2013

"iDilemmas" and Humanities Education: Redefining Technology Literacy Pedagogy and Practice

Steven Richard Watts
Utah State University

"IDILEMMAS" AND HUMANITIES EDUCATION: REDEFINING TECHNOLOGY LITERACY PEDAGOGY AND PRACTICE

by

Steven R. Watts

A thesis submitted in partial fulfillment
of the requirements for the degree

of

MASTER OF SCIENCE

in

English Literature and Writing

Approved:

David Hailey Major Professor	Ryan M. Moeller Committee Member
Ronald Shook Committee Member	Mark McLellan Vice President for Research and Dean of the School of Graduate Studies

UTAH STATE UNIVERSITY
Logan, Utah

2013

ABSTRACT

"iDilemmas" and Humanities Education: Redefining Technology Literacy

Pedagogy and Practice

by

Steven R. Watts, Master of Science

Utah State University, 2013

Major Professor: Dr. David Hailey
Department: English

U.S. and global citizens will increasingly be called upon to navigate complex social issues surrounding information and communication technologies (ICTs). At the start of the 21st century, humanities educators are uniquely positioned to impact the ways technology literacy is taught and learned in secondary and post-secondary educational settings. Cultural, social, and textual criticism are increasingly embedded in the evolving theories surrounding technology literacy.

To build the new kinds of technocultural humanism required, however, humanities educators must continue to fight against fragmented, "atheoretical" technology literacy practices that while not ill-intentioned, do not fit the methodologies needed to produce the best results. Humanities educators must 1) inoculate themselves against the "E-Literacy Myth" positing that Gen-Y / Millennial students are inherently "tech savvy"; 2) be willing to provide key perspectives and conversations that have been largely absent from technology discussions; 3) avoid focusing research on narrow textual perspectives, but also investigate the vast range of practical and social implications of technology's use conditions; and 4) explore new classroom techniques that can produce immediate technology literacy gains even if programmatic changes are not forthcoming.

(89 pages)

PUBLIC ABSTRACT

"iDilemmas" and Humanities Education: Redefining Technology Literacy Pedagogy and Practice

Humanities educators at U.S. colleges and universities face sustained challenges in building effective technology literacy practices. As theories of technology literacy evolve, humanities topics are increasingly relevant in technology discussions, as rhetorical and critical analysis, textual analysis, and student learning theory are deeply embedded in current definitions of technology literacy. As such, humanities scholars have dramatic opportunities to become more involved in technology studies generally, and have a voice in technology policies that affect their institutions and students.

However, critical research, classroom teaching methods, and curricula in ICT literacy have fallen behind current needs, and many institutions struggle to define appropriate ICT methodologies, policies, and practices. Though students regularly exhibit surface-level skills in navigating information and communication technologies' (ICTs) user interfaces, they often lack critical knowledge frameworks to move beyond being passive technology users and consumers.

Humanities scholars have the opportunity to better serve their institutions of learning and students by embracing a model of technology "multiliteracy," where functional technology concepts are joined with broader social and rhetorical issues. By studying computers not just as "tools," but as metaphors for broader patterns of thinking, rhetoric, and "ways of knowing," students can build better technology knowledge frameworks, and humanities scholars can re-invent their futures from a position of strength, as their knowledge and expertise intertwine with critical conversations surrounding technology studies and policies.

Steven R. Watts

ACKNOWLEDGMENTS

I would like to immensely thank the Utah State University Department of English faculty, advisors, and administrators for creating an engaging and rewarding course of study that ultimately led to this thesis. The professionalism evidenced by so many demonstrates a remarkable commitment to the true spirit of humanist study, connecting passion and creativity to the pursuit of knowledge.

Special thanks goes out to my wife, Sabrina, who has (mostly) cheerfully born the challenges of "academic widow-hood" with grace—and provided a much-needed kick in the pants as often as necessary. In a very real sense, this thesis is as much hers as it is mine.

Steven R. Watts

TABLE OF CONTENTS

LIST OF TABLES

INTRODUCTION

The E-Literacy Myth

In 2008, Emory University professor Mark Bauerlein, a regular contributor to CNN and former Director of the Office of Research and Analysis for the National Endowment for the Arts, published the controversial book *The Dumbest Generation: How the Digital Age Stupefies Young Americans and Jeopardizes Our Future*. The text, as one might predict based on the title, examined (among other things) the relationship between the ever-present digital technologies of the time, and their effects on measurable academic performance in young adults, particularly those in high school and just entering college.

One of the text's key points elucidated a widespread, assumed public narrative surrounding "Generation Y." This narrative, Bauerlein (2008) claimed, framed Gen-Y / Millennials as being fundamentally different and more intellectually advanced than students of prior generations—in other words, those taught in more "conventional" classrooms. Due to the pervasive culture of technology, Gen-Y students had, so the narrative went, moved beyond the outdated, restrictive classroom of yore.

> Countless commentators recite [the Gen-Y / Millennials'] tech virtues with majestic phrases [such as] unique, singular, and savvy . . . . A 2005 Forrester Research report [announces]: "The 'Millennials'—those born between 1980 and 2000—have an innate ability to use technology, are comfortable multitasking while using a diverse range of digital media, and literally demand interactivity. . ." (Bauerlein, 2008, p. 73)

Bauerlein was particularly interested in the verbiage of the report: "Note the language here; young technology users don't just possess skills, they have 'innate ability'"

(Bauerlein, 2008, p. 73), and unlike their supposedly more "passive" educational forebears, they actively "construct knowledge" (p. 73).

This idea, or narrative, was popularized by a number of sources, Bauerlein (2008) stated, though he referred to Marc Prensky's 2001 essay "Digital Natives, Digital Immigrants" as a particular touchstone on the subject:

> It is amazing to me how in all the hoopla and debate these days about the decline of education in the US we ignore the most fundamental of its causes. Our students have changed radically. Today's students are no longer the people our educational system was designed to teach . . . . Today's students have not just changed incrementally from those of the past . . . a really big discontinuity has taken place. One might even call it a 'singularity'—an event which changes things so fundamentally that there is absolutely no going back. This so-called 'singularity' is the arrival and rapid dissemination of digital technology in the last decades of the 20th century . . . .
>
> It is now clear that as a result of this ubiquitous environment and the sheer volume of their interaction with it, today's students think and process information fundamentally differently from their predecessors. (Prensky, 2001, p. 1)

Bauerlein later attributed an *Education Week* quote to Prensky directly: "'School represents the past . . . After-school is where they are training themselves for the future. The danger is that as school becomes less and less relevant, it becomes more and more of a prison'" (Bauerlein, 2008, p. 68). In this view, Gen-Y students are not merely socially conditioned around technology, their actual intellectual capacities are fundamentally different and greater:

> That's the claim. Screen time is cerebral, and it generates a breakthrough intelligence. E-literacy isn't just knowing how to download music, program an iPod, create a virtual profile, and comment on a blog. It's a general deployment capacity, a particular mental flexibility. (Bauerlein, 2008, p. 84)

In the end, this "e-literacy" argument had become nearly ubiquitous; it "proceeds everywhere" (Bauerlein, 2008, p. 67).

The advancement of this "e-literacy" narrative should hardly be surprising, given the political underpinnings for its rise. In 2007, Patrice Flichy, a sociologist and technology studies researcher at France's University of Marne-la-Valleé, published *The Internet Imaginaire* through the MIT Press. In the book, Flichy (2007) vividly described how in the U.S. at least, the Internet and Information Superhighway can now be conceived as an "imaginaire," an intermingling of physical artifact, social and political capital, myth, and ideology. In this sense, Flichy stated, we no longer simply *use* information and communications technologies (ICTs), they are part of our cultural *ethos*, our sense of being. In the case of the Internet, Flichy (2007) pointed out, it was not necessarily the "relevance of the technical solution" (p. 3) that had caused such wide-spread adoption of ICT, but the ability of those most vested in its success to attract political and economic allies. In this sense, the "technology revolution" was often driven by a highly coordinated and interrelated distribution network, not because the Internet offered the most relevant solutions to every key social problem. In Flichy's mind, this led government officials to adopt political stances in favor of technology—often effusively so—because they needed to justify the exorbitant tax expenditures needed to build tech infrastructures. The very notion of Cyberspace was politically charged early in its inception (Flichy, 2007).

Fractures in the Myth

As a graduate instructor of composition, I experienced first-hand the effects of the "e-literacy" and "Internet imaginaire" narratives. Individually I identify myself as a "humanities scholar." As an undergraduate I studied lit theory, and taught composition as a graduate instructor while pursuing a Master's degree in English literature and writing. Yet personally and professionally I have also held a keen interest in technology. I have built my own computers, certified as a low-level computer service technician, done some light-to-moderate Web programming, worked as a technical writer for a "cloud computing" software provider, and dabbled in digital graphic design.

As a result, when I began teaching composition, I naturally believed that my Gen-Y students were "Digital Natives." I built my classroom curriculum around the assumption that they would need little to no training in general information and communication technology (ICT) use cases, especially the relatively simple ones used in an English composition course. My students, I reasoned, should be eminently capable of working comfortably in ICTs' online and other environments.

Imagine my surprise when I quickly discovered that my students' skills with technology were regularly lacking. Even simple things like basic file management, structured word processing, and database research techniques were often foreign to them. Oh sure, there were those who had no issues, generally the computer science / IT majors and hard-core techno-hobbyists. But for the majority of my students, I quickly realized that to receive expected results on their writing assignments, I needed to dedicate class time on the technology techniques I was expecting them to use.

The simple reality was, I was experiencing a "narrative disconnect." If my students were supposed "Digital Natives," born and bred around their iPods, laptops, game consoles, and Facebook, using computers in schools since kindergarten (because the government had metaphorically moved mountains to ensure they could), why was I being forced to dedicate precious classroom time to basic computing and research techniques—things the "e-literacy" narrative seemed to indicate should be as natural as breathing to these students?

The fact I was asking these questions would have hardly surprised Mark Bauerlein (2008). As *The Dumbest Generation* goes to great lengths to show, there is not, in fact, an "ample and growing body of research on the digital facility of adolescents," but merely "the commonplace assertion" that Gen-Y students possess more technology aptitude (Bauerlein, 2008, p. 68). "For most rising [technology] users, screen time doesn't graduate them into higher knowledge / skill states" (Bauerlein, 2008, p. 139), and despite the "e-literacy" movement's vociferousness, the average Gen-Y / Millennial student gets worse scores on civics, language, and history, does less homework, and reads less outside of traditional educational settings than any body of U.S. students in recorded history (Bauerlein, 2008). The result sets up a strange dichotomy, where on the surface Gen-Y / Millennials appear eminently comfortable using ICT systems, but beneath that surface lies less actual knowledge, poorer learning skills, and depleted frameworks on which to build future learning.

Further research only confirms Bauerlein's assertion that "e-literacy," at least as popularized by the media, is a myth. Syracuse University law professor Ian Gallacher, also acting as the school's Director of Legal Communication and Research, conducted a survey in 2006 of 740 postgraduates preparing to enter law school, investigating the incoming students' information literacy skills. The results strongly affirmed that students overestimated their writing and research skills, and were inadequately trained in necessary reading, writing, and research information literacies (Gallacher, 2007). In his findings, Gallacher (2007) postulated that law schools would need to "substantially increase the amount of time spent in teaching information skills to law students" (p. 33), and that law school instructors and administrators would need to seriously account for "student writing and research deficits . . . when developing skills criteria" (p. 3).

