CHAPTER 10

Technical Communication Pedagogy and the Broadband Divide: Academic and Industrial Perspectives

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OVERVIEW

Technical communication is a field poised to benefit substantially from the high-speed networks, distributed workplaces, globalizing economies, and innovative communication technologies that characterize the Broadband Age. Communication today is more rapid, more complex, and more enhanced with multimedia capabilities than ever before. And interdisciplinary professionals who can navigate these high-tech networks and disseminate information to a wide range of audiences are in great demand. Regrettably, technical communicators are often ill-equipped to excel in high-tech environments; as a result, the Broadband Age is contributing to the rift between technical communication pedagogy and industrial practice. In this chapter, we identify and explore various gaps that have emerged between communication practices in academe and industry. We conclude by foregrounding pedagogical activities designed to prepare technical communication students to act as leaders in the information economy.

According to *A Nation Online: Entering the Broadband Age*, the largest sector of growth in home Internet use in the United States has been aided by the transition from dial-up to broadband technology (cited in U.S. Department of Commerce, 2005). Such movement, however technically impressive, has two problematic implications in terms of digital divergence: For one, it widens the gap between those without any form of Internet access and those who now have high-speed access; for another, it creates a new gap between those with low-speed and those with high-speed access. Not surprisingly, the shift to higher bandwidth also has important consequences for the profession of technical communication. We argue in this chapter that differences in broadband usage constitute a new challenge to the at-times fraught relationship between academics teaching technical communication and practitioners working in industry.

We explore in the first part of this chapter the problems associated with pedagogical models and industrial workflows designed more for static media and documentation than for the newly interactive environment made possible by broadband technologies. This resource gap is noteworthy in the business world and has led some writers to suggest the existence of a broadband divide between large and small businesses (Arbori & Ordanini, 2006, p. 84). We will show that a similar fissure has opened between many technical communication education programs and the interests hiring from such programs. Currently, many curricula may not be preparing students adequately for the technological and political challenges they will encounter as designers and facilitators of complex information in the highly visual and interactive environments made possible through broadband technologies. Whereas academic training in the development of critical thinking skills (skills such as audience analysis, evaluation, and assessment of source materials; selection and arrangement of materials; and other rhetorical strategies for document design) is undeniably necessary, problems may arise when graduates find themselves unprepared to work in an industry where competencies are normally assessed from within a positivist framework (cf. MacDonald, 2002; Scollon, 2003). Carolyn Miller (1979) describes this framework as a knowledge model heavily reliant on sensory data and empirical verification (p. 612). Relying on quantitative data, logical decision making, and processing rules, information technology (IT) drives the operational practices of industrial technical communication. Everything from the structure of file servers to the availability of word processing software to the policies and procedures associated with electronic mail influences the social and professional practices of industrial communities.

Because the positivist knowledge paradigm persists throughout industry, we argue that technical communicators in the workforce tend to be classified according to technical skills and knowledge instead of according to writing expertise or rhetorical acumen. As a result, technically competent communicators tend to be located at the top of the institution's professional hierarchy. Technological skills and conceptual understanding of interactive media design and integration are made even more important by new broadband technologies, for these technologies enable the convergence of sophisticated media types such as video and animation. Graduates who are not technologically savvy are thus often at a disadvantage, despite their training in critical thinking and rhetoric. The notion that the person doing the thinking is more important than the tool or system being used (see Rutter, 1991) is all too often honored only when the person focuses his or her thought on tools and systems.

While much modern communication theory suggests that meaning is wrapped in layers of cultural and sociopolitical ideologies, ideologies that should often be called into question, examined, or even challenged, industrial logic tends to operate under a different paradigm. A central industrial belief is that processes and workflow deliverables should be *fast, efficient,* and *maintainable*. Calling into question political practices is often a risky move, especially for entry-level practitioners such as those who have just graduated from technical writing programs. Because of this dissonance between academic and industrial perspectives, recent technical communication graduates working in industry may be startled to see the emphasis on standardization, encapsulation, and IT in the creation of texts for specialized training or distribution of technical content. This problem is exacerbated as digital systems continue to evolve in terms of growth capability and bandwidth allowances, since many of the cutting-edge technologies designed to improve speed, efficiency, and maintainability are not available in cash-strapped universities, where professors are unlikely to be trained in the use of the latest technological tools. Students graduating from such programs may be surprised to see how different the practitioner's world is from the academic's. In industry, the pace is faster, the tools are more complex and sophisticated, and information moves very quickly through both sociopolitical (e.g., departments) and technological (e.g., optical fiber) networks. Broadband network access in this context accentuates epistemological differences and places recent graduates in a sink-or-swim situation in which they must rapidly adapt their skill sets.

