7 Composing Human-Computer Interfaces Across the Curriculum in Engineering Schools

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In this chapter, we discuss some contributions that technical communication studies might make to electronic communication across the curriculum in engineering schools. One premise of our chapter is that teachers of technical communication, those individuals interested in nonacademic writing issues and communication practices in modern technological contexts, have areas of expertise that can productively influence the teaching of human-computer interface design for World Wide Web pages, multimedia programs, and hypertext applications. Another premise of the chapter is that within the context of an engineering or technological school, these areas of expertise, areas which are rooted in a multitude of humanistic and rhetorical traditions, are often either undervalued or not well understood, and that in many instances technical communication teachers will need to make arguments that demonstrate the pedagogical value of their perspectives. In this chapter, we provide a framework for helping teachers make these arguments in their own institutions.

We begin the chapter with some local context, describing writing-across-the-curriculum efforts at Clarkson University and recent movements toward electronic-communication-across-the-curriculum activities. Next, looking more closely at these electronic activities, we briefly discuss the emerging digital composition practices that we see in science and engineering courses—practices that are not uncommon in other colleges and universities focusing on science, engineering, and technological enterprises. In the main portion of the chapter, we outline five key areas associated with technical communication that relate to communication across the curriculum in an electronic age: interface design practices, usability testing methods, pedagogical issues, humanistic perspectives on computer technologies, and electronic portfolios of professional work. Although we focus on technical communication and engineering contexts, our discussion should be useful to a wide range of teachers and researchers: as other chapters in this collection indicate, teaching about the design of World Wide Web pages, multimedia programs, and hypertext applications is a pedagogical practice that interests many different disciplines.

Movements toward Electronic Communication Across the Curriculum

For a variety of institutional and political reasons, writing-across-the-curriculum activities at Clarkson University have been relatively limited in historical terms. Despite guidance from several WAC specialists, including Anne Herrington, Gail Hawisher, and William Condon, the only formal initiatives that currently exist at Clarkson are in early pilot stages. However, the Department of Technical Communications is expanding these efforts by engaging in three interdisciplinary projects broadly related to electronic communication across the curriculum: supporting the instructional design of two major CD-ROM initiatives in the School of Engineering; developing a master's degree program in electronic communication and rhetoric that includes courses taught by teachers working in other departments; and creating a communication center that can help undergraduate and graduate students from across the curriculum develop a wide range of literacies, including those associated with computer-mediated communication. Increasingly, such centers promote a model of electronic communication across the curriculum that is network-supported and writing-center-based (Palmquist, Rodrigues, Kiefer, and Zimmerman 1995).

The two engineering initiatives represent major funding sources for Clarkson University professors. The Center for Advancement in Instruction for Science and Engineering (CAISE) is developing CD-ROM-based textbooks for the delivery of online engineering curricula. This project is currently funded by a variety of corporations and government agencies: General Motors ($750,000 over three years), NASA ($300,000 over two years) and EDS ($150,000 over three years). The Clarkson Thin Film Multi-Media Development group, funded by the National Science Foundation ($400,000 over three years), is developing hypermedia-based instructional materials for teaching thin-film technologies to engineering students. The role of technical communication in these two projects is in the related areas of interface design and usability testing. Working in these critical development areas is helping the department accomplish two connected goals: positioning itself as a contributing member to dominant research activities on campus; and, in turn, productively influencing the ways in which science and engineering teachers teach human-computer interaction principles to students across the curriculum.