In 2003, a trio of Colorado State University educators surveyed approximately 2,100 students enrolled in a seminar course required for all freshman and transfer students on their information and technology literacy skills. In spite of the students' general enthusiasm for technology, Kaminski, Seel, and Cullen (2003) observed wildly divergent levels of skill amongst respondents.

> A remarkable range [exists] in students' knowledge about information technology concepts and in their software skills . . . the disparities in pre-college use of information technology, if not attended to, might seriously compromise some students' ability to succeed to the fullest extent in college. Faced with such an inconsistent background environment among students, instructors cannot assume prior knowledge of even the most basic of IT skills. (Kaminski et al., 2003, p. 34)

As a result, college administrators and teachers regularly overestimated what their students actually knew about technology, and that teachers could not take for granted even basic skill masteries.

In a 2002 survey sponsored by the University of Oklahoma's Authentic Teaching Alliance (ATA), professors Cecilia Brown, Terri J. Murphy, and Mark Nanny observed that though student Internet users seemed to find information quickly and easily online, they exhibited a general overconfidence in their overall "techno-savvy" skill sets. Students regularly equated their "tech savviness" on the Internet and with Google as being the same as "information savvy," and often failed to see the importance of information literacy generally in their research (Brown, Murphy, & Nanny, 2003).

In an effort to evaluate the effectiveness of Missouri State University's computer literacy courses, in 2009 computer information systems professors Michael Hignite and Thomas M. Margavio, and accounting professor Geanie W. Margavio tested over 600 first- and second-year students enrolled in a general education technology literacy course. Delivered at semester's end, the test was designed to evaluate the course's effectiveness at translating practical technical skills, such as knowledge of various software programs, into academic uses such as writing and content development. Despite being enrolled in a course whose sole purpose was to ostensibly train students in these techniques, barely 40% of tested students could reach a "passing" level of performance as defined by the Educational Testing Service (ETS). The authors themselves seemed astonished at their findings: "If we truly wish to convey to students the ability to gather and analyze information and then to make good decisions as a result of that analysis, clearly the course activities must go beyond the use and manipulation of hardware / software in order to complete some lower-level tasks" (Hignite, Margavio, & Margavio, 2009, p. 816). In their minds, the pedagogies and methodologies in place were inadequate to generate the needed skills and knowledge base—"In this age of accountability and given the resources often committed, if such courses are to continue to provide value to students (and continue to exist), it would appear that significant future attention must be devoted to achieving greater success in such endeavors" (Hignite et al., 2009, p. 816).

Each of these evidences begs the question—if, as Mark Prensky (2001) claimed, students have "evolved" and "adapted" to seamlessly use digital technologies to "construct knowledge," why, as Kaminski, et al. (2003) noted, can we not even assume basic IT skill sets for incoming college students? If Gen-Y students are inherently conditioned to use technology, why, as 2010 Computers and Composition Outstanding Book author Bradley Dilger asked, are many students incapable of performing rudimentary file management and network access skills (Dilger, 2000)? If today's college freshmen are naturally tech-savvy, why can only 40 percent pass a basic ICT literacy skills test, even *after* taking a semester long, general-education technology literacy course (Hignite et al., 2009)?

The Meaning of the Myth

I bring these points forward—the notion of Gen-Y "e-literacy" and the Internet as an ideological "imaginaire"—because as a long-time humanities student and early-career humanities teacher, we the collective Body Humanist are being influenced—and occasionally controlled and even victimized—by a narrative surrounding technology that is foundationally incorrect. Rare, I suspect, is the college humanities instructor who has not heard arguments that our traditional mainstays of humanist education—English, history, rhetoric, composition—have naturally and necessarily fallen by the wayside in favor of more "technological" subjects. And if this is the case at our colleges and universities, so the story goes, it is because that is what our students and job market demand. According to Bauerlein (2008), the pervasive and powerful "e-literacy" narrative surrounding technology tells us that our students don't want to learn "humanities stuff" anymore, it's not "relevant" to their future job searches, and frankly, haven't they "moved past" that type of learning, as Prensky (2001) claimed? If today's techno-centered learning embodies "a full-fledged intellectual practice, a mode of reading and learning a lot more exciting and promising than old kinds" (Bauerlein, 2008, p. 66), then where indeed do humanities studies fit in?

There is obviously no one right answer to those questions, but there is one answer of which I am now certain: something is wrong with our current technology narratives, and the teaching approaches those narratives promote.

Nor am I alone in that opinion.

Jaron Lanier's name consistently appears as one of technology's early pioneers in historical accounts of Silicon Valley in the 1970s and '80s. Lanier was directly involved in the earliest iterations of virtual reality technology, the MIDI digital music interface, worked as a researcher for Microsoft and SGI, and taught at Columbia University as a visiting professor. Yet even having seen the rise of the Digital Age first hand, in 2010's *You are Not a Gadget* Lanier strongly asserted that our 21st century society had almost blindly embraced "computationalism," an ideology-cum-philosophy that values digital technologies not just for what they do in our lives, but for their own "technology-ness"—technology as an end to itself. Computationalism values digital interaction above human interaction, not simply because it is more "efficient," but because it can be logged, tracked, codified, stored, and statistically analyzed (Lanier, 2010), all so it can be later factored into future technologies to make them "better." As a result, Lanier (2010) believed, our obsession with technology has had and continues to have a dehumanizing effect on society.

As Robert Hassan, Senior Research Fellow for the Australian Research Council at the University of Melbourne stated, we are not "critical" technology users, nor thinkers. "Not often do we consider the technology itself: its history . . . its 'social shaping', or where its uses 'situate' us within society. When we do give the technology any thought at all, we tend to think of it as neutral" (Hassan, 2004, p. 16). As Penn State professor of English and associate professor of Information Sciences and Technology Stuart Selber described, this lack of critical dialogue plays out almost daily in higher education, where institutions have made massive investments in technology infrastructures, yet those investments consistently "fail to make humanistic perspectives a concern" (Selber, 2004, p. 1).

Does this mean technology investments were unwarranted and wasteful? Not necessarily, but as a long-time student of the humanities and early-career humanities educator, I believe that those of us working and teaching in postsecondary humanities classrooms have significant opportunities to both challenge these narratives and to establish new ones, and more to the point, that the elucidation of such challenges is now a core part of our teaching responsibilities.

My teaching experience brought me face-to-face with what Lanier termed the "techno-political-cultural orthodoxy" (Lanier, 2010, p. 22), where technology solutions are regularly assumed to be the most rational, correct responses to problems regardless of individual need. "Computationalism" often forces us to adopt particular ways of knowing and thinking about technology generally, lest we be seen as going against the "natural self-evident correctness" of technology solutions. As Iowa State professor of rhetoric and professional communication Barbara Blakely Duffelmeyer (2000) stated, we are surrounded by "the strongest cultural assumptions" (p. 290) that technology is both transparent and / or neutral, has no side effects other than to make things "easier and faster"; it is "all-powerful—and even if we have some concerns about technology's effects, we can't do anything about them anyway, so we might as well learn to accept them" (p. 290), and perhaps most importantly, articulating and working towards solving technology problems is "not our job, not our problem" (p. 290).

The result is that too many of us, especially those of us in postsecondary humanities education, are unfortunately "operating in a culture that vastly underestimates what must be learned to take advantage of technology, and to understand its social and pedagogical implications" (Selber, 2004, p. 2). We the collective Body Humanist are, as NYU media studies professor, author, and cultural critic Neil Postman envisioned, cast as the "losers" in the technology debate:

> It is to be expected that the winners will encourage the losers to be enthusiastic about technology . . . They [the winners] tell them [the losers] that their lives will be conducted more efficiently. But discreetly they neglect to say from whose point of view the efficiency is warranted or what might be its costs. Should the losers grow skeptical, the winners dazzle them with wondrous feats of computers, almost all of which have only marginal relevance to the quality of the losers' lives, but which are nevertheless impressive . . . .
>
> Eventually the losers succumb, in part because they believe . . . that the specialized knowledge of the masters of new technology is a form of wisdom. (Postman, 1992, p. 11)

How many of us have watched our colleges and universities rip out floors, walls, and entire buildings to add technology infrastructure? How much money is spent on Adobe and Microsoft software licensing each year by universities, when many perfectly acceptable free and open-source solutions exist—yet no one is willing to learn or train students on them due to vendor lock-in, lack of teacher training, and the misguided sense that "learning the software" is an unassailable prerequisite for future job attainment?

In early 2010, I witnessed a department email exchange that morphed into spirited debate over a simple technology tool one particular English teacher was using as an in-class voting mechanism for large class sizes (80+ students). Some teachers questioned whether the cost of the technology (approximately $20 per student) was worth the investment. Others envisioned if they would use such a technology in their own classrooms, while others argued that the required support costs to implement the solution far outweighed the benefits, while still others wondered why English professors even needed to be invested in the argument at all, since whether adopted or not the technology's use cases seemed to run counter to our true humanistic mission.

Yet in spite of the surreal (nigh-absurdist?) air of the exchange, it acted as a microcosm to many of the debates surrounding technology in humanities education—issues of cost, usability, fitness for the subject matter, and required support. One of the primary purposes of this text is to argue that these kinds of discussions need be happening more often, on a broader scale, and in more productive venues. We are, like it or not, embroiled in a techno-narrative in need of change. As this text will show, we the collective Body Humanist have significant opportunities to blend technology learning with classic humanist subjects, and a responsibility to accept a more vital role in technology literacy sense-making. Just as importantly, when technologies fail to meet broader humanist imperatives in our universities, we must provide viable, ongoing, and relevant critiques of "computationalist" culture.

PART I – CONCEPTIONS OF LITERACY

Claims that the humanities should play a more vital role in technology education are hardly new (see Apple, 1998; Noble; 1998; Postman, 1992, 1995; Selber, 2004; Selfe, 1999). Postman, in fact, specifically stated in *The End of Education* that "technology education is not a technical subject, it is a branch of the humanities" (1992, p. 191). Yet the prevalence of the "e-literacy myth" and a lack of dissenting voices in shaping technology narratives has led to a growing consensus among commentators that additional humanist involvement is needed, across a host of educational and social settings.

In 2010, Dr. J.M. Perez Tornero of the University-Autonoma of Barcelona, and Dr. Tapio Varis of the University of Tampere in Finland published *Media Literacy and New Humanism* in conjunction with the UNESCO Institute for Information Technologies in Education (IITE). Within its pages the two scholars outlined a distinct connection between the process of technology education and humanism.