To support our argument that differences in broadband usage are influencing the field of technical communication, we consider examples from a typical career field: simulation and training. Using several examples taken from this industry, we discuss how professional communicators are being trained in the classroom and how they are expected to function in the workplace. Next, to address some of the problems associated with these methodological differences, we propose a hybrid curricular model for assessing and producing emergent forms of interactive technical documentation, a model relying on both academic and industrial practices for support. A curricular model acknowledging both core technological competencies and professional paradigm differences can help technical communication students trained to approach knowledge through a discursive and constructivist lens to sustain themselves in environments where positivist notions hold sway. We will begin by considering the issue of technological training for technical communicators.

ACADEMIC PERSPECTIVES

Technological differences between academic and industrial practices are nothing new. In fact, these differences are often thought to be advantageous to students and soon-to-be junior employees. Traditionally, college-educated workers have learned to think and to solve problems rather than to use specific tools. This emphasis is often held up as a point of pride in the university. Noting that specific technologies are always changing but that an ability to solve problems creatively and to feel comfortable with learning new technologies will serve an individual well across a wide range of career paths, professors might characterize an in-depth knowledge of a specific computer technology as a suitable goal for a trade/vocational school but not for a university. As a result, upon graduating from college, students may expect to move from one problem domain to another with minimal discomfort or anxiety and may assume that learning new tools should likewise be easy enough. After all, new graduates should have the ability to transfer basic theoretical skills to the design and construction of applied technologies and should be able to learn to apply these technologies to the solution of specific problems.

Certainly, the rhetorical and critical skills learned in technical communication classrooms are adaptable and configurable to a multitude of industrial tasks, as Aimee Kendall Roundtree demonstrates in this anthology in her chapter on the urgent need for more rhetorically informed application of extensible markup language (XML). As technologies continue to mature and applications become more media intensive, however, the gap between digital competencies required in industry and the basic computer skills learned in academic programs widens precipitously. In this context, rhetorical skills, critical maturity, and general knowledge of how to learn technology may be insufficient to overcome even the entry-level barriers for employment in certain industries.

This situation indicates a deepening rift between academics and industry practitioners, a rift caused in part by the fundamentally different ways in which their respective communities see the world. Academics often prefer to study theoretical issues; this preference is not necessarily surprising, as promotion and tenure committees often value theoretical over applied research. Even applied research in academe can tend toward the abstract, as evidenced by the use of systematic research to generalize results from a test case to a larger population. Industry practitioners, on the other hand, must continually be concerned with minutiae, production deadlines, and deliverables, as well as with mastering and applying the latest technologies in order to stay ahead of the fierce competition brought on by globalization. Let us now consider these differences in light of the changes introduced by broadband technology.

MULTIMODAL PRODUCTION: A DIVISIVE APPROACH?

As Gunther Kress and Theo Van Leeuwen (2001) write, "We live in a world where discourse, design, and production no longer form a unity, where teachers are trained to teach without any reference to what they are teaching, managers to manage without any reference to what they might be managing, interviewees to being interviewed without any reference to what the interviews might be about" (p. 9). Rather than diminishing this sense of postmodern disconnection, Internet and broadband technologies may be deepening it. Complex information presses from multiple sides and angles, threatening information overload through cognitive burden or distraction. To make matters worse, many of the technologies that are important for contemporary technical communication in industry (e.g., single sourcing, XML, database-driven Web design, extreme programming, Rich Internet Applications, etc.) continue to grow in complexity and sophistication as greater affordances are provided by faster technologies with wider bandwidths. Even traditional ideas about writing (e.g., the craftsman model) are threatened in this fast-paced drive catalyzed by IT-centric organizations. Thus the gap between academic and industrial thought and practice widens.

In considering the historical factors leading to this disconnect, it is useful to note how both groups traditionally have positioned themselves in regard to production processes. Kress and Van Leeuwen's discourse model, which traces communication through the practices of discourse, design, production, and distribution, enables techniques for both the articulation/analysis and the creation/invention of materials functioning in multimodal environments. Historically speaking, academic programs in technical and professional communication have tended to focus almost exclusively on the discourse and design domains, or *strata*—to use Kress and Van Leeuwen's term (p. 4), and mostly on the discourse domain, which is most abstract. In contrast, industrial workflows have been much more concerned with the highly specific production-oriented and distributive acts of communication.