As with many institutions, Clarkson is rethinking its approach to education within the context of shrinking fiscal resources. Operating with budget deficits for the past five years, the university has hired a new president and reformulated its vision of what a Clarkson education should promote: in short, (1) solutions to real-world, open-ended problems; (2) exceptional communication skills; (3) collaborative projects; and (4) instructional computing. Historically, as with many technical communication programs, the department has supported more traditional print-based publications work, work that is still important but not aligned in square ways with the evolving educational goals of many technological institutions in the late 1990s or with the emerging research directions of the technical communication profession. By partially refocusing research and teaching activities around two linked components of the university's new vision statement—developing exceptional communication skills using instructional computing technologies—the department is beginning to revitalize itself in both intellectual and fiscal terms: it has hired a new faculty member, built a new multimedia lab, developed new courses on World Wide Web authoring and rhetorics of the Internet, developed the online writing lab (OWL) on campus, and gained other kinds of material support, both internally and externally.

This new focus on electronic communication and instructional computing is helping the department make contributions to electronic communication across the curriculum. Not only has technical communication contributed to the interface design of CD-ROM-based instructional materials developed on campus, for example, but these contributions, in turn, have encouraged broader pedagogical discussions with the university President, Dean of Liberal Studies, and engineering professors in different departments. In the long run, we hope that our willingness to accommodate the multimedia and instructional design needs of science and engineering teachers will abate their resistance, in many instances, to humanistic and rhetorical perspectives on student writing in online information space. As Spilka (1993) cogently argues, agents of change and social innovation must also be agents of accommodation on some level. Composing in an electronic age at engineering schools, we realize that student writing in science and engineering courses is still often paper-based. Students use word processing, graphics, statistics, mathematics, and other computer programs to create reports, feasibility studies, research papers, journal entries, proposals, and other documents that are laser printed on white paper and handed in for evaluation. And it is a safe assumption, we think, that these paper-based requirements will continue in educational environments: conservative institutional forces—for example, standard curricular approaches, teaching and research perspectives invested in technologies of print, and certification agencies for academic programs—often encourage rather than defy existing discursive practices in classroom settings. Moreover, clear value exists in helping students develop the print-based literacies still privileged in most aspects of corporate and civic life.

At the same time, the projects of science and engineering encourage technological optimism. Despite critiques from rhetoricians of science and from scientists and engineers concerned about human and environmental conditions, the Western, commonsense connection between technologies of all sorts and cultural and educational progress remains strong (Feenberg and Hannay 1995; Smith and Marx 1994). In most disciplines, at least some teachers on our campuses seem interested in computer-based writing and the promise of hardware and software to support new and different ways of learning. And indeed, in many cases a significant number of institutional resources are being shifted in this direction—consider, for example, the grant monies now available on college campuses for instructional computing purposes in all areas. Although as humanists we tend to be more skeptical about the potential of mechanical devices, on their own, to bring about productive pedagogical change in classroom settings, we appreciate the enthusiasm of the science and engineering teachers we see working along a continuum of modest to robust electronic-communication-across-the-curriculum approaches.

In terms of modest efforts, teachers use electronic mail to promote student communication beyond the temporal and spatial boundaries of the classroom, synchronous conferencing sessions supported by local-area networks to provide alternative forums for classroom discussion, and asynchronous conversations supported by wide-area networks to extend both face-to-face and online, real-time discussion. Entire courses revolve around bulletin board applications running on campus-wide servers in which teachers post and collect writing assignments, projects, quizzes, and tests. The electronic writing done in connection with these efforts is often valuable: in many instances, science and engineering students have more opportunities in which to write over the course of a term, more informal contexts in which to write, and more opportunities in which to use writing as a way of collaborating, knowing, and learning. Even when teachers use these computer technologies for reasons of simple technical efficiency, we often see the kinds of positive effects just outlined (although automating course requirements and procedures is not without its pedagogical problems).

For the purposes of this chapter, teachers working in more robust ways are of particular interest. Increasingly, we see teachers asking students to develop World Wide Web pages, multimedia programs, and hypertext applications, and to author electronic course-related projects either in place of or in addition to more traditional print-based assignments. We suspect that this kind of digital composition will become increasingly common in colleges and universities, not just in science and engineering courses but in many other types of courses as well. Indeed, as we draft this chapter (April 1997), AltaVista, a popular search engine developed by Digital Equipment Corporation, finds thirty-one million World Wide Web pages on 627,000 Internet servers, and multimedia projects in both academic and nonacademic instructional contexts are increasingly common (Hodges and Sasnett 1993).