> Education is strongly influenced by the processes emerging within the society, by intellectual, philosophical and political movements. In the past the humanists' approach had the most lasting impact on education, initiated innovation in school curriculum and pedagogical methods. Current advances in information technologies and propagation of new digital media and learning environments stipulate the increasing importance of media literacy, which is today recognized almost universally as one of the key competences in the educational system . . . .
>
> Digital literacy is linked to the new digital media and is largely dependent upon the language of IT. Its emergence has necessitated a serious transformation in the literacy competences [sic] and the addition of new skills and aptitudes. (Tornero & Varis, 2010, p. 5, 33)

Here the correlation is made explicit—humanities approaches have had lasting positive impacts on pedagogy and curriculum, and as such new techno-skills and aptitudes must be tied to current humanist approaches.

This view is consistent with other definitions of ICT literacy. University of Minnesota professor of writing studies Lee-Ann Kastman Breuch (2002) posited that ICT literacy is

> a complex set of socially and culturally situated values, practices, and skills involved in operating linguistically within the context of electronic environments, including reading, writing, and communicating . . . [Technology literacy] further refers to the linking of technology and literacy at fundamental levels of both conception and social practice. (p. 272)

Having worked for the U.S. State Department in library science and information policy, Dr. Forest W. Horton, along with colleague Barbie E. Kaiser, adjunct faculty at Johns Hopkins Carey Business School, published "Encouraging Global Information Literacy" in 2008. Referencing the 2003 UNESCO International Colloquium on Information Literacy, Horton and Kaiser further broadened ICT literacy's reach, stating that technology and information literacy

> . . . encompasses knowledge of one’s information concerns and needs, and the ability to identify, locate, evaluate, organize and effectively create, use and communicate information to address issues or problems at hand; it is a prerequisite for participating effectively in the Information Society, and is part of the basic human right of life long learning. (Horton & Kaiser, 2008, p. 9)

Note the language here; technology literacy is not simply a vehicle for economic opportunity, but "a basic human right of lifelong learning" (Horton & Kaiser, 2008). Taken together, these definitions assert technology literacy has a functional basis, but requires more than the simple acquisition of "practical" skills. Today's technology literacy intersects functional capacity with long-term humanist agendas.

The Humanist Imperative

While not all humanities educators will agree, I find these definitions provide a view, or space, from which the humanities can re-direct and re-invent itself within the context of university education. If, as Selber (2004) claimed, humanities generally have been devalued in the face of "practical" technology needs and economic agendas, then a fusion of the humanities to technology's broader social topics provides exciting new opportunities for rebuilding humanities classrooms and departments. As Anthony Wilhelm, director of the Technology Opportunities Program of the National Telecommunications and Information Administration (NTIA) suggested, our current state of affairs "calls urgently for a new basic literacy addressing the obligations of citizenship in an interdependent world . . . civil society must act as the catalyst, sparking a social movement to demand a Digital Nation agenda, a regimen to accelerate economic competitiveness and broaden civic engagement in the information society" (Wilhelm, 2004, p. 19).

At Utah State University, I personally watched classrooms and building sections get ripped out to install Category-5 network cable, overhead projectors, and multimedia teaching stations in dozens of locations. As a teacher, I appreciated the investments, and looked forward to using the tools such classrooms offered. Yet in retrospect, I now recognize that I missed significant opportunities to not simply use YouTube and MP3s in my classrooms, but to have my students ask real, serious questions about not just what their technology was doing *for* them, but *to* them.

For example, in first-year college composition courses we regularly ask students to upload material to the Web, use a digital course management software package, and follow formatting conventions defined in a word processor. Yet how often do we take the opportunity to not simply use technology tools to make our teaching more efficient, but direct students to examine why a particular technology has been designed, historically, to perform that task? As teachers we examine the results, or the *products* of what students *produce* with technology, but often do not ask our students what the technology itself asks of them while they produce it.

This kind of engagement, or mode of thought looks at ICTs not simply as a set of neutral tools, as Noble (1998) and Selber (2004) argued against, but as an active constraint on the method of production and delivery of the content itself. The physical constructions of technologies—the physical artifacts—constrain not simply the kinds of messages that can be delivered, but ultimately influence its users as to what messages are even considered valuable in the first place (see Postman, 2005).

This concept of the medium determining not just the *form* of content, but the perceived value of the content was championed by Postman, himself a former student of media age "patron saint" Marshall McLuhan.

> Whatever the original and limited context of its use may have been a [technology] medium has the power to fly far beyond that context into new and unexpected ones. Because of the way it directs us to oganize our minds and integrate our experience of the world, it imposes itself on our consciousness and social institutions in myriad forms. (Postman, 2005, p. 18)

These ideas are not wholly different from the kinds of questions we ask in literature theory studies—questions of meaning and authorship, historicity and cultural context. As

University of Minnesota Internet studies and communication researcher Laura J. Gurak stated, "An age of electric rhetoric must make room for differing kinds of knowledge and must recognize that literacy is always connected to issues of power—who owns information and who controls it" (Gurak, 2001, p. 21). In addition to mere practical considerations, technology literacy also asks questions about what the technologies *themselves* communicate about what is considered privileged, and what is devalued (Gurak, 2001, p. 21). Postman (1995) believed schools should ask students to examine how technologies "reorder our psychic habits, our social relations, our political ideas, and our moral sensibilities . . . how the meanings of truth, law, and intelligence differ among oral cultures, writing cultures, printing cultures, electronic cultures" (Postman, 1995, p. 191).

As Professor of Curriculum and Instruction and Educational Policy Studies at the University of Wisconsin-Madison, Michael W. Apple has written extensively about the struggles of integrating technology and technology literacy in the classroom. In "Teaching and Technology: The Hidden Effects of Computers on Teachers and Students," Apple reflected:

> The debate about the role of [ICT] in society and in schools is not and must not be just about the technical correctness of what computers can and cannot do. These may be the least important kinds of questions, in fact. At the very core of the debate instead are the ideological and ethical issues concerning what schools should be about and whose interests they serve. (Apple, 1998, p. 317)

Stuart Selber (2004) wrote something strikingly similar in *Multiliteracies for a Digital Age*:

> As a rule . . . students are not encouraged to ask important questions when it comes to technology development and use: What is lost as well as

> gained? Who profits? Who is left behind and for what reasons? What is privileged in terms of literacy and learning and cultural capital? What political and cultural values and assumptions are embedded in the hardware and software? (p. 81).

Apple (1998), Gurak (2001), Postman (1995), and Selber (2004) each demonstrate what can be considered "classic" literary study methodologies—deconstructionist critiques around technology's positions of hierarchy, privilege, and meaning. These kinds of critical examinations dispel the notion that ICT subjects are merely technical, or sub-divided from the "real teaching" of humanities topics.

Current conceptions of technology literacy are firmly embedded in humanist paradigms, suggesting perhaps that we, humanities teachers in colleges and universities, have more opportunities than we often realize to examine technology subjects, even in classrooms where this may not ostensibly be the primary focus.

PART II – SETTING THE FRAMEWORK

Yet are college classrooms of composition, lit theory, history, and folklore really the places that technology studies should have more focus? The assertion that technology subjects carry humanist implications is not itself a rationale for changing our current humanities classrooms. I personally would not trade a minute's worth of technology training for what I learned and gained through my upper-division undergraduate literature theory classes; many of the seminal moments of my entire educational experience occurred there. Yet I cannot help but think that we can, and should supplement our current humanities courses to more deeply examine technology in relevant, productive ways.

The first rationale for this claim is the simple acknowledgment that technology's ubiquity means that our students are going to be learning *something* about technology from *someone*, whether we in the humanities are involved or not. If we want our students to engage in productive, humanist dialogues about how they use technology and its effects on them and society, then on some level we need to be the ones leading the discussions. We have to provide critical voices challenging the "promotion of the latest techno-political-cultural orthodoxy" (Lanier, 2010, p. 22). This is especially important when the "e-literacy myth" and ideology of computationalism are so ingrained that critique from within technology's "inner circles" will be increasingly difficult. As Lanier explained:

> Someone who has been immersed in orthodoxy needs to experience a figure-ground reversal in order to gain perspective. This can't come from encountering just a few heterodox thoughts, but only from a new encompassing architecture of interconnected thoughts that can engulf a

person with a different worldview. (Lanier, 2010, p. 23)

The humanities have historically provided the "spaces" from which these kinds of "figure-ground reversals" originate. One of the things that has always attracted me to the humanities is the role of humanism in fostering public debate. We engage in discourse about not just the problems at hand, but the ways the discussions themselves are shaped and controlled. At its core, humanist discourse is both *reflective* and *reflexive*; challenging internal and external participants to examine not just what is being argued, but *how* it is being argued, and how particular discursive frameworks promote or obscure understanding.

Documentary filmmaker and instructor for NYU's Interactive Telecommunications Program Douglas Rushkoff specifically believed that these kinds of "reflexivity" are now required on technology subjects:

> The sustained thought required now is the sort of real reflection that happens inside a human brain thinking alone or relating to others in small self-selecting groups, however elitist that may sound to the techno-mob. Freedom—even in a digital age—means freedom to choose how and with whom you do your reflection, and not everything needs to be posted for the entire world with "comments on" and "copyright off." In fact, it’s the inability to draw these boundaries and distinctions—or the political incorrectness of suggesting the possibility—that paints us into corners, and prevents meaningful, ongoing, open-ended discussion. And I believe it’s this meaning we are most in danger of losing. No matter the breadth of its capabilities, the net [sic] will not bestow upon humans the fuel or space we need to wrestle with its implications and their meaning . . . smarter deployment and use of these tools needs to invite not just better practice—faster, easier, more efficient—but more comprehensive and inclusive approaches to improving key areas of human life. (pp. 18-19)

Technology's reach into the fabric of our society will increasingly demand real, hard conversations about its effects. As Lawrence Lessig, current Harvard Law professor and founder of Stanford's Center for Internet and Society wrote, the Internet and its related technologies pose no end of future legal challenges and debates—concepts of governance based on physical space; the basis of free speech surrounding libel and harrassment; the rights of privacy in a world where a single camera can transmit video and sound anywhere in the world in a matter of seconds; the effects of digitization on copyright, cultural capital, and the creative commons (Lessig, 2006).

University of Southampton senior research fellow in electronics and computer science Kieron O'Hara, and his colleague David Stevens, political lecturer at the University of Nottingham, stated that technologies will increasingly play a deterministic role in people's ability to function normally in society.

> . . . in the last decade or so, we have seen opportunities for work and employment being affected and transformed by developments in technology. When we consider all the other areas of social existence—education, politics, entertainment, leisure activities, consumption, communication—then the impact of these technologies is likely to be even greater, and is likely to affect the ability of individuals to function normally to a much greater extent, as whole swathes of civil society move online. (O'Hara & Stevens, 2006, p. 86)

All of these ideas harken back to one of Horton and Keiser's (2008) key points, namely that technology literacy now carries with it an aspect of social responsibility.

Let me be clear—I am not suggesting that providing our college students a foundation in rhetoric, composition, and history is a trivial undertaking. In some ways, these knowledge frameworks act as precursors to exploring critical ICT subjects. Yet most of us would, I suspect, hesitate to abdicate discussions of privacy law, civil rights, business and political self-interest, public information access, and right of self-governance to the technologists and computer scientists.