The academic phase of a technical communicator's training therefore deals more with conceptual reasoning and abstract design than with production and distribution. To be sure, there are exceptions, such as the many technical communicators trained in disciplines such as computer science, engineering, or any academic field other than English studies or communication; and within these latter fields the scattering of courses concerned with the production of specialized forms of documentation such as computer software manuals or training materials. More than 85% of technical communication programs are structured around English, communication, or other departments in the humanities, however (Harner & Rich, 2005); thus, the tendency of such programs to devote large amounts of time to abstract concepts and to analyses of existing examples of communicative modes and media is not surprising. For the most part, technical communication programs focus on the learning outcomes most often associated with good *writing*, and good writing in the *general* sense—basic communication skills and on the theoretical paradigms supporting or packaging such skills. Programs' learning outcomes might include skills such as identifying and addressing an audience, describing procedural tasks with appropriate scope and focus, and editing for conciseness and clarity. These skills are certainly important, but the broadband mechanism is one of networked collaboration and media intensity, and the newer skills of writing modular and reusable content, integrating text and graphics, and building procedural systems rather than simply describing procedural steps are left underdeveloped. Even cutting-edge research in technical communication classrooms still tends to focus on print media, and strategies such as single-sourcing and metadata manipulation, while undoubtedly useful, are taught mainly in relation to print. Not surprisingly, problems emerge when technical communicators are presented with more dynamic and specific forms of media production and distribution (e.g., interactive video training materials, dynamic Web sites, and tools for virtual or augmented reality) in which familiar measures no longer apply or are altered significantly in form or function.

This focus on general or traditional writing, coupled with the rapid evolution of other technologies and ideas in industry, often complicates academic and industrial collaboration. With such a fundamental difference in perspective such as that toward production processes, it is difficult to find a means for building an intersubjective space (i.e., a common ground) between the two communities. One would hope that the research produced by academics would help drive the latest innovations in technical communication and documentation practices, but the two communities are much less likely to interact than one might think (Grove, 2005; Kress & Van Leeuwen, 2001; Mirel & Spilka, 2002;), and academic faculty and industry professionals rarely publish *any* articles together (Palmeri & Tuten, 2005), let alone articles that might lead to ideas for resolving these issues. As Laurel Grove (2005) explains, "Practitioners and academics often fail to recognize their common interests—practitioners see research as irrelevant; academics see practice as lacking any theoretical basis" (p. 237).

Differences in access to resources further complicate the division between academic and commercial domains. Broadband technologies enable the use of video conferencing and real-time, distributed simulations of complex mechanical and procedural processes. Such technologies remove the requirement that team members and employees be co-located and encourage the spread of industrial tasks from a central location to a more decentralized and cost-efficient model of operation. As Sosa, Eppinger, Pich, McKendrick, and Stout (2002) note, various stages of industrial processes often take place in different areas of the world; large corporations commonly design hardware in one location, design software in another, and begin the manufacturing process in yet another. In an academic setting, it is much more likely for students to encounter all aspects of their training in a singular, central location. On the positive side, internships, distributed learning, and Web-based coursework are beginning to offer universities some of these same types of cost and efficiency benefits enjoyed by industry.

BROADBAND MEDIA AS AN ACADEMIC CONSIDERATION

Given this rather polarized arrangement of academic and industrial goals and methodologies, it seems that technical communication pedagogy will need to continue to evolve in order to respond to the increasing prevalence of multimodal materials and broadband business practices. This argument presupposes, of course, that the goal of such curricula is to prepare the majority of graduates for industrial placement. Students headed for graduate school, however, will also benefit from a more robust treatment of media theory and processes of designing, producing, and distributing products.

The intrinsic properties of broadband media and the ways in which these multimodal media are produced and distributed to an audience are important topics for the technical communication classroom. There are some notable differences between how information can be packaged and transported in a broadband environment and how it can be moved in more limited network environments. These differences range from the technological (more bandwidth suggests greater opportunity for interactive and immersive multimodality) to the rhetorical (user agency is enhanced and reformulations of ethos are based on community-driven support forums and other feedback-based documentation initiatives). Academic study of these issues can offer insight, especially regarding the relation between bandwidth and Internet connection speed to technical communication design and production standards.

This task may be less daunting than it seems, since many properties of broadband media are refashioned from traditional media. Hypertext, for example, draws on and reconfigures earlier technologies such as alphabetic media, the telegraph, video, film, and animation (Bolter & Grusin, 2000). Even so, such juxtapositions and reapplications of older forms in newer interfaces inevitably create new rhetorical contexts, as Adrienne Lamberti discusses in her chapter in this collection. For instance, we might consider the notion of high-speed kairos for broadband technologies. In a broadband environment, virtual time can be shifted and reorganized using creative video editing techniques such as the shuffling of keyframes (the beginning and ending moments of a transition between video frames) in an Adobe Flash-based interactive tutorial. Space also can be altered through the creation of simulated three-dimensional training environments, allowing a viewer to perceive depth and texture through creative applications and manipulations of rendered art, wireframes (the layout of a visual interface's basic components), shadow, and lighting. The question from a kairotic perspective, then, might be which changes in the rhetorical act occur when the medium shifts from a linear to a random timeline, or from a two-dimensional to a three-dimensional environment?