An example of the kind of digital composition project to which we are referring was developed by a student, Mark Cornett. His project describes research expertises existing among Clarkson professors for students interested in learning about these expertises and for corporate sponsors interested in funding research projects.[1] His project discusses sea ice, a sub-field within the area of Cold Region Technologies important to civil and environmental engineering in northern climates. The project includes a wide range of written texts, still graphics, audio clips, and video clips—all designed, developed, and synchronized into a coherent whole for several different audiences with several different purposes. It includes an elaborate navigational structure for users, who can read information nonsequentially by using the toolbar at the bottom of the program, several dynamic maps, hypertext links embedded in key places, search engines, and a bookmarking feature for creating personalized place holders.

In courses encouraging this kind of digital composition, a primary focus is on designing the human-computer interface, in using Internet resources, object-oriented multimedia authoring programs, and hypertext authoring programs to create the ways in which users interact with educational applications in online environments. Such work, even when done in limited ways, often departs from the traditional concerns associated with writing and reading printed texts, requiring expanded textual perspectives and design considerations (Selber 1997; Kolosseus, Bauer, and Bernhardt 1995). As science and engineering teachers encourage their students to create online materials in the form of World Wide Web pages, multimedia programs, and hypertext applications, technical communication studies is positioned to make some important rhetorical and humanistic contributions. The following five areas represent a starting place in which such contributions might be made.

Area #1: Interface Design Practices

Historically, representing human-computer interactions in online information space has been the task of technologists—in many cases, computer scientists and engineers with important programming expertise but also a system-centered perspective encouraging interface designs that fail to consider adequately the needs and complexities of end users. As Johnson (1994) notes, "much of the research in human factors, from its beginnings over a century ago to the present day, places the needs of technology over the human, thus treating the 'human factor' as an unfortunate impediment in the process of developing emerging technologies" (196). Although such a situation might have been less problematic in the 1960s and 1970s, when computer users were most often other scientists and engineers, individuals now interested in computing for educational, professional, and personal reasons are far less specialized and far more diverse. In fact, Duffy, Palmer, and Mehlenbacher (1992) argue that the computer-using population now includes fewer experts in any one software program; fewer users developing expertise in the majority of the software programs they use;

more users using different software programs in the same application area, trying to apply their knowledge of one program to another; and, increasingly, more first-time users of hardware and software (2-4).

This expanded user base, other market forces, and a host of social and technological factors have encouraged new ways of thinking about the interface that are more inclusive. The tasks associated with human-computer interaction, once solely aligned with computer specialists, are now engaged by teachers, artists, activists, and other individuals for whom considering social interactions and human consequences is an important fact of professional life. Interface design teams in both academic and nonacademic settings now commonly include interdisciplinary mixes of product managers, marketing representatives, instructional designers, multimedia developers, graphic artists, subject matter experts, systems analysts, quality assurance specialists, audio/video specialists, filmmakers, software engineers, technical communicators, end users, and others—all workers with varying expertises, educational backgrounds, and ways of seeing the world (Whiteside and Whiteside 1994). Mountford (1990) outlines some specific contributions of creative fields such as film, animation, theater, architecture, and industrial design to interface design practices, and Laurel (1993) provides an extensive framework for envisioning human-computer interactions as dramatic rhetorical moments.

From our perspective, the contributions of technical communication to developing human-computer interfaces across the curriculum relate to rhetorical and social concerns, concerns not always privileged in system-centered ways of teaching digital composition. Two important contributions—naturalistic usability testing methods and humanistic perspectives on computer technologies—are discussed in detail later in the chapter. But in addition to these two critical areas, numerous other contributions exist. As with writing, if we envision interface development as a recursive process situated within complex social contexts, then rhetorical considerations become a central concern on both macro and micro levels.