Humanist Involvement = Immediate Gains

The second rationale for increased humanities involvement is that by so doing we increase the effectiveness of existing programs, in addition to providing input on how to formulate newer, more progressive ones. Acting as director of educational technology for the U.S. Agency for International Development in Cairo, UC-Irvine's Mark Warschauer observed a critical disconnect in many political circles when implementing ICT projects in educational and social settings. Leaders of projects regularly focused on technical aspects, reasoning that the mere deployment of ICT assets constituted a "win." This attitude repeatedly led to unsatisfactory outcomes "in technology projects around the world . . . [they] too often focus on providing hardware and software and pay insufficient attention to the human and social systems that must also change for technology to make a difference" (Warschauer, 2003, p. 6). When we instead recognize that "ICT is embedded in a complex array of factors encompassing physical, digital, human, and social resources" (Warschauer, 2003, p. 6), technology implementation programs result in more effective overall outcomes, including better skills retention.

This general attitude of "throwing more money and more computer screens" at the problem is a side-effect of the long-standing "Digital Divide" and political responses to it. As Patrice Flichy (2007) described, the race to "techno-equity" in the U.S. caused politicians to largely adopt a "brute force" approach to ICT literacy, shoveling billions in tax dollars to create "necessary" hardware telecommunications infrastructures. Yet this drive was not followed up with any particular follow-up plans for rationally redesigning educational curricula (Flichy, 2007).

Brute-force technology "immersion" tactics misgauge the problem at hand. As a professor of economics at Tilburg University, Jeffrey James has focused much of his work on analyzing the social and economic tensions in implementing technology in developing nations. James (2008) observed that simply increasing the number of physical resources has little net positive effect if a necessary skill base is not already in place. "Below the minimum level of skills . . . no amount of computers can increase output . . . in fact, the more computers are used, the greater will be the waste measured in terms of unused resources" (James, 2008, p. 2028). This is particularly interesting in that many colleges and universities have implemented or at least considered a requirement that all students must purchase a laptop computer when they begin their college education.

Though such a policy is useful in providing core "tools" to students, how much money and time are colleges and universities forced to invest to support under-trained students when they need help accessing networks and finding digital library materials? How much effort is required to enforce network security, prevent malicious software outbreaks, and prevent illegal piracy for systems users who fall below the minimum level of skill? On this topic, Wilhelm (2004) had this to say in *Digital Nation*:

> Investing in new technologies is no recipe for success. Simply having the tools, as is already the case in most wealthy nations, does not guarantee performance. By themselves, information and communications technologies will not bring about results . . . Anyone who has stepped into a school knows that plowing billions of dollars into classroom educational technologies has done little on the whole to transform these efficient yet ineffective institutions. Access is necessary but not sufficient to enhance performance. (Wilhelm, 2004, p. 3)

Improving technology studies and literacy obviously requires some investments in infrastructure, but more than that it requires a body of "community leaders, educators, managers, and organizers . . . capable of managing complex social projects to foster innovative, creative, and social transformation" (Warschauer, 2003, p. 212).

It is my assertion that we in the Body Humanist have a unique opportunity to begin filling those roles of community leaders, managers, and organizers. Using digital tools may make some improvements in our classrooms, but as noted by Warschauer (2003) and Wilhelm (2004), larger-scale technology problems require more input from leaders who are invested in shaping the direction of technology discourse as a whole.

What does this mean from a practical teaching standpoint? Namely *investment*—a recognition that we bear a greater responsibility in the implementation of technology resources at the college ground-level. As we will discuss in a minute, this includes updating classroom pedagogies and curricula to implement relevant technology subjects, working to develop teacher training and career advancement objectives that incorporate technology concerns, and working with other departments and faculty to demonstrate the value and necessity of fusing classic humanist studies into a larger technocultural whole.

PART III - FROM THE "ATHEORETICAL" TO THE MULTILITERATE

So far we have analyzed a disconnect in ongoing technology narratives, and examined the need for greater humanist critique in technology debates. Yet a third assumption underlies both of these ideas, namely that the right kinds of teaching frameworks are already in place. Yet as Selber (2004), Selfe (1999), and others have asserted, ICT literacy efforts are often acted out without any real knowledge base or programmatic system of implementation. My research for this text revealed that effective solutions to technology literacy issues remain disturbingly fragmented, vague, and incomplete, a frustration shared by scholars across a variety of locales.

In 2003, a group of Rands Afrikaans University scholars were attempting to develop more coherent, outcomes-based education (OBE) frameworks for teaching technology in South African universities. Yet their initial review of current programs showed technology education as a whole seemed to be "emerging from an atheoretical perspective" (see Reddy, Ankeiwicz, Swardt, & Gross, 2003, p. 28). Whatever programs were in place, they observed, were implemented primarily through instructor intuition and whatever resources happened to be locally available, rather than through any defined methodology.

In a meta-analysis of existing technology literacy research, a group of scholars, including Kent State Professor of Learning Technologies Richard Ferdig and Cal-Berkeley Professor of Language and Literacy and Human Development P. David Pearson, noted an "alarmingly low number of published research studies investigating technology and literacy . . . . Clearly either more research has to be done, or we need a better approach to identifying and analyzing relevant existing research" (see Moran, Ferdig, Pearson, Wardrop, & Blomeyer, 2008, p. 12).

In reviewing professional development research for teachers using technology, the University of Illinois-Chicago's Department Chair for Educational Psychology Kimberly Lawless, and Distinguished Professor of Education James Pellegrino had this to say:

> Much of the activity under way on multiple levels of the educational system is driven by a very strong perceived need for action, but it is often not guided by any substantial knowledge base derived from research about what works and why with regard to technology, teaching, and learning . . . .
>
> The importance of technology in educational settings has also prompted various organizations, including those responsible for accrediting teacher-education programs, to develop technology-related standards. This activity has ensued despite the lack of a compelling knowledge base for understanding technology's impact on learning. (Lawless & Pellegrino, 2007, p. 576)

While applauding educator efforts to make a difference, Lawless and Pellegrino cited an extensive need for "a coordinated, large-scale program of research on educational technology and learning . . . to address the many questions still in need of answers" (Lawless & Pellegrino, 2007, p. 576).

My own research revealed a similar trend. I easily found volumes of research examining how to teach *with* technology (implementing technologies in the classroom, using software tools, etc.), how to *use* technology to produce digital texts, and explorations of "rhetorics" in digital media forms. Yet there was strikingly little available on how to constructively teach students what technology *is* and *does*, or providing teachers with curricula and frameworks to do so.

Teaching With Technology /= "Teaching Technology"

This research trend is endemic to a general educational philosophy that assumes getting students to use technology tools was equivalent to "teaching technology." As Cambridge Vice-President of Wolfson College and technology columnist of the *London Observer* John Naughton (2012) observed, this attitude is

> what the philosopher Gilbert Ryle would have called a "category mistake"—an error in which things of one kind are presented as if they belonged to another. We made the mistake of thinking that learning about computing is like learning to drive a car, and since a knowledge of internal combustion technology is not essential for becoming a proficient driver, it followed that an understanding of how computers work was not important for our children. (Naughton, 2012)

This "category error" has created two specific problems—we do not have a sufficient knowledge base for teaching technology to students, and we do not have institutional measures, programs, and support structures in place to sustain long-term needs. We need a plan, or process, for moving beyond current "atheoretical," ad-hoc approaches.

Stuart Selber's (2004) model in *Multiliteracies for a Digital Age* is far from the only voice advocating institutional change, but the framework he presented provides an effective starting point. Selber (2004) strongly advocated a reimagined "technological ecosystem" for our universities—a concerted, holistic set of practices and curricula that produce progressive ICT literacy agendas.

To Selber (2004), technology literacy extended beyond purely functional concerns like creating spreadsheets, searching an online database, or downloading music. In Selber's mind, ICT literacy must "tread the terrain" between concerns of functional literacy (i.e., knowing "how to use a computer"), and the broader critical issues that shape educational policy.

Interestingly, as *College Composition and Communication* reviewer Janet Eldred (2006) stated, the boldness of Selber's work is not necessarily in its final proposed solutions. In terms of "real world" practical advice, *Multiliteracies*' aims are in many cases "quite modest in scope" (Eldred, 2006, p. 122), but the text's approach lends it more weight with those whom Selber is most trying to reach—humanities teachers and department leaders.

> While the book is primarily theoretical, it aims to move individual instructors, but more emphatically programs, to build curricula that address [ICT literacy]. Selber’s book is remarkable not just because it is interdisciplinary, but because it synthesizes parallel academic conversations, the insider nattering, if you will, about liberal arts education, composition studies, computers and composition, literacy studies, human computer interaction, and social activism. (Eldred, 2006, p. 121)

This "insider nattering" is one of the text's key components, and is a clear rhetorical move to address one of our earlier identified problems—the need for greater humanist participation in technology subjects. By using these "parallel academic conversations," as Eldred (2006, p. 121) defined them, Selber creates an entry point for humanist dialogue. *Multiliteracies* specifically highlights technology literacy studies from Johndan Johnson-Eilola and Cynthia Selfe; incorporates linguistic theory from Saussure; metaphor theory from Lakoff and Johnson; discusses composition theory from David Bartholomae; analyzes (albeit briefly) constructivist pedagogy theory from Kenneth Bruffee, Lev Vygotsky, and Jean Piaget; cites the information literacy studies of Walter Ong and James Gee; and probes the media and cultural critiques of Neil Postman, Marshall McLuhan, and Vannevar Bush.

These grounding frameworks act as a rhetorical move to create "outposts" where humanists can latch on and engage in dialogue. Holistic, humanist approaches also help educators avoid taking narrow, monolithic stances that regularly fail to serve participants. Change, Selber believed, could not come from any single component acting alone. "Computer technologies are embedded in a wide range of constitutive contexts, as well as entangled in value systems" (Selber, 2004, p. 22). This sentiment was echoed by Mark Warschauer (2003): "Access to ICT is embedded in a complex array of factors encompassing physical, digital, human, and social resources and relationships" (p. 6). In agreement Jeffrey James (2008) added, "Much of technology comes as a package which cannot be separated and introduced bit-by-bit, but as a package which goes together," and extends beyond "material inputs" and "infrastructural services" (James, 2008, p. 2028). ICT literacy, then, requires at its core *holism*, a recognition by invested parties that isolated solutions and approaches are unlikely to produce the right kinds of material results.

The Multiliteracies: Functional, Critical, Rhetorical

To this end, Stuart Selber (2004) proposed a set of three core categories that distribute ICT literacy into discrete, though fluid topical ranges. The first multiliteracy, the functional literacy, encompasses the pragmatic, day-to-day skills required to successfully operate a personal computer and other ICT devices. These literacies include such things as understanding basic software navigation, hardware functions, use case scenarios, and a working vocabulary of critical terms.

Yet as Selber also observed, one of the ongoing problems in ICT literacy is that very little discourse ever moves beyond this first "purely functional" phase, especially when economic pressures from businesses push aside other critical discussions (Selber, 2004, p. 34).

To avoid getting trapped in the purely functional phase and going no further, Selber defined the second multiliteracy as *critical literacy*, which examines the social and cultural exigencies of technology production, biases in interface and design. Similar to Breuch's (2001) earlier questions regarding ICTs' social distribution of power, critical literacy examines the "the cultural study of power in situated uses of computers" (Selber 2004, p. 95).

