When we approached our local CBS-affiliate for television news reports, we learned that they were already automated to support closed-captioning for hearing impaired viewers. We offered our experience managing daily publications for the Web, effective security precautions, stable and constantly-available information resources, and experience with indexing and search engines. The station manager agreed to send SCP their news report files and a local programmer wrote the scripts that link the reports to a calendar so that within 24 hours of broadcast, local and regional news reports are available from the library's Scholarly Communications Project.

Having accumulated the experience and some hardware through the growth of the ejournal collection, SCP was confident that it could handle anything available in an electronic format. Based on the staffing levels I have described, SCP certainly could not provide scanning services to convert from hard copy to digital formats. Initially, however, we digitized a few minutes of the accompanying video clips so that while reading a story, the reader could also see and hear a televised interview, for example. This more fully replicated the content of the news reporting, while lacking faithful (archival) reproduction.

[slide 13 International News homepage]

Similarly, last March (1997) a news agency contacted SCP about an experiment to supply international newspapers online. Continuing our philosophy to "never say no," SCP began the experiment by creating a Web page and used a password assigned by NewsExpress to download files as they became available. Within four months the programmer replaced this now primitive method, first training the NewsExpress staff to standardize file names. The programmer then wrote scripts that would automatically add each new electronic newspaper file to the SCP server under the correct title and date.

STANDARD OPERATING PROCEDURES: NOT!

Not the typical library reaction to new information resources, but the result of having a unit within the library with the experience with the new technology and its network applications as well as the authority to take action. Combining the freedom to add and the responsibility to maintain new materials in the library's collection enables experiments that would otherwise have taken months to work through the governance structure.

That the Scholarly Communications Project was in a position to negotiate for library services and resources was, again, not standard operating procedure. An important factor was the simultaneous improvement to library and information resources available beyond the building and the campus largely using existing library staff, free software from the Internet, mostly self-taught skills, and modest equipment purchases. The library organization was changing.

[slide 13 International News homepage]

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ELECTRONIC RESERVES

[slide 14]

During this period in the early nineties, other University Libraries' staff also began to explore new avenues of information access. Reserve Desk staff attended a meeting about online course materials and the Scholarly Communications Project was exactly the unit for such an initiative.

In the spring of 1995 about thirty faculty at the FDI (Faculty Development Institute) heard that they could submit their class materials to Electronic Reserve in a manner very similar to what they were used to doing through the library's Reserve Desk, only via online file transfers. The result of that announcement and FDI training, eight faculty teaching ten classes sent their files of online class materials to the library. These files were linked to the Web through lists of class numbers and instructors' names. At the end of the first semester, students and faculty in each of these classes completed a written survey to determine their level of satisfaction with the EReserve system and to gather comments about how to improve it. Both the students and participating faculty were enthusiastic. The following summer and each break in classes since then SCP participates in the FDI to introduce faculty to the central archive and directory of class materials online. From an online version of the Reserve Desk, EReserve expanded to include (1) links to class materials available on servers outside the library and (2) a server where faculty can store and manage their full range of class materials without waiting for library intervention before they become available to their students.

SCP CONCLUSION

Designing systems to host online class materials, journals, dissertations, news reports, and more has enabled the library to expand its information resources through publishing, to improve timely patron services, and to broaden its instructional activities. It took grassroots support from faculty (and students) and collaboration between disparate university components to make a variety of resources, access methods, and services available for the distance as well as the traditional, on-campus library users. Especially important is the library's ability to evolve into new roles as needed and as appropriate. An

example is an evolutionary partnership with faculty, administrators, and information systems personnel that resulted in VTOnline.

VIRGINIA TECH ONLINE

[slide 15]

Virginia Tech Online was created in response to a number of perceived needs. It is currently a pilot project, incomplete and imperfect--a work in progress. The intent of VTOnline is to make possible improved and efficient marketing of Virginia Tech's online and electronically-enhanced courses by providing one Web site that presents all of Virginia Tech's electronic learning opportunities. The goals of Virginia Tech Online include, *[slide 16]*

- Support student enrollment in electronic courses by providing links to electronic services such as online enrollment, financial aid, the transcript and registration services (part of the Hokie Spa), University Bookstore order forms, electronic reserve, and other library services and resources.
- Encourage the development of additional online course materials by providing links to electronic services for faculty members regarding the design, delivery, support (such as electronic reserve), and assessment of innovative, computer-mediated teaching.
- Demonstrate that Virginia Tech wishes to recruit and retain international students by providing, VTOnline in a number of languages.