On macro levels, for example, audience and task analyses are an essential part of determining what kinds of collaborative and individual activities a computer interface should support. Moreover, the organizational, navigational, and contextual structures of an online environment—three core areas supporting human-computer interaction—should reflect the broad rhetorical concerns of users, goals, and time/space frames rather than the formal characteristics of online genres (Selber, Johnson-Eilola, and Mehlenbacher 1997). Two recent graduates of the technical communication program at Clarkson debated this interface design principle as they developed a large-scale multimedia project for the Admissions Office. Both students took the department's hypertext course and were at odds over a particular instance of how best to structure navigation paths for end users. Based on audience and purpose profiles developed in an initial documentation plan, one student argued for as much user freedom as possible, while the other student argued that extensive freedom, in this instance, would only confuse users of the program. From our view, the tensions existing between the rhetorical theories they studied in the course and their actual development practices led to a useful interface design debate, a debate that demonstrated the importance of social and rhetorical perspectives on user-centered design.

And on micro levels in the development process, for instance, there are numerous critical issues associated with composition and balance, from developing an online writing style to achieving visual symmetry on the screen. These are just a few of the areas in which technical communication might make rhetorical contributions to the pedagogical practices of science and engineering teachers teaching interface design practices across the curriculum. Other related areas are discussed in an emerging literature on the rhetorical and social dimensions of design (Coe 1996; Kaufer and Butler 1996; Barrett and Redmond 1995).

Area #2: Usability Testing Methods

A central component of developing a computer interface is evaluating its effectiveness in terms of human performance as opposed to technical or fiscal performance, a task often accomplished with formal usability testing methods. According to Nielsen (1993), usability testing is commonly concerned with five key areas: learnability, efficiency, memorability, errors, and user satisfaction (26). That is, how easily can users learn an interface? Once they learn it, can they use it efficiently? Can they remember how the interface features work over time, even if they only use those features sporadically? Do users make errors using the interface? And, are users personally satisfied with how the software looks and feels? Systematically examining these kinds of questions at key stages in the development process helps designers create human-computer interfaces that are more usable for end users.

Usability testing procedures, as with other research methods, represent ways of framing and seeing a problem. Historically, in many engineering cases, the privileged lenses for examining usability have been experimental: studies are designed for controlled environments, variables defined, and results often derived in quantitative terms. And indeed, there is clear value in this type of empirical work, depending on the questions that a researcher is asking. But we would argue that technical communication, a field that often appropriates ways of knowing from the social sciences, has a different empirical contribution to make. According to Lauer and Asher (1988), empirical research can also be descriptive, employing approaches that restructure the situation or environment under investigation in as few ways as possible (15). In their taxonomy of empirical research designs, a taxonomy which moves from explanations that are less to more quantitative and statistical, Lauer and Asher locate case studies and ethnographies within the realm of descriptive work (16). Unfortunately, these two approaches to understanding user behavior in context and as situated are often devalued in engineering environments: as one teacher told us, "they're too soft and subjective to yield reliable results." Indeed, on at least two separate projects at Clarkson, engineering faculty were reluctant to subject their interface designs to even modest usability testing of a qualitative nature, even when that testing might have yielded useful results.

As opposed to discussing specific procedures for conducting case studies and ethnographies in this short chapter, discussions which already exist in other places (Zimmerman and Muraski 1995; Silverman 1993; Sullivan and Spilka 1992), we provide five key reasons why it is important, in an age of electronic writing and communication, to promote usability testing methods for naturalistic settings. Technical communication teachers can use these arguments to expand the experimental testing procedures that science and engineering teachers often privilege in human-computer interface design projects:

- *Developments of human-computer interfaces are not solely determined by technological possibilities.* Human-computer interfaces are designed within organizational contexts that are subject to a wide range of forces, among them, economic, political, and social. The designs informing human-computer interfaces are therefore ideological, embodying particular ways of knowing and working. Understanding how organizational contexts influence the work of interface designers is an important area of research.
- *Uses of human-computer interfaces are not solely determined by mechanical features.* Computer users approach communication problems with a wide range of complex tasks that are at least partially determined by their work environments and institutional cultures. Often, the tasks of workers fail to align closely with system features, software commands, and interface structures. Understanding how organizational contexts influence the work users is an equally important area of research.
- *Final forms of human-computer interfaces are not solely determined by designers.* In an age of electronic writing and communication, end users will have increasingly more control over the content and shape of their software. Understanding the role of users in modifying human-computer interfaces is a complicated and relatively new area of research.
- *Work contexts are not solely determined by employers.* As institutional downsizing continues and telecommuting increases, more individuals will work at home and at other alternative sites. Corporate offices are no longer considered typical work spaces, just as traditional classrooms are no longer considered typical education spaces. Articulating the nature of these new spaces will be critical to understanding how human-computer interfaces should be structured in the future.

- *Educational activities are not solely determined by local possibilities.* World-wide area networks and the Internet provide interesting opportunities for professional development and instruction. But understanding how particular educational models and institutional cultures might encourage or discourage computer-based learning activities will require naturalistic research perspectives. These five arguments presuppose that interface design practices are bound in complex ways to the social, political, organizational, and rhetorical contexts in which both developers and end users work. Making this case in engineering and technological schools, however, is not always an easy task for electronic-communication-across-the-curriculum specialists.

Area #3: Pedagogical Issues

It is not difficult to find arguments claiming that computer-based learning is better than other types of learning. Indeed, newspapers, magazines, trade journals, and academic journals feature articles on a regular basis describing the ways in which hardware and software will revolutionize education in positive ways, or at least make it faster and cheaper to deliver. And indeed, writing and communication teachers are not immune from such technological optimism. According to Hawisher and Selfe's (1991) survey work, for example, in the late 1980s many teachers preferred teaching writing with computers based on the following claims: using hardware and software, students spent more time working on their writing; peer teaching was common; classes became more student-centered; one-on-one conferences between teachers and students increased; opportunities for collaboration increased; students shared more with other students and teachers; and communication features provided more direct access to students, thus allowing teachers to get to know them better (59).

A decade later, although the technological optimism that Hawisher and Selfe critiqued still exists in both the popular press and professional discourse (a fact we consider in the next contribution area), critical perspectives toward instructional computing seem less isolated. We realize now more than ever, though still not widely and deeply enough, that productive computing in classroom settings is more than a function of creating good human-computer interfaces or eliminating the very real technological inequities that exist across educational institutions at all levels. Rather, for students to learn in productive ways with (or without) computers, additional forces must be considered, among them, their basal needs (Rockman 1995), reward systems in academic units (Strickland 1991), professional development programs for teachers (Selfe 1992), and a whole host of social, cultural, and political factors.

At the same time, we cannot ignore the instructional dimensions of the interface. Too often, software is structured in ways that fail to consider what it means to productively teach and learn, supporting the worst as well as the best of instructional design practices. For example, in 1994 two technical communication faculty members at Clarkson were involved in an initial experiment to develop multimedia instructional materials for an engineering course. Although the technical communication faculty members were included early in the development process and worked with engineering faculty to generate and answer important pedagogical questions about instructional goals and approaches, in the end this work was dismissed as "too time consuming." Instead, the lead faculty member from engineering scripted his own lecture, taking traditional lecture notes and transferring them to an online environment. In effect, he created the computerized equivalent of a film strip, which on occasion he would turn off in order to answer and ask questions.