The third multiliteracy is *rhetorical literacy*, described as a recognition of "the persuasive dimensions of human-computer interfaces and the deliberative and reflective aspects of interface design" (Selber, 2004, p. 140). If critical literacy examines cultural use cases and design structures, rhetorical literacy explores the ideological effects of actually communicating *through* ICTs. Rhetorical multiliteracy is closely aligned with the kinds of critiques offered by Neil Postman (1992, 1995, 2005), McLuhan (2003), and Terranova (2004), which examine the physical constraints and social constructions in which ICTs are used. It explores how the inherent properties of ICTs influence the forms of communication they engender, and the inherent "messages" they contain about the *form* and *value* of the content they deliver, and not just the explicit content itself.

Ultimately Selber's approaches emphasized a strong interdisciplinary focus and a commitment to systemic, programmatic methodologies, approaches that necessarily preclude ad hoc, piecemeal "band aids" to technology teaching. Selber (2004) specifically warned against any practice or heuristic that reduces a technology literacy program "to its parts but ultimately [neglects] the relationship of the parts to the whole" (2004, p. 188). No matter how important any one factor might appear in the technology literacy debate, educators need to be vigilant against holding up that element as the "one great fix." Change, Selber stated, "is not something achieved once and for all but must be constantly nurtured" (Selber, 2004, p. 191).

Looking Inward Institutionally

Selber's multiliteracies are instructive in that they first ask us to identify relevant problems, but also present a praxis, or framework, from which departments could begin outlining needed changes. *Multiliteracies for a Digital Age*'s table 5.1, recreated here, defined a progressive hierarchy for approaching necessary changes. This table is most instructive when viewed metaphorically as a bottom-up "construction plan." The lowest section (Departmental and Institutional Changes) forms a foundation that emphasizes administrative efforts. Change will most readily occur when *administrators and departments*, and not just individual teachers, mandate courses, curricula., hiring practices, and support systems that address identified needs. Schools and universities must commit to ongoing professional technology training for faculty and staff, include incentives in teacher performance reviews, and revise degree requirements to incorporate the right kinds of technology literacy curriculum.

Table 3-1

Reproduction of Table 5.1 from Multiliteracies for a Digital Age

(Selber, 2004, p. 186-187)

Requirements	**Approaches**
Technical	(1) Shape computer-related infrastructures on campus through participation in official discussions about technological requirements. (2) Use technical exigencies as a way to raise questions about current practices that do not support the needs of students and teachers in writing and communication courses.
Pedagogical	(1) Scaffold instruction that leverages well-known contexts and gradually releases certain responsibilities to technologically competent students. (2) Use (ungraded) diagnostic measures to learn about the technological experiences and attitudes of students. (3) See pedagogy and technology as coextensive and mutually constitutive, which requires teachers to become thoughtful designers of technological environments.
Curricular	Conceptualize the tripartite framework of functional literacy, critical literacy, and rhetorical literacy as a fractal that can be applied in ever smaller scales to the curricular components of academic programs. That is, apply the framework (1) to curricula as a whole, (2) to specific courses, and (3) to individual assignments.
Departmental and Institutional	(1) Demonstrate that humanists can help a university construct better alternatives to computer literacy. (2) Hire, retain, and value tenure-line faculty members whose primary scholarly work resides at the nexus of literacy and technology. (3) Provide ongoing professional development opportunities for faculty and graduate students. (4) Provide easy access to technological environments that have been designed to support the work of writing and communication teachers. (5) Account for the fact that technology adds real layers of complexity to any project. (6) Recognize the fact that technology work typically contains a measure of professional risk for teachers, which is often unforeseen. (7) Hold open forums in which people who might be affected by the computer literacy initiatives have opportunities to voice their perspectives. (8) Recognize the fact that successful computer literacy programs require significant ongoing expenditures. (9) Encourage administrators to clearly and continuously communicate their support for the computer literacy

	initiatives of writing and communication teachers.

In short, academic institutions must avoid settling for wishful thinking, untenable "magic pill" solutions:

> There must be a significant amount of dissatisfaction with the status quo. Teachers, program administrators, department heads, and upper administrators should all sincerely believe that the dominant approaches to technology education on campus are impoverished, if not harmful, and that humanist perspectives can help a university construct better alternatives . . . . departmental and institutional support structures will be crucial in all phases of any approach that attempts to invent or reimagine any ambitious curriculum that encompasses multiple computer literacies. (Selber, 2004, p. 226-227)

Once institution-level changes are in place, they must be pushed to the curriculum, the next row up in the table. Changes must be made across the board "to (1) curricula as a whole, (2) to specific courses, and (3) to individual assignments" (Selber, 2004, p. 187). This includes re-organization of existing course tracks to reflect the required multiliteracies, inclusion of additional or supplementary course units, and revising assignments to better meet identified objectives. With new a curriculum comes the responsibility for teachers to update in-class pedagogies and techniques to leverage the new material and mandates.

The three lower "tiers" must then be the basis for actual technology adoption, the top row of the table. For some institutions this represents a fundamental paradigm shift, since often instructors in the humanities and elsewhere are provided technology tools without input or consent, and then expected to build their classrooms and pedagogies around whatever is supplied.

Once again, *Multiliteracies* strongly advocates holism as the only viable solution to long-term ICT literacy. Fixes to individual corner cases without addressing the needs of the whole will remain ineffective. Relevant techniques and programs will integrate to the end-to-end process of student education, and not merely get shoe-horned into a one- or two-semester skills course where participants can "pass the test and move on."

PART IV – IN THE CLASSROOM

While Selber's (2004) framework in *Multiliteracies* is necessarily generic (it would be impossible to account for every institution's individual needs), it is not difficult to extrapolate some direct, in-the-classroom applications of Selber's principles. I believe teachers can begin making subtle yet significant shifts in basic classroom approaches even before other institutional pieces are in place.

As *College Composition and Communication* luminary and Ohio State University Humanities Distinguished Professor Cynthia Selfe (1999) stated, it begins with a re-examination of an attitude that "has led composition faculty only to the point of *using* computers—or having students do so—but not to the point of *thinking* about what we are doing and understanding at least some of the important implications of our actions" (Selfe, 1999, p. 414).

In my mind this points to a phrase I used earlier—*teaching technology*. Many of us in the humanities are comfortable using technology tools in the classroom, and may even prefer it, especially when they make our lives easier, yet I believe teaching *with* technology, or even teaching how to write and read rhetorically with technology, is fundamentally different from *teaching technology.* I hope to make the distinction clear with some further examples, but as a basic definition I would propose that *teaching technology* is:

- *The practice of teaching using technology artifacts (physical devices) not just as teaching aids, but as metaphors for exploring their embedded logic and cultural contexts; demonstrating ICTs' physical limitations and how those limitations* *constrain functional use; how core systems logic drives specific user behaviors, attitudes, and social mores; and how ICTs' modes of communication affect the messages they contain.*

Teaching technology envisions teaching students to be functionally proficient users, but moves dramatically forward in Selber's critical and rhetorical literacies. *Teaching technology* encompasses assignments, courses, and course tracks that engage students in reflective and reflexive activity on technology, that explore the long-term consequences of ICT on our society, economy, and self-governance.

To better realize this concept, I want to share some ideas, or topics that might be used to build specific assignments or course unit designed around *teaching technology.*

Technology as a Metaphor and Culture

In "Schema Theory Revisited" (2005), Mary McVee, Kailonnie Dunsmore, and James Gavelek, professors at University of Buffalo/SUNY, Calvin College, and associate professor at the University of Illinois Chicago, respectively, wanted to re-evaluate the place of schema theory in reading and reading comprehension. Classic schema theory, as developed by Vygotsky, Piaget, Gee, Ong, and others (see McVee, Dunsmore, & Gavelek, 2005) posits that people do not learn new concepts in isolation, but relationally to existing mental models and experience. Schema theory is often related to constructivist approaches to pedagogy, where learners do not simply "assimilate" information handed to them, but "actively construct" knowledge through their participation and engagement. Virginia Tech professors of education Terry Wildman and John Burton referred to this type of learning as learning through "cognitive orientation," defined as "an active, generative process where meaning and understanding must be constructed from experiences . . . The products of such learning are viewed not simply as single behaviors or classes of behaviors, but are described as organized memory 'units' for which there are certain known characteristics (Wildman & Burton, 1981, p. 6).

Linguists George Lakoff and Mark Johnson stated something similar in their oft-cited *Metaphors We Live By*—"Most of our normal conceptual system is metaphorically structured; that is, most concepts are partially understood in terms of other concepts" (Lakoff & Johnson, 2003, p. 56). In other words, when learning about new ideas and concepts, they are not based on the inherent properties of the idea or concept themselves, but in their connections to what we already know. "People categorize objects not in set-theoretical terms, but in terms of prototypes and family resemblances" (Lakoff & Johnson, 2003, p. 71). New Concept X resembles old Concept Y, and the learner pieces together the relational aspects between the two to formulate a mental model surrounding Concept X.

These models not only encompass experience, but cultural contexts also play a factor. Philip Abrami, Director of the Centre for the Study of Learning and Performance at Concordia University in Quebec stated,

> Learning is an active construction of meaning, drawing upon the myriad of internal and external factors affecting learning (e.g., prior knowledge, cognitive development, task demands, etc.). Constructivist approaches also realize that complex cognitive activities are normally carried out in challenging environments; context may have a significant bearing on both skill mastery, execution, and transfer . . . cognition [is] situated in the culture, setting, history and environment of the learner. (Abrami, 2001, p. 119)

McVee, et al. (2005) agreed that cultural considerations also come into play in developing knowledge frameworks:

> Because the world is infinitely full of potentially meaningful patterns and subpatterns in any domain, something must guide the learner in selecting the patterns and subpatterns to focus on. This something resides in the cultural models of the learner's sociocultural groups and the practices and settings in which they are rooted. (p. 546)

All told, technology learning and literacies follow the same schema-building processes. When faced with a learning "problem" surrounding technology use, students will examine their existing knowledge frameworks, making connections to what they already know. Attempts at constructing a knowledge framework will be based on students' existing models, metaphors, frameworks, and cultural patterns and sub-patterns.

However, if we have historically struggled to create meaningful technology literacy frameworks over the years, part of the problem, as noted by MIT Professor of Social Studies of Science and Technology Sherry Turkle (1982), is that computers defy being pigeonholed into a single, precise, metaphor—they're "hard to pin down" (p. 178). Computers act as art studios, sophisticated typewriters, text transmitters, television and movie screens, and game stations. Computers cannot be "reduced," like other technologies with more singular uses, to "terms of familiar objects or concepts" (Turkle, 1982, p. 177). Simply stating what a computer "does," in terms of its functions, does not capture the full significance or essence of how it operates, nor how it directs its users to behave in certain ways. For example, Turkle (1982) stated that claiming that a computer plays a game of chess simply by performing arithmetic

> is a little bit like saying that Picasso "created Guernica by making brushstrokes". Reducing things to this level of localness gives no satisfying way to grasp the whole . . . there is a pervasive tension between

> the local simplicity of the individual acts that comprise a program or a computation, and what one might call the "global complexity" that can emerge when it is run. (Turkle, 1982, p. 178)

As Turkle (2005) later stated, computers become a metaphor for thinking about our own mind, our own problems, and their possible solution (p. 150). If students have a hard time grasping technology concepts, it may in part be because we have not helped them examine these "global complexities," to make sense of ICTs' metaphorical underpinnings.