This type of academic question can apply to other fundamental topics of rhetoric, including decorum and audience, as they relate to industrial contexts. For instance, how will a typical end-user feel about being able to rotate and to expand a vacuum cleaner in three dimensions in order to find a belt that needs replacing, instead of reading about this process in a bulleted list? Is such interactivity and fidelity even necessary? What type of empirical evidence might be gathered to support a conclusion on this point? What is more, the professional research of faculty members can be offered to students in order to demonstrate the value of both theoretical and applied academic work, as well as the benefits offered by the modest pace of academic inquiry.

The Broadband Age presents a unique vantage point from which to explore the implications of modern technical communication practice from an academic perspective. As another example, the design of products used for simulation training purposes requires more than the integration of multimedia and software development knowledge. A holistic view of product design, much like the principles and practices of systems engineering, are necessary if a product is to be useful as a training tool or as a job aid. In providing a framework for a systems engineering curriculum, Aaron Shenhar (1994) advocates a holistic view of product design that is "the design of the whole as distinguished from the design of the parts" (p. 328). A "holistic view," Shenhar argues, "is multidisciplinary in nature, rather than disciplinary or interdisciplinary" (p. 328). To be sure, as a new-media production, simulation demands application and tool knowledge, but as Shenhar writes, "Complex systems can only be created through the combined efforts of many people" (p. 328). In the workplace, technical communicators will more than likely be an integral part of a product team. In the case of a simulated training product, training-systems analysts typically conduct a needs assessment in the discourse stratum to identify the requirements of training and systems. Instructional-systems designers develop the instructor tasks and functions and work with multimedia engineers to select the appropriate media for instruction and delivery. Concurrently, cognitive psychologists and learning theorists focus on students and learning objectives; both might participate in curricular design and storyboarding, as might graphic designers and multimedia specialists. A move into the production stratum occurs as software and electrical engineers design the system architecture and as mechanical engineers design the physical workspace. Lastly, during both production and distribution, human engineering ensures that ergonomic concerns are met; specialists in this field also participate in human-computer interaction analysis, usability studies, and system testing.

As the examples above illustrate, to align rhetorical skills with industry needs fittingly, a fairly precise understanding of what happens as students move from academic training into the professional community is necessary. We next will look closely at technical communication in the industrial professions our students may enter. This analysis is derived from more than 28 years of experience working with military technology and technical documentation.

INDUSTRIAL PERSPECTIVES

Broadband technologies have had an especially powerful influence in the defense industry. Because of the unique situation in which technical communication materials must be used in this field, it is comparatively easy to study technical communication as it relates to a larger systems-design process using broadband media. In this section, we focus on industrial perspectives and the deliverable production cycle to identify different types of gaps that emerge when newly educated technical communicators enter the workforce. This focus will set the stage for the revised curriculum we suggest in the final part of the chapter.

Our analysis of deliverables here is focused on one particular type of document: the Interactive Electronic Technical Manual (IETM). We exemplify the disconnect between academic and industrial knowledge by illustrating how this type of deliverable has been held back by traditional conceptualizations of technical communication curricula.

Paradigm Gap

We might begin by asking this question: Where does technical communication fit within the complex scenario of systems design? What seems obvious is that the holistic and multidisciplinary approach advocated for system design should be extended to include interactive and intelligent technical documentation. But surprisingly, technical communicators often view their documentation projects, whether new-media designs or traditional linear documents, as distinct and separate products from the product being developed. These documents are not considered a crucial part of the whole system design, but rather a small and often insignificant part. And it is here within the technical publication groups that the differences in skill level created by differences in broadband adoption are most obvious.

Broadband-enabled technologies have exposed skill deficiencies within groups of and, ultimately, in individual technical communicators. An assessment of the design of an IETM shows just how substantial this skills gap can be.

IETMs on one level are nothing more than reference materials, but on another level are artificially intelligent applications meant to improve maintenance time and accuracy. The IETM concept model is focused on machine-to-machine interactivity, with human intervention when and if extra guidance is necessary. An IETM residing on a laptop computer is connected to a sensor embedded in another product, and some type of electronic control-unit interface allows a dialog to commence between the two computers involved. Depending on the outcome, the user will be instructed on a task to be completed, if any. For example, soldiers use IETMs to troubleshoot and to maintain their equipment in lieu of paper technical manuals.