From our view, part of the problem with the design approach just described relates to pedagogical perspective—misconceptions about learning are simply transferred from traditional classroom environments to online environments. Among these misconceptions, Kay (1991) includes the fluidic theory of education (akin to Freire's banking concept, in which students are viewed reductively as empty vessels waiting to be filled); the notion that education is a bitter pill that must be sugarcoated (in online environments, such sugarcoating includes the game-like images and sounds often found in instructional multimedia programs); the idea that during activities of learning, students can only rely on innate ways of thinking; and the equally disturbing idea that reality is only what the senses reveal (138). As with many literature professors (Latterell 1996), we realize that the education of engineering teachers often provides little formal training in pedagogical areas. And yet such a background seems central to teaching human-computer interaction principles across the curriculum that are instructionally sound.

In this area, technical communication has much to contribute. Social perspectives on writing, reading, teaching, and learning relate to instructional design practices in substantial ways, as do the rich rhetorical traditions informing the communication practices of individuals working and learning in complex cultural contexts for over 2,500 years. When organizing information in a multimedia program, for example, designers must make decisions about the degree of complexity supported by the navigational and organizational structures of their application. These design decisions, for the most part, should be influenced by pedagogical and rhetorical concerns and not by the available technological features of an authoring environment. Moreover, if we expand the domain of human-computer interaction to include the physical environments supporting interface design work, then technical communication has additional contributions to make. Research by writing teachers indicates that the design of a computer lab or classroom significantly influences the teaching and learning occurring in that space (Selfe 1989; Myers 1993). Technical communication teachers, therefore, can also help engineering departments design computing environments in which student-centered electronic communication across the curriculum is encouraged and supported.

Area #4: Humanistic Perspectives on Computer Technologies

In addition to pedagogical issues, we cannot ignore the political and ethical dimensions of the interface in teaching human-computer interaction principles. Too often in science and engineering contexts, however, computers are viewed as neutral tools, machines that support the work of interface designers and users in apolitical ways (Winner 1986; Feenberg 1991). Such a view arose at a recent retreat for Clarkson academic administrators. Although there was wide consensus at this retreat that the first-year program should include, among other things, instruction and experience with computers and communication, the details of what that meant were unclear. Many people interpreted this statement in strictly functional terms: all students should be able to accomplish the basic computer tasks that support the work of scientists and engineers. There was no real recognition of the fact that computers not only support but also influence these tasks in central ways, and that students need to be prepared as both consumers and critical users of hardware devices and software applications.

In the best of cases that we have seen, such an instrumental perspective is modified to account for technological concerns but in a manner that seems little better: although computers can be used for both productive and unproductive purposes, if we just choose the right ones educational and social progress will necessarily follow. On some level, such logic rings true: a hammer can be used either to build a shelter or to commit a heinous crime. At the same time, however, a hammer cannot replace a screwdriver or a saw. In other words, computer technologies, as artifacts of an industrial culture, instantiate particular ways of knowing and working that are far from neutral. But grand narratives perpetuated in Western culture, those linking technological developments with notions of cultural progress, remain an influential force encouraging computer-related optimism in educational settings (Postman 1995).

In terms of the politics and ethics of the interface, a literature informed by humanistic perspectives is emerging. For example, Turkle (1995) describes different orientations informing dominant human-computer interactions in online information space. She aligns the design of her old Apple II computer with modernist interpretations of the world, while her new Macintosh seems more informed by postmodern ways of knowing. Respectively, the design difference here is between depth and surface, between the values of calculation and those of simulation (34). Johnson-Eilola (1995) traces three models influencing interface design practices in online research spaces, arguing that certain cultural tendencies toward valuing information can have the negative effects of technical decontextualization and cultural fragmentation.[2] Selber (1995) considers metaphorical perspectives on hypertext appropriated from a variety of disciplines, claiming that these diverse ways of knowing centrally influence the design of texts, nodes, and links in complex hypertext systems. And Selfe and Selfe (1994) contend that human-computer interfaces, in many popular instances, can be read as maps that value "monoculturalism, capitalism, and phallologic thinking" (486). Although these technology critiques may seem unusual to some because they challenge the commonsense cultural connections existing between computer technologies and notions of educational progress, these critiques provide important political and ethical perspectives that fields aligned with the humanities can provide.