This has some potentially interesting applications for teaching technology in the humanities classroom. First, as Neil Postman suggested, the study of metaphor gives students a highly constructive way of examining an idea or topic's basic assumptions:

> It has always astonished me that those who write about the subject of education do not pay sufficient attention to the role of metaphor in giving form to the subject. In failing to do so, they deprive those studying the subject of the opportunity to confront its basic assumptions . . . Definitions, questions, metaphors—these are three of the most potent elements in which human language constructs a worldview. (Postman, 1995, p. 174-175)

Stuart Selber (2004) was keenly aware of this phenomenon in *Multiliteracies for a Digital Age*, where he explicitly attached a metaphor to each of the three multiliteracies—*The Computer as a Tool* metaphor to functional literacy, *The Computer as a Cultural Artifact* to critical literacy, and *The Computer as a Hypertext Medium* to rhetorical literacy.

Computers as Tools

Selber used *The Computer as a Tool* metaphor to emphasize a common misconception about technology, namely that it is "neutral," possesses no inherent qualities or biases for its use other than its acceptability or unacceptability for a particular task at hand. This mode of thought "masks the political dimensions of technology as well as the ways in which it helps to structure a wide variety of human activities" (Selber, 2004, p. 35). As humanists, we should be the first to recognize that claims of "technology neutrality" are in fact fraught with bias.

As a professor of education and education curriculum in the U.S., Canada, and the U.K., Ivor Goodson contributed dozens of books and hundreds of articles examining various educational issues. In 1996, Goodson and colleague J. Marshall Mangan, both working as faculty at the University of Western Ontario, identified a number of concerns surrounding the rise of "technology agendas" in Canadian schools. Goodson and Mangan noted that technology literacy had "become widely accepted as a kind of value-neutral, technological necessity of modern life" (1996, p. 68). While the two do not dispute *in theory* the need to improve ICT literacy, both were concerned that the rhetoric surrounding the argument extended beyond the rational—"the claim of value neutrality [is] itself ideological . . . the concept of computer-mediated language as a neutral conduit of meaning is deceptive . . . it ignores the importance of discursive context for all human interaction" (Goodson & Mangan, 1996, p. 68).

One particular iteration of the *Computer as a Tool* metaphor has been discussed since the dawn of the personal computing age in the late 1970s—the *Computer as an Appliance*. In 1984, *Compute!* magazine's associate editor, Fred D'Ianazio, commented that the *Computer as an Appliance* metaphor had been popularized over the years, which in some ways was natural, considering the personal computer's proximal, categorical resemblance to other electrical home technologies. If we metaphorically connect new technologies to those that precede them (see Lakoff & Johnson, 2003, p. 122), it is not hard to place a personal computer along side a typical home appliance. A personal computer requires electrical power, a physical space in the home, user input to operate. It has a viewable screen, like a television; a keyboard, like a typewriter; speakers like a stereo system.

However, as D'Ianazio noted, this categorization severely misses the mark when it comes to computers' true nature.

> Some misleading advertisements have made people buy computers as a home appliance. Unfortunately, the computers have not met some people's expectations, and ended up gathering dust in the closet . . . computers, to be useful, need good software, memory, printers, and disk drives. [The average consumer] realizes that even with all this equipment, a computer is not a home appliance. On its own it won't guarantee him or his family anything. (D'Ianazio, 1984, p. 126)

Even as user interfaces and accessibility have made enormous advances, this motif of the *Computer as an Appliance* has continued well beyond 1984. Two decades after D'Ianazio's *Compute!* editorial, *PC Magazine* contributing editor and columnist John C. Dvorak followed up with this treatment of the subject:

> Over the years I have fought against the notion that computers are appliances. This is not to say that an appliance-like device cannot be basically a computer. But that's not what we are talking about here. We are talking about extremely complicated programmable devices that combine telecommunications, television features, an Internet client, a node, a presentation machine, a word processor, a photograph manipulator, a music player, a music editor, a movie editor, a storage system, and a file transfer unit, all rolled into one system. There will be even more features once someone dreams them up.
>
> The only commonality between one appliance and another is that they all use electricity. They plug in. Somewhere along the way—for no other reason than the fact that a computer plugs into the wall—someone perceived it to be an appliance . . . . Computers can indeed be made easier to use, just as the automatic transmission makes a car easier to drive, but a computer is still not a toaster . . . [A PC] is never going to be an appliance. It's the wrong analogy in every way. (Dvorak, 2006)

Ken Dilger (2000) reflected on these topics in what he refers to as "The Ideology of Ease." If a computer is an appliance, then a computer must be easy. We expect to be able to use appliances simply and unambiguously; we expect the identified benefits without having to go through the process of learning the technologies themselves. In this way, *The Computer as an Appliance* is a reflection of our relationship to the computer, and whether conscious or otherwise, it promotes "an uncritical turn toward making computer interfaces and software easy to use" (Dilger, 2000), in ways that do not "demand knowledge." Our desire for ease, if unchecked, creates an "absence of generalized knowledge [that] can be very disempowering" (Dilger, 2000).

So how, then, does the metaphor of the *Computer as a Tool* or the *Computer as an Appliance* affect teaching technology in a humanities classroom? At the very least it presents a topic for student engagement. Have students ever believed that computers should "act like an appliance"? How would such an expectation drive technology production, interface designs, and embedded values? How does such an expectation change the way we interact with ICTs in physical space? If a computer is supposed to be an "appliance," that very notion pushes systems designs in specific directions. If a computer is NOT supposed to be an appliance—as John Dvorak (2006) vehemently argues—what then is it supposed to be, and how does that affect our expectations of what we need to know to use one?

Note that none of this line of discussion involves teaching hardware configurations, programming, or software to students. The metaphor of the *Computer as a Tool* is itself food for student discussion.

Computers as Artifacts

The metaphor attached to Selber's (2004) critical literacy, the *Computer as a Cultural Artifact,* examines the idea that computers are not merely tools, but *artifacts* in the sense that they embody particular viewpoints, values, and modes of thinking naturally arising from the designs of their creators. Using a course Web site for a university class as an example, Selber (2004) outlined that far more goes on under the surface than a teacher simply placing his or her syllabus to be viewed online:

> . . . Culture, politics, economics, and social institutions have all become inexorably intertwined with technology, producing an overdetermined milieu in which its directions, uses, and representations can potentially be shaped by a wide range of factors. Consider something as basic as a course Website [sic]. One could study its interface and undoubtedly produce an instructive political critique. However, in order to characterize the political dimensions in a more accurate and robust manner, additional questions would need to be posed and pursued: Is the site affiliated with any officially sanctioned initiatives? Are there institutional rules for site design? Are there systems in place to support site development, and if so, what is their influence over design tasks? (Selber, 2004, pp. 99-100)

This line of questioning parallels that of Lessig (2006), who explained that technology's foundations rest on the code that creates the user "spaces" in which technology's end products are used. As these spaces are inherently constructed by people, those who do the constructing control in large measure the space itself. "What does it mean to live in a world where problems can be coded away? And when, in that world, should we code problems away, rather than learn to work them out, or punish those who cause them?" (Lessig, 2006, p. 15).

Examining the *Computer as an Artifact* metaphor allows students to investigate not just how technology physically functions, but the purposes, intentions, and biases behind its designs.

As a professor of media ecology at Westminister University, Richard Barbrook published 2007's *Imaginary Futures* as an examination of the social conditions under which technology disseminates, and inserts itself into public consciousness. "Knowing who invented the information society," Barbrook argued, "is the precondition for understanding the ideological meaning of its intellectual concepts" (p. 289). Consider, for example, Robert Hassan's (2004) statement that the Internet's original design was not in any way conceived as the tool we now use (a publicly accessible global citizen, communication, and business interest network).

> The Internet and by extension the network society that we increasingly inhabit has its genesis in Cold War strategic thinking. This has not been made irrelevant through its popularization and ubiquitous non-military uses . . . the digital logic, the logic of technique, is one of the rationalization and instrumentalization of communications: that is, a stripped-down, goal-oriented mechanism that allows for no 'human error' factor. The logic was and is designed specifically to take out the human factor as much as possible . . . .
>
> The network society more generally is embedded with the military–industrial logics of control, rationalization, instrumentalization and domination . . . . We tend to notice only the 'utility' and 'aesthetics' of ICTs because, in the main, the media (much of it operating on the same logic and with the same technologies) tell us that this is what is important. What is not overtly disclosed in the technology is that the underlying embedded logic of the on–off, yes–no, binary language of computerization tends, like the military itself, to be rigid, to foreclose other ways of seeing, other ways of thinking and other ways of being. So powerful is the ideology that masks this, however, we (mostly) are willing to adapt ourselves to it. (Hassan, 2004, p. 16-17)

In other words, as Jeron Lanier (2010) observed, as technology creators layer more states of interaction between the user and the machine, the inherent ideological and creative biases become less transparent. While creating more "usable layers" may improve user interactivity, "Each layer of digital abstraction, no matter how well it is crafted, contributes some degree of error and obfuscation. No abstraction corresponds perfectly to reality. A lot of such layers become a system unto themselves, one that functions apart from the reality that is obscured far below" (Lanier, 2010, p. 97). User design may re-characterize computers' abstractions through elaborate interfaces, yet the underlying, embedded logics do not change.

This creates difficulties for users where their existing knowledge frameworks do not support an immediately apparent logic for the computing task at hand. If the interface designs are poor, users become "puzzled by the levels of abstraction associated with operating computers," and are "likely to be deskilled or disempowered in technological contexts" (Selber, 2004, p. l46). When users cannot grasp the holistic nature of computing, they tend to focus focus on specific features that serve as "triggers" for understanding technologies as a whole (see Griffith, 1999, p. 480). Without appropriate schema in place, the value of a given technology is largely lost to its users (Griffith, 1999, p. 482).

Now in some instances this suggests that rather than radical changes to computer literacy pedagogy, better interface designs are the solution. I am willing to admit this is sometimes the case. Having worked hands-on for a number of years as a technical writer surrounding software development, I can attest first-hand that developers' innate biases are regularly responsible for the oft-esoteric user interfaces we see in some programs. That said, I do not think this excuses teacher behavior that abrogates technology literacy over to those "darn software developers, if they'd ever get their act together." In the classroom these elements can become fruit for discussion—what is obscured below the surface of a software digital interface? What cultural and critical biases might have lent themselves to this particular design?