Although technical documentation can be both interactive and multimodal, even when the documentation is tagged in specialized metadata markup languages such as Standard Generalized Markup Language or XML and embedded with media, IETM documentation usually represents the "look and feel" of a traditional manual. This reflects the fact that technical communicators are trained to remain faithful to the idea of traditional print writing techniques, while other industry professionals tend to be trained to view writing as secondary to their primary goals and tend not to offer much useful criticism regarding the selected content delivery system. As a result, technical communicators may use models more appropriate to print media than to broadband media, and these models, however outdated, continue to survive unchallenged. It should be clear that broadband technologies are capable of using high-bandwidth networks at full extent. Why is it, then, that the average IETM is no more than repurposed print enabled by low-speed broadband multimedia technologies?

Expert system design, along with developing queries, if-then-else prompts, scripts, and the intelligent user interface, is the result of the interplay of group members whose skills are diverse, such as cognitive psychologists, human engineers, instructional designers, and information technology professionals. When so many of the materials and exercises students encounter in the classroom are printcentric, it is no wonder that industrial employees do not readily understand the potentials of the increased bandwidth and speed provided by faster networks. Those who create IETMs could contribute significantly to designing such manuals if they followed a more creative and inventive mode of multimodal communication—one that might be used to refashion a broadband medium more appropriate to the environment in which it is used.

Group Dynamics Gap

Group dynamics may also provide some insight into printcentric practices, for technical publication groups can be territorial. This can be another abrupt change from the academic classroom, where individuals are encouraged to work together. For the most part, this process is mediated by a central figure (e.g., the professor) who is likely to encourage democratic behaviors and respectful and open conversation within and across the groups. Often staffed and organized according to group member's skills, classroom groups tend to reinforce the craftsman model (Albers, 2003) of technical documentation development, with individual students contributing different sections of a group document and then a collective review of its contents. Although groups are *somewhat* heterogeneous, students in advanced technical communication courses are mostly strong writers and have similar basic skills and competencies gained from prerequisite courses.

On the other hand, in a traditional defense industry training organization, for instance, technical publication groups are *highly* heterogeneous. They generally consist of employees with specialized skills (unless in a truly small business), all of which contribute to the discourse, design, production, and distribution of the manual: subject-matter experts with relevant experience, skilled writers and editors, word processors and end-product publishers, and technical illustrators. In the flight-simulation industry, people are employed based on individual subject-matter expertise and, as Katherine Staples (1999) notes, are "probably males, perhaps ex-military or a former technician, of middle age, and probably a long-term employee of a single company" (p. 156). These technical communicators are hired because they were once users of related equipment themselves and as such, have worked intimately with similar systems and their supporting technical documentation. Changing organizational practice or attempting to revise existing technological practices (as suggested in the prior section) can be quite difficult for new employees because they have comparatively little experience with organizational or multidisciplinary culture.

Creative Skill Gaps

The increased capacities of broadband technology and its ability to showcase more media-intense forms of documentation such as animation and three-dimensional video games has elevated artistic skills in industry and surfaced related fissures between academic training and industrial procedures. Again, this is a case in which writing is stressed in the classroom at the expense of covering other potentially necessary skills. Currently, most industrial teams in the defense industry have other members of the technical publications group provide illustrations and graphics expertise.

While subject-matter experts and writers once sketched concept drawings for the technical illustrator in order to suggest a 3D dimensional perspective of the product and its components, broadband technologies have enabled both technical illustrators and technical communicators to share design space. Technical communicators often are asked to use engineering drawings as the basis of a figure or graphic and work with the drafter to modify drawings or convert them to a format that can be imported easily into the desktop publishing application and modified by the technical communicators themselves. This is one example of an opportunity whereby technical communicators can position themselves as knowledge workers within the organization, yet it is unlikely that individuals will demonstrate this type of initiative or creativity when it has not been stressed as part of their academic training.

Summary and Analysis

To summarize, in the traditional workflow model of technical documentation development, those in the technical publications group not only are disconnected from the product development team in terms of space, but also may be segregated by skill within the group. Concerned with supplying the appropriate content, subject-matter experts interact with the product development team but typically have little interest in the writing and editing phases or in the production and distribution phases of development. Writers and editors rely on input from the subject-matter experts but are not really concerned with how that knowledge is created and probably do not understand how their writing skills can enhance overall product design. Technical illustrators rely on input from writers and perhaps from subject-matter experts but have very little to do with the overall production of documentation. Concerned mainly with producing the final product and distributing it to the customer, word processors and lower-level tool users express little interest in the collection of the subject matter or in transforming it into a viable text. Some of these problems stem from the ways in which employees were trained in the classroom to think about the discipline.

Within any organization, and especially in the engineering or technical industries, team members with a multidisciplinary point of view and with a holistic understanding of the product are much more highly regarded than those who work in isolated territorial environments. As Roger Grice (1994) points out, these individuals "can bring a broadened enriched perspective to the product being developed and produce something that may be more widely accepted in the marketplace" (p. 389). Such team members are considered technically literate, not because they have technical educations, but because they understand the team dynamic and how this dynamic works to achieve a marketable and usable product. They are proactive contributors, consider the contributions of other disciplines crucial inputs into the design of technical documentation, and view technical documentation as an integral part of the system, not as a stand-alone product or as a by-product. Such a team member profile is commensurate with the technological, economic, and communicative developments afforded by the Broadband Age.