[slide 17?]

Before VTOnline, Virginia Tech did not display in a coherent way the extraordinary and creative work that is the result of the Faculty Development Institutes. Certainly, most college and academic departments point to the online work of their faculty. For instance, an extremely innovative program in the College of Arts and Sciences, Cyberschool, maintains a web site for the work of Arts and Sciences faculty, but it is hidden several layers under the main Virginia Tech Web homepage.

VTOnline provides easy-to-use information about all of the instructional, administrative, and public service activities that is available at Virginia Tech over the Internet. It provides a point within the university that coordinates information concerning online degree programs, short courses, extension activities, and public service initiatives. It also links existing and new network centered teaching initiatives, ranging from course and program innovation to intellectual property policies, assessment, and evaluation practices.

VIRGINIA TECH: SELF-ORGANIZING RATHER THAN SHARED GOVERNANCE

[slide 18, last slide]

From a planning and policy perspective, almost as interesting as the operationalizing of VTO is the process through which plans and implementation decisions were made. Coincidentally, in the spring 1997 issue of *CAUSE/EFFECT*, Richard Katz records an interview with Margaret Wheatley that reflects our experience working with VTOnline: (*and I quote)*

> What I have observed is that the minute you create access along these [self-organizing] networks, you are creating a revolution. Networking is an incredibly revolutionary act. . . . People find each other. They find who they need. They enjoy the creativity that's available once they can find others for what they need. . . . It changes them. It changes their work. [2]

Traditionally the mechanism for collaboration, across disciplines and administrative units and among faculty, staff, and students, that enriches the university experience for all concerned, has been the governance system. Built through an iterative process over many years, participation in governance brings together faculty, administrators, staff, and students to contribute to the progress and development of the university. Nonetheless, in the new context for higher education the governance system is felt by many to be a hindrance rather than an asset. It may take as long as a year to "move" a policy through the system or to gain the necessary approvals for a new

course or acceptance for major revisions to an existing academic program. In addition, the governance system does not operate in the summer since many students are not in residence and faculty members with nine month contracts are not available. This is not an acceptable time frame in a climate where the accelerating pace of change combined with legislative and governing board assertiveness requires expeditious decision-making.

Information technology has created, almost overnight, new mechanisms for collaboration, communication, and building "virtual communities"--the self organizing process described by Margaret Wheatley. At Virginia Tech mechanisms such as the Faculty Development Institute, Center for Excellence in Undergraduate Teaching, the Center for Innovation in Learning, and the initiatives of the Scholarly Communications Project are intermixed and sometimes in conflict with older structures, i.e., the departmental administration and shared governance systems.

Because the nature of information technology requires timely and complicated decision-making, and because the university is becoming transformed as a result of new partnerships, more responsive procedures must be developed to take advantage of new opportunities, to handle the volume of curricular change, and, to make the necessary policy revisions. However, an improvement in responsiveness cannot be made at the expense of the quality of deliberation on such issues as the development of new programs and the degree to which they accomplish university goals.

The network is a metaphor for a new work style and organizational culture. For example, as we implement Virginia Tech Online rather than work within organizational boundaries a group of faculty members, librarians, information services/educational technologists, systems analysts, graphic designers, and admissions staff are collaborating on an ad hoc basis.

As a result of the networks, universities and their libraries are obviously in a time of transition. The evolution of scholarly communications through electronic media is ongoing and will become more intense. In addition, there are more options for people who want an education beyond high school. In the years ahead many students will have different constraints

and aspirations from today's students. Technology-mediated asynchronous learning, educational support services, and network-based information delivery holds great promise. The innovation required to meet the needs of these students and to support scholars in a digital environment will change what universities, their libraries, and information services organizations do and the way they do it.

**Technology Initiatives and Organizational Change:
Higher Education in a Networked World**

ENDNOTES

1. *Instructional Development Initiative : Phase II*. Blacksburg, VA: Virginia Polytechnic Institute and State University, 1997 p. 15.

2. Katz, Richard N. "Higher Education and the Forces of Self-Organization: An Interview with Margaret Wheatley." *CAUSE/EFFECT*. Spring 1997, vol. 20, no. 1:18.

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