Another avenue might be to explore the effects of technology "lock-in." As Jeron Lanier (2010) observed, particular technology designs

> will occasionally happen to fill a niche, and once implemented, turn out to be unalterable. It becomes a permanent fixture from then on, even though a better design might just as well have taken its place before the moment of entrenchment . . . the designers and programmers of technology must be extremely careful when they make design choices. The consequences of tiny, initially inconsequential decisions often are amplified to become defining, unchangeable rules of our lives. (pp. 8-9)

Using the MIDI digital music interface as an example, Lanier (2010) illuminated the long-term effects of what at one time seemed to be a trivial goal—to allow a keyboardist to digitally send musical "notes" to a computer. Yet due to its rapid adoption and a lack of other competing designs, MIDI ultimately produced a number of initially unnoticed side-effects. Instead of representing music as a spectrum, or "watercolor world" (Lanier, 2010, p. 7), in many ways MIDI transformed music into a binary of "key up" or "key down," as it would appear for a keyboardist. "Despite Herculean efforts to reform it on many occasions by a multi-decade-long parade of powerful international commercial, academic and professional organizations" (Lanier, 2010, pp. 7-8), the MIDI music standard became entrenched, as more music programs and digital synthesizers were designed to work with it.

The idea here is not to analyze the "functional" basis of music production, but to ask students to reflect on the costs of these kinds of "lock in." Who is the winner when a technology is "entrenched"? Who gains from the "lock in," and who loses?

These discussions could later merge with broader topics of technology control. As with other industries with governing bodies, technology standards boards exert tremendous control over potential use cases. As Patrice Flichy (2007) pointed out, the creators of ICT—the intelligentsia, the academics and business interests—have always been reluctant to relinquish positions of power, believing they

> were to act as mediators between designers and users. Like any good mediator, they not only served as a link but also participated intensely in the definition of the new sociotechnical frame and stabilization of the new medium. More generally, they were to launch and structure public debate on the Internet and other digital technologies. (Flichy, 2007, p. 91)

Richard Barbrook (2007) elaborated by linking technology to political power and economic control:

> At various times from the 1950s to the 2000s, the information society has been identified as a state plan, a military machine, a mixed economy, a university campus, a hippy commune, a free market, a medieval community or a dotcom firm. During these five decades, these rival definitions came in and out of fashion as the fortunes of their promoters waxed and waned . . . Above all, whatever their political positions, these competing proponents . . . saw themselves as the vanguard of this hi-tech utopia. (Barbrook, 2007, p. 273)

The goal is to have students explore these "competing components" by looking at technology not just as something they use, but as uniquely a product of its time and the people who produced it. As Neil Postman suggested, "any subject becomes 'humanistic' when taught historically" (Postman, 1992, p. 124). The *Computer as an Artifact* metaphor asks students to lay bare ICTs' historical assumptions and biases.

Computers as a Communications Medium

Related to Selber's (2004) rhetorical multiliteracy, the *Computer as a Hypertextual Medium* metaphor parallels a line of inquiry begun by McLuhan (2003) and Postman (2005), wherein students examine not just the political and cultural biases under which technologies are built, but the ways in which those biases affect the transmission and encoding of communication itself. Postman (2005) specifically attempted to codify this relationship between technology as an artifact (physical entity) and technology as a medium:

> A technology is to a medium as the brain is to the mind. Like the brain, a technology is a physical apparatus. Like the mind, a medium is a use to which a physical apparatus is put. A technology becomes a medium as it employs a particular symbolic code, as it finds its place in a particular social setting, as it insinuates itself into economic and political contexts. A technology, in other words, is merely a machine. A medium is the social and intellectual environment a machine creates. (Postman, 2005, p. 84)

Tiziana Terranova, Associate Professor in the Sociology of Communications at Naples Eastern University, advocated a similar position in 2004's *Network Culture.* Referencing the Shannon-Weaver communication model for separating information from "noise" in a communications channel, Terranova reiterated, "Information is no longer simply the first level of signification, but the milieu which supports and encloses the production of meaning. There is no meaning, not so much without information, but outside of an informational milieu that exceeds and undermines the domain of meaning from all sides" (p. 9). The process of communication is not a simple encoding / decoding of signals—for instance, the placement and rendering of hypertext on a Web page. Instead, "The modern concept of information is explicitly subordinated to the technical demands of communication engineering" (Terranova, 2004, p. 12). Without accounting for the effect of the *system* of communication on the message being delivered, it reduces theories of communication to "drastic simplification[s] of the physical dynamics of communication as such" (Terranova, 2004, p. 19).

In other words, hypertext as a mode of conveying information does not merely result in texts being produced. The form of communication itself imposes assumptions about the kinds of messages that are appropriate and even desirable to be delivered in the first place. As Postman rejoined, a communications medium "directs us to organize our minds and integrate our experience of the world, it imposes itself on our consciousness and social institutions . . . it is always implicated in the ways we define and regulate our ideas of truth" (Postman, 2005, p. 18).

When students read or create hypertext, they are, either knowingly or unknowingly, "buying in" to a host of assumptions about the nature of how that communication actually works—who supports it, who is responsible for maintaining it, and the value of what kinds of content should be kept "alive" on the Internet, and what kinds should be discarded. Allowing students to examine *Computers as a Hypertextual Medium* adds yet another avenue for exploration, research, and discussion.

Other Metaphors

Each of Selber's metaphors—tool, artifact, medium—provide "spaces" from which a composition instructor might create a writing assignment designed to explore each of these metaphors' meanings, and how they define students' relationships to technology. Yet these are not the only metaphors available. Circa 2012, one of the most popular technology metaphors in business is *The Computer as a Cloud*, and its associated metaphor *The Computer as a Hive Mind.* Narratives surrounding these two computing metaphors are broad in scope, and overwhelmingly positive (see Lanier, 2010), citing our ability to mine ever-increasing aggregates of digital interactions ("Big Data") that will change our approaches social problems and the human experience.

What is less transparent, however, is that these two metaphors drive specific hardware and software designs, which increasingly devalue people at an individual level. As Jeron Lanier (2010) implied, in this mode of thinking our value as people resides less in our individual talents and experiences, but in our ability to serve as a node in a machine network. Speaking in the context of this kind of data mining, Lanier stated, "A fashionable idea in technical circles is that quantity not only turns into quality at some extreme of scale, but also does so according to principles we already understand" (Lanier, 2010, p. 49). This affects the ways we live and associate with technology, because on some level this concept assumes that it is better for us, the people, to tailor or experiences to the machines, and not the other way around. The *Computer as a Cloud* and the *Computer as a Hive Mind* metaphors not only drive adoption of specific hardware, software, and networking principles, they embody basic beliefs about the value of the individual, and construct a paradigm of how people should think.

Extolling the same ideas as Lanier, Rushkoff added:

> We are not just extending human agency through a new linguistic or communications system. We are replicating the very function of cognition through external, extra-human mechanisms. These tools are not mere extensions of the will of some individual or group, but tools that have the ability to think and operate other components in the neural network—namely, us. (Rushkoff, 2010, p. 15)

Rushkoff's and Lanier's statements are made more generally about large-scale, systemic biases that influence user behavior, but even relatively simple "functional" features can have the same effect. Interestingly, on a classroom level teaching these concepts often requires very little "higher order" technology training. Consider the following example of a computer hard drive, and how a demonstration of its basic use cases can enlighten and empower student behavior.

A typical hard drive in most current computers is physically comprised of a series of metal plates, or discs, that have been coated with a microscopically-thin metal alloy. A magnetic instrument changes the magnetic polarity on a finite section, or sector, of the plate. The polarity of a sector can be phased up | or down __ , with each position representing a binary 1 or 0. Through software designed to interpret data sent and received from the drive, a computer can appear to do marvelous, almost miraculous things—yet in Turkle’s (1982) "reductive sense," the sole physical function of a hard drive is to do nothing more than magnetize and demagnetize metal, and tell another piece of hardware whether the magnetic position of any given sector is up or down. While newer, "solid state" hard drives comprised of nothing but electrical components are working their way into the "mainstream," the vast majority of personal computer users' hard drives are the older, metal disk variety.

The magic of the hard drive is not what it does, but the speed at which it does it (a recurring theme for much of computers' physical components). In the hard drive's case, it uses an electromagnetic motor to spin its discs at 5400, 7200, 10,000 or more revolutions per minute (RPM). Engineers calibrate a tiny magnetic "arm" to hover fractions of a millimeter above the spinning discs, to create the | and __ polarity patterns. Hard drives are the natural progression of earlier magnetic image storage media—tape drives, floppy disks, and the like. The hard drive's primary advantage over earlier technologies is speed, and quantity of storage per unit cost ratio. The hard disk is one of a half-dozen technologies that forms the backbone of modern computing and the Internet. Every piece of text, image, video, and audio file ever accessed in a Web browser resides somewhere on a physical hard drive attached to the computer that serves it to viewers.

Yet as any serious computationalist will tell you, a hard drive is a naturally unreliable form of data storage for a number of reasons. The metal alloy coating the rotating discs can break down, making the | and __ polarity patterns unusable on sections of the disc. A drive can fail because the motor that rotates the plates can fail, or the "arm" that magnetizes and demagnetizes disc sectors become uncalibrated. The result of these failures is that the drive can no longer accurately detect the correct placement of the | __ patterns. A drive might also fail because the bearings that smooth the revolution of the plates can degrade or become unbalanced. A hard drive can have data corrupted through bad software input and output, through power failure during a read / write cycle, or other system events.

In short, the most critical piece of hardware in terms of computer data preservation is also one of, if not the most unreliable component of the system. A hard drive failure of any kind is for all practical purposes a total system failure until the drive and attending data are replaced.

Yet in spite of decades of common use, many computer users disregard this reality until the inevitable break down occurs (as a graduate instructor I was privy more than one conversation between department administrators bemoaning the loss of files due to drive failure). I personally have lost thousands of meaningful digital image files due to hard drive failure, all due to my negligence of the hard drive's natural and widely-known physical limitations. Though there are ways to recover lost data even from physically damaged or failed hard drives, such procedures are costly in terms of both time and money.

Armed with this knowledge, government and economic entities whose existence resides on data integrity approach their data backup needs with a zeal approaching paranoia. In instances where a hard drive failure (and its attendant loss of data) is a mission-critical event, organizations plan rigorously for such failures. They create redundant arrays of disks, where systems automatically make exact copies of all data on one drive onto another. They move data to off-site locations from the original system. They back up data to different physical media (digital tapes or discs). Yet the average home user does little of this. Observationally, having worked as a computer services technician for a number of years, the percentage of general consumers who make regular, consistent back-ups of critical data are far in the minority. How many readers of this text have data on a computer system, somewhere, that if lost today would cause a significant loss of productivity, time, or potential loss of income? How many readers can say that such data has been backed up to a safe location or medium in the last 72 hours? The last 7 days? The last 30 days? The safeguarding and security of data is one of the most paramount concerns of all high-level computer users, but such attitudes and actions have largely not been adopted by home users.

This may seem an over-long elaboration, but from a "teachability" perspective, knowledge of the properties and use conditions of a hard drive form a vital component of long-term personal computer use. To mitigate data loss risks, users must have at least a basic understanding of:

- How a hard drive works.
- Why backups are necessary.

- The files considered most critical to back up.
- The benefits and disadvantages of doing incremental vs. partial vs. full backups.
- The associated costs and hardware needed to do each potential type of backup.
- The need to back up to multiple media.
- How to safely store backups.