We are not suggesting that valuable technical communicators must have an engineering or technical background, nor do we mean to imply that they should become subject-matter experts in the topics being written about. We do suggest, however, that technical communication curricula begin to focus on a diversity of skills and disciplines, much like that in systems engineering, whose "wide applications in various industries prove its effectiveness as a means of integrating distinct disciplines and technologies into an overall complicated purpose" (Shenhar, 1994, p. 327). Marjorie Davis (2001) adds, "Unless technical communicators want to remain in a servant role, [they] must become more than tool jockeys [and] complete the evolution from craftsperson to professional" (p. 139). Familiarity with a diversity of skills and disciplines can liberate technical communicators from their perceived role as "support" and elevate their status within the organization, as experts in both communication and product design. In our concluding section, we offer ideas for initiating steps in this direction.

A PROPOSED CURRICULUM FOR TECHNICAL COMMUNICATION

This final section of our chapter presents strategies for strengthening technical communication pedagogy for the Broadband Age. We also consider applying academic techniques to improve industrial practices. This holistic approach means improving and incorporating more interactive and tools-driven design techniques for the student during academic training and utilizing more inclusive and multimodal theories for the industry practitioner in the development and deployment of broadband documentation products. Such a model borrows from both communities, for the academic world is ideally suited for the advancement and pursuit of knowledge, while industrial models leverage resources that lead to improvements in efficiency and innovative practical models for facilitating technological workflows. By considering the standpoints and practices that have led to divergences in these two communities' understanding of groups, writing, and technology, we can initiate a conversation between experts in both domains regarding how to narrow methodological and epistemological fissures.

Before outlining our plan, we wish to acknowledge that this model evolves out of our own focus on military training, maintenance, and simulation documentation. We feel that many of these discipline-specific ideas are worth considering at a more general level for two reasons. First, new media products in this field are perhaps uniquely complex, demanding a very high degree of innovation in terms of text and technology, all of which *future* broadband forms of documentation almost surely will need to possess. Second, there is a long and well-studied shared history between military and academic applications of technical communication. This rich history demonstrates crucial interactions between media and rhetoric that, we believe, are useful for shaping a unified model of pedagogy. Before moving to our curricular suggestions, we will briefly examine a theoretical framework useful for merging key ideas from both academia and industry.

Reconciling Academic and Industrial Objectives

With the functional and rhetorical dilemmas from the earlier parts of this chapter in mind, we turn to a theoretical model that may address some of the divergent paradigms that can frustrate academic and industrial collaborations in the Broadband Age. The academy and industry are obviously different institutions with different goals and practices, and we do not mean to suggest that they should have the same vision, nor that they should share the same goals; indeed, we consider their differences to constitute an advantage to society. Rather, we suggest that a shared understanding of production is useful and can help align educational goals with the professional skills required by employers. We suggest specifically that a theoretical model can help identify divergences between the production process as a student understands it when graduating, and the production process as it exists in industry.

This model of multimodal communication, developed by Kress and Van Leeuwen (2001) and mentioned at the beginning of our chapter, is especially appropriate to our task for three primary reasons. First, it is *practice-based*. Second, it is *multimodal*, meaning that it can account for traditional text as well as for the juxtaposition of such text with audio and video materials. Third, it does not abandon the socially constructed influences of meaning making, but rather incorporates these elements as integral to its theoretical foundations. Although this model was not constructed initially to deal with interactive, high-speed media, it is flexible enough to be extended in that direction, toward the rich media applications so often dependent on broadband technologies. In short, we offer one interpretation of Kress and Van Leeuwen, from the perspective of technical and professional communication.

As discussed earlier, Kress and Van Leeuwen's multimodal theory of communication is built on discourse, design, production, and distribution strata, or domains of practice. Discourse is found in those social spaces where specialized knowledge is shared and exchanged (p. 4). In our discussion thus far, we have suggested that discursive knowledge gaps exist between academic and industrial communities of technical communicators, for a variety of reasons.

Design is described by Kress and Van Leeuwen as standing "midway between content and expression" (p. 5). In this sense, design can be considered the articulation of an idea in an abstract form. The design phase is important because it serves as an intermediate stage in which methodological or technical wrinkles associated with a product can be ironed out. Design products may take on tangible shapes as well, in forms such as design blueprints for a given architectural structure (though not necessarily the final blueprints), in written notes for a given meeting, in notes taken during a meeting, or in other intermediary mental or articulated states. Even the deliverables produced through most technical communication courses—documents such as instruction manuals, project plans, and even software documentation files—are more characteristic of design than of production, for these so-called final projects are imperfect and in a state of revision, with the final assessment of quality provided by the course instructor. Were a final project to be carried over from one course to another and handled by multiple groups with multiple agendas and foci for assessment, the type of transfer found in the production stratum would be reproduced more authentically.