In encouraging humanistic perspectives on computer interface design across the curriculum, technical communication specialists can focus on at least two related areas: the authoring environments that students use to create World Wide Web pages, multimedia programs, and hypertext applications; and the design decisions that students make when using these environments to create human-computer interfaces. From an end user's perspective, these two areas represent a double layer of political choice that structures the field of possibilities in at least partial ways. The developers of an authoring environment determine its operation and how designers work with objects, linking structures, system features, and so on. In turn, designers use these biased environments to build human-computer interfaces for end users, making additional choices about how a program operates, looks, and feels. These layers of interest can be productively scrutinized during the teaching of interface design practices. For instance, students and teachers can critique implicit and explicit assumptions about learning, working, and knowing in a wide range of areas, among them, interface metaphors, default structures, permission settings, composing and editing tools, menu arrangements, and features supporting collaboration.

Area #5: Electronic Portfolios of Professional Work

Professional portfolio development is a final, more practical contribution of technical communication to electronic communication across the curriculum. Writing specialists use portfolios as an alternative to traditional evaluation methods, asking students to participate in the construction of their grading context by providing commentary on their work and by selecting and organizing the writing samples to be graded. Other reasons for using portfolios relate to process concerns: grading is delayed to encourage substantial revision, and whole performance is privileged over the narrow surface features of a final written text. In addition to formative and summative portfolios of writing, however, technical communication, a field aligned with workplace and product concerns, also often requires students to develop presentation portfolios, portfolios that showcase final projects and serve as professional writing samples in job interview situations.

Our earliest experience with presentation portfolios was in 1994, when Peter Deuel, an undergraduate in the technical communication program at Clarkson, posted his portfolio on the World Wide Web. At the time, his portfolio included his resume and links to some sample HTML documentation he had written. This relatively early example of an online portfolio attracted the attention of the Intel Corporation, leading first to a summer internship for Peter and then to a full-time job. Pilot efforts are now under way at Clarkson to encourage all technical communication majors to develop professional electronic portfolios, and campus-wide discussions are considering the issue of extending this opportunity to all Clarkson students. As digital composition practices becomes increasingly central to science and engineering workplace environments, students in all majors will benefit from representing their electronic work in these types of portfolios.

Creating an electronic portfolio of professional work is a complicated rhetorical process. Once content decisions are made and the best electronic samples are in final form, one central concern exists: developing an overarching interface design that integrates the samples into a focused, coherent whole. Before beginning this task, students must select an online environment that can display their electronic projects, which are often created in a variety of programs and contain a wide range of data types (sometimes, file conversions and screen captures are required). In designing the portfolio interface, there are many critical issues to consider, among them, providing a conceptual model for readers; developing front matter that introduces the portfolio and describes its design; organizing and annotating the portfolio entries; developing a linking structure for navigating the portfolio; creating cohesive ties that logically connect the entries; creating aesthetic dimensions and transitional effects; highlighting the most important material; and, perhaps, creating a micro-portfolio of one or two self-running samples that can be left with a potential employer. Although the task of creating an electronic portfolio of professional work is time-consuming, it is a useful project in which engineering teachers and students can consider the rhetorical and social dimensions of human-computer interface design.

Notes

1. In creating his multimedia program, Mark Cornett used Multimedia Toolbook 3.0 running on a Pentium machine with 16 MB RAM, 500 MB hard drive, VGA monitor, mouse, Windows 95, sound board, external speakers, and a CD-ROM drive. In addition, Mark used Paint Shop Pro, PhotoShop, a scanner, CD-ROMs with sound clips and art clips, and a digital camera.

2. We thank Johndan Johnson-Eilola for his helpful comments on a draft of this chapter.

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