None of these concepts require a "high order" of literacy. Sound data backup principles do not require learning code or mastering esoteric computing functions. Yet without a basic understanding of a hard drive's core functionality, users are missing key information that can, and inevitably will affect their long-term personal computer use.

A hard drive's physical properties also teach a significant lesson about the relationship between computer artifacts and its users, namely that the physical properties of technology artifacts are not particularly concerned with "user attitudes." A hard drive cares not a whit how a student "feels" about the way it works. To successfully work within the functional constraints of a hard drive, a user needs to adopt specific behaviors based on its capabilities and limitations. To effectively back up and store data, a user must either adopt certain behaviors, or accept the consequences of failing to do (or wait until a completely fail-safe, foolproof way of storing digital data is created—not likely).

From the LCD to the Chalkboard

So how does this relate to *teaching technology* in a composition classroom? Simply put, why not offer up classroom discussions, or even planned assignments analyzing technologies in this way, especially in cases where students will be interacting heavily with computers? This brief analysis of a hard drive is only one of dozens of hardware and software features that make up a modern personal computer (and when it comes down to it, smart phones and tablet devices are nothing more than personal computers in a smaller package).

Consider—what if instead of creating a writing assignment and sending our students off to collaborate on a Web site content project, we asked them to analyze how a Web server actually works, and explore what it means to post text to the Web itself? What kinds of questions could students begin to consider—who determines access to the text? Will the students, or some other entity have the power to remove the text later? Does physical ownership of the physical network equipment naturally mean ownership of the content stored on it (historically the answer to this question has been an unequivocal yes, see Lessig, 2006)?

Avenues clearly exist for engaging composition and rhetoric students in these kinds of technology topics. For example, at Utah State University, several upper-division, undergraduate technical writing courses do not begin with discussions of rhetoric and writing style, but instead with professors taking apart a computer in class, and exploring the basic concepts of computer processing technology.

Ultimately I am suggesting that even the most ill-prepared, technologically untrained composition instructor has opportunities for driving technology subjects in the classroom, using basic rhetorical concepts—technological ideologies, culture, and metaphor. While a six-page student paper on ICT metaphors would hardly qualify as a comprehensive treatment of the subject, the point is to provide "spaces" from which students can ask questions, perform research, and write about their experiences.

Ultimately such approaches will also require long-term institutional backing (see Lawless & Pellegrino, 2007; Selber, 2004; Selfe, 1999), but humanities teachers can help students better understand not just what they do with technology, but what technology is doing to them.

PART V – CURRENT BARRIERS TO CHANGE

Yet even if immediate classroom changes are not forthcoming, we have an additional opportunity regarding technology literacy research, in that we still lack a true "body of knowledge" to guide our approaches. We need to move significantly beyond our current "ad hoc" (see Selber, 2004) and "atheoretical" (see Reddy, et al., 2003) literacy methodologies.

I mention this particularly in light of my own experience teaching composition. In the classroom I felt a distinct need to address what I saw as gaps in my students' technology knowledge frameworks, but had no clear direction or goals for change. As Lawless and Pellegrino (2007) stated, we simply do not have a rigorous, viable base of knowledge "derived from research about what works and why with regard to technology, teaching, and learning" (p. 567). My fear is that too many decisions have been made absent a holistic, substantiated body of research to back up the veracity of the decision itself.

As outlined by Cynthia Selfe (1999), humanities teachers and composition instructors need to take greater responsibility and accountability for teaching technology issues, and as we perform future research we must repress the urge to approach ICT literacy from what I call a "pro-textual" standpoint. As I will show, our instinct as writing and composition instructors is to appropriate technology within our primary scholastic focus—that of producing and analyzing texts. While "pro-textual" approaches are not inappropriate in many cases, they often fail to incorporate the kinds of multiliterate concepts that can build a more cohesive body of research, skills, and knowledge, which can be later transferred to students.

The Enemy Within

Before continuing, I am not suggesting we criticize those applying technology solutions, where merited, to particular educational problems. There are obvious areas where technology provides exceptional advantages and benefits in education (automation of grading, access and presentation of learning material, "evergreen" digital textbooks, etc.). Furthermore, numerous educators, schools, and programs are doing marvelous things in ICT literacy. If you personally, your college, your department, are farther along the path of ICT multiliteracy than described here, it would be my desperate wish for those efforts to be applauded and recognized, not just singly but institutionally. As outlined by Selber (2004), too many teachers doing the "best they can" to build ICT literacy receive too little recognition from the institutions for which they work.

Somewhat tangentially, I also want to be clear that I am taking no stance on the effectiveness or appropriateness of long-distance "E-learning." Arguments abound surrounding the effectiveness of distance learning versus traditional classrooms. In my opinion, these issues pose an entirely different set of problems and arguments than what I am examining here. In fact, this text should primarily be viewed as an examination of the literacies teachers and students should have in place before they sit down to take an online class, not the effectiveness of the course itself.

With these caveats in mind, in brief the first problem we need to address is the reality that humanities instructors—particularly composition instructors—need to stop treating technology in "piecemeal fashion" (Selfe, 1999, p. 414). As Selfe further asserted:

> I believe composition studies faculty have a much larger and more complicated obligation to fulfill—that of trying to understand and make sense of, to pay attention to, how technology is now inextricably linked to literacy and literacy education . . . As a part of this obligation, I suggest that we have some rather unpleasant facts to face about our own professional behavior and involvement. (Selfe, 1999, p. 414)

To make this point further, consider a quote from British Secretary of State for Education Michael Gove (2012), who stated that barring a few minor changes to available teaching tools, a 19th-century, Victorian-era school teacher could enter a 21st-century classroom and "feel completely at home." For some I imagine this quote is actually a positive—we really haven't moved *so* far from our educational past, where print technology ruled the day, and writers and rhetors were among the most respected of scholars. Yet in the vein of Selfe's (1999) analysis, this is distinctly not an affirmation. A no less searing critique was offered by Jerome McGann, former Professor of Humanities at the California Institute of Technology and co-founder of the University of Virginia's Institute for Advanced Technology in the Humanities. He stated, "If you want to engage [in] serious, practical conversation about humanities education and digital culture, our most distinguished humanities research institutions—with few exceptions—are not the places to go" (2005, p. 72). The reason? "We're illiterate" (McGann, 2005, p. 72).

Describing a meeting of editors for the academic journal *Critical Inquiry*, McGann stated:

> Besides myself, no one on the *Critical Inquiry* board can use any of the languages we need to understand how to operate with our proliferating digital technologies—not even elementary markup languages . . . In the coming decades—the process has already begun—the entirety of our

> cultural inheritance will be transformed and reedited in digital forms. Do we understand what that means, what problems it brings, how they might be addressed? Theoretical as well as very practical discussions about these matters have been going on for years, and decisions are taken every day. Yet digital illiteracy puts us on the margin of conversations and actions that affect the center of our cultural interests (as citizens) and our professional interests (as scholars and educators) . . . . This situation has to change. (McGann, 2005, p. 72)

At its core, the problem is simple—we, the Body Humanist, have abrogated the responsibility for technology teaching. In *Understanding Media*, Marshall McLuhan (2003) recalled an anecdote that with some minor alteration, provides a semi-amusing allegory for an all-too-typical relationship between humanities educators and technology. Referring to a "civilized UNESCO experiment" conducted in the 1960s, McLuhan mentioned that a number of villages in India were introduced to the concept of running water and its "lineal organization of pipes" (p. 122). Playing a bit with McLuhan's words, "Soon," he observes, "the ~~villagers~~ [humanities departments] requested that the ~~pipes~~ [computer systems] be removed, for it seemed to them that the whole social life of the ~~village~~ [university] had been impoverished when it was no longer necessary for all to visit the ~~communal well~~ [departments of humanities]" (McLuhan, 2003, p. 122). The time has come for humanities scholars to put aside our "degree of ignorance about information technology and its critical relevance to humanities education and scholarship" (McGann, 2005, p. 71)

By now I hope this statement is less controversial than merely considered wisdom. Technology literacy has serious implications for the social advancement of the underprivileged (see Banks, 2005; O'Hara & Stevens, 2005), political activism and government reform (Flichy, 2007; Hassan, 2004; Lessig, 2006), and university scholarship, tenure, and advancement (Selber 2004). Our involvement should be considered mandatory.

As Tornero and Varis (2010) stated:

> If the global communication society has come hand in hand with disproportionate promises and unfulfilled utopias, today it is compulsory to examine and evaluate why this has transpired. It is now imperative to abandon blind trust in technology and to deepen our critical spirit. We need to develop an aware attitude that is capable of weighing the positive and negative effects of the changes and especially one that is able to inspire new technical developments that mesh with human beings' aspirations. (p. 24)

Our participation and "critical spirit" can, and must be an essential part of shaping technology futures. As Lessig (2006) has pointed out, left to itself our techno-futures are highly unlikely to "fulfill the promise of freedom. Left to itself, cyberspace will become a perfect tool of control" (Lessig, 2006, p. 4). Without a serious re-examination of programmatic ICT literacy as espoused by Selber (2004), we and our students are unlikely to exercise "control over the technologies [in our] lives, or over the wider economic, social, political and cultural dynamics in which these technologies are contextualized" (Hassan, 2004, p. 89). Our lives will regularly be "shaped and formed . . . through dynamics and systems over which [we] exercise little real sovereignty" (Hassan, 2004 p. 89).

As Selfe (1999) observed:

> We are all—each of us—now teaching students who must know how to communicate as informed thinkers and citizens in an increasingly technological world . . . [yet] this recognition has led [us] only to the point of using computers—or having students do so—but not to the point of thinking about what we are doing and understanding at least some of the important implications of our actions . . . .
>
> Nor have organizations addressed the "serious need for professional development and support for teachers . . . despite the fact that

> so many literacy educators in a range of situations—including all English and Language Arts teachers in primary, secondary, and college/university classrooms—have been broadly affected by the technology-literacy linkage for the past decade and will continue to be so involved well into the next century. (Selfe, 1999, pp. 414, 419)

As Laura Gurak (2001) expressed, our primary commission is to enable *choice*. We and our students should *choose* what technology tools we use, *choose* appropriate ways of teaching with and teaching about those technologies, and *choose* the directions in which further technology programs move. At the very least, Gurak believed, the choice must be more than to consume or not consume. "To most people, technologies are not about choices. Technologies are invented, advertised, packaged up, and sold to you" (p. 2).

Current Associate Professor of Writing, Rhetoric, and Digital Media at the University of Kentucky, and Visiting Scholar in Comparative Media Studies at MIT, Adam J. Banks published *Race, Rhetoric, and Technology: Searching for Higher Ground* as an analysis of African-Americans' struggle to "re-interpret" the Digital Age from within Black culture, but also offered salient points surrounding technology studies generally. Banks too warned against "the passive consumerism that drives almost all computer advertising and much technology policy" (Banks, 2006, p. 138). Instead, Banks asserted, teachers and students "need to be involved in the messy arguments around technologies as much as in the tools themselves" (Banks, 2006, p. 138).

This effectively encapsulates the thrust of this argument—get involved in the messy, divisive, aggravating, but potentially rewarding, personal- and career-enhancing arguments around technology literacy. Regardless of our