When these abstract ideas or intermediate forms are moved into more permanent and architecturally sound states, they become productions (p. 6). Examples of productions are the construction of a building from a set of blueprints or, more generally, the use of material resources to commit abstract ideas to fully realized forms. In industry, these forms might be represented by final-release versions of documentation, by shipped copies of software manuals, by the launch of a new documentation Web site, or by the movement of an interactive electronic technical manual from Beta (pre-release) to non-Beta (release) status. In contrast to the design stratum, however, the production stratum involves no mediator standing between designer and audience: no instructor looms over the product and assesses whether the articulated form and its medium are appropriate for the intended audience or audiences. In the production model, errors are minimized and the product is shaped into its final form and prepared for distribution.

Final products are disseminated to an audience in the distribution stratum. While this may introduce new theoretical or philosophical considerations—Kress and Van Leeuwen note Walter Benjamin's (1977) work on the loss of the "aura" of authenticity when an object is removed from its original context and mechanically reproduced and relocated—this phase in industry typically is much more concerned with the practical and economic issues involved in providing an audience with access to production materials (p. 7). Digital media environments often integrate production and distribution strata, in that digitally mastered forms of artwork and documentation can simply be moved from one server to another in order to enable worldwide access to materials.

Although these four domains may be accessed by a student in a classroom or by an employee in an industrial setting, there usually are more opportunities for discourse and design to be discussed in an academic setting, where control of both design and synthesis of academic products can remain with an individual student. In industry, it is rare for an employee to follow a design from abstraction to concrete formulation; instead, a given employee may inherit a task after it has gone through its initial conceptualization and been vetted for production by management personnel or committees. Insofar as teachers cannot anticipate the position a specific student may end up securing upon graduation, it seems sensible to us to engage all four discourse and design strata in technical communication curricula, and especially to prepare students for high-speed production and distribution, processes they are likely to encounter in their workplaces.

In considering this scaffolding for multimodal synthesis, we can begin to develop a more precise theoretical understanding of the types of skills necessary in the Broadband Age. A preliminary attempt at such a task, which considers not only examples of existing formative products used by technical communicators but also the media in which those products are made evident, might include examples of activities such as (a) audience analysis, (b) project management, and (c) help documentation; along with their corresponding media, such as oral interviews or ethnographic studies, Gantt charts or project management plans; and HTML help documentation, compiled help documentation, or XML/docbook help documentation. Although these examples do include media and modes from several of Kress and Van Leeuwen's strata, including discourse, design, and production, they are oriented more firmly in the former two strata.

What is immediately evident from this assessment of both tasks and theory is that technical communication in broadband and networked industries increasingly is becoming a multimedia-enabled process; employees building interactive documentation systems will often work with two-dimensional and three-dimensional graphics, audio files, computer programming scripts, static and dynamic forms of text, and interactive video. Additionally, they will be expected to interface with hybrid groups composed of management, graphic designers, project managers and team leaders, subject-matter experts, and clients. While the selected "traditional modes" outlined in this discussion do much to address these actions and interactions, a more marketable professional portfolio may in fact involve synthesis and cultivation of the additional (and oftentimes multidisciplinary) skills we might define as “broadband skills.”

Practical Suggestions

While we hope that this theoretical treatment is useful for conceptual alignment of paradigms between the academic and industrial perspectives identified in this chapter, we also need practical and immediate solutions to address gaps in skill and practice. An immediate step in the right direction would be to move from an isolated model of professional training to a more integrative and multidisciplinary model. Based on our analysis of current academic trends and technical publication groups working in the field of simulation and training, we urge technical communicators to immerse themselves in overall product design. They should not continue to work, as Grice (1994) describes it, “in an isolated, support group,” but attempt to become “an integral part of the product-development team” (p. 389). According to Grice, “Those who can thrive in the environment will be able to make significant contributions to the product being developed; those who cannot, on the other hand, will make smaller contributions, if any, and may be perceived more as a liability than as an asset” (p. 389).

This is painfully true in the simulation and training industry. Technical communicators who are limited in terms of the technological skills they can bring to the table are considered a burden to the team, and their products are often considered archaic. And as a result, interactive technical documentation with true interactive functionality often is given over to technical experts for development, not to technical communicators. The Broadband Age presents technical communicators with an opportunity to reverse this trend, but this will not occur without a change in practice by both educators and by managers.

What, then are some of the core competencies a technical communicator should develop for the Broadband Age? Corey Wick (2000) suggests that “technical communicators develop a more comprehensive understanding of the technologies that service knowledge management as well as business in general” (p. 527). Davis (2001) suggests that technical communicators should have a basic understanding of technological competencies, management, and teamwork skills. We believe all these skills are required for the future of technical communication and propose that technical communicators must also be versatile in a wide range of skills and disciplines.

Our assessment of the current state of affairs in both academics and industry reveals several overall factors leading to deficiencies in professional, entry-level skills for technical communicators entering the workforce immediately after completing their undergraduate educations:

- They do not have multidisciplinary backgrounds.
- Their focus is on the product as a separate entity rather than as part of a unified process.

- They continue to support and to be trained in the craftsman model of technical documentation, with minimal attention paid to more modular methodologies.
- The skills they do have are consistent with skills enabled by low-bandwidth technologies.
- They do not have the skills to take advantage of high-speed-enabled multimedia technologies.

To address these deficiencies, we suggest four practices that span both academic and industrial contexts and that we feel are important and relevant to the Broadband Age. First, we feel that both academic and industrial attention to the characteristic of computational interactivity is critical. An approach compatible with that of IT will be vital to the survival of technical communicators in broadband and networked economies. Such partnerships already are being formed with library sciences, for example, under the term "information literacy" (see D'Angelo & Maid, 2004). Understanding the various interactions between teams of humans and computers will be crucial for designing effective new types of documentation products situated in broadband digital space. As interactivity is what separates "new" media from "old" media (Murray, 1997; Zappen, 2005), it is something that needs to be continuously stressed and explored in both education and industry.

Second, we feel that a multidisciplinary education is essential. For technical communicators to break out of the craftsman model of technical documentation development, and for students to understand how other team members can provide valuable input into documentation development, technical communication curricula should include courses in human factors, instructional systems design, IT, digital media, and cognitive psychology. These disciplines are involved in overall system design, and these specific disciplines are useful for a variety of industrial tasks, not just for those associated with military simulation and training. It is not practical or fair for us to ask the typical technical communication professor to learn the wide array of skills necessary to educate students in the many skills they will need for working in modern industry. It is fair, however, to ask program administrators to recognize the value of different skills and how they fit into the overall matrix of technical communication pedagogy, and to arrange students' coursework around this multidisciplinary structure. Recognizing the inevitable political battles and turf wars that may occur here, we conclude that this will perhaps be the most difficult change to effect in academe.

Third, we believe that collaborative internships are vital for establishing a linkage between academic skills and practical, on-the-job needs. Internships in technical communication can provide valuable insight and experience for discipline-specific and industry-specific types of problem solving. Technical communicators who intern at large and small businesses will ideally have the opportunity to see firsthand where their contributions have the greatest impact. They will also learn if their core competencies and technical skills are adequate for workplace success. Moving curricula outside of the classroom and into the field has interesting implications for technical communication students hoping to catch a glimpse of their future professional lives before actually beginning them. Such a strategy has proven successful in rhetoric curricula (McGill, 2003); similar benefits likely can be found in arrangements whereby technical communication students conduct ethnographic research on industrial teams.

Lastly, we feel that it is important for technical communicators to understand and to appreciate the business-oriented mechanisms driving industrial practice. Management and leadership courses may be useful for this goal. Curricula that include program management studies—cost strategies, scheduling, risk-mitigation techniques, resource management, team building, and customer relations—at the product level will help technical communicators understand how documentation fits into overall project development and which factors ultimately influence its success. Knowledge of these practices can also be helpful for understanding how different teams and groups work together with common goals in mind.

CONCLUSION

In this chapter, we explored the ways in which digital divergence is affecting the simulation and training industry by giving rise to a gap in understanding and practice between communicators who are equipped to deal with broadband technologies and communicators who are not. We offered examples from the defense industry to highlight the key trends we believe are affecting the field of technical communication and will be affecting it for some time. Although certain differences between academic theory and practice and industrial theory and practice are longstanding, we have attempted to demonstrate in this discussion how these differences are being exacerbated as a result of the challenges that broadband technology poses to both producers and consumers of media.

Using Kress and Van Leeuwen's multimodal theory of communication, we examined the function of technical communication from an academic perspective focused primarily on discourse and design, and from an industrial perspective focused primarily on production and distribution. Later, we revisited this model to examine the shifts in thinking that may be necessary to better align practices in academe and industry. Finally, we identified several problematic factors that may disadvantage future technical communicators and offered preliminary suggestions that might prove useful remedies. It is our hope and expectation that researchers will continue to investigate methods for empowering technical communicators in IT-laden environments and to encourage interdisciplinary and collaborative initiatives incorporating the benefits of broadband technologies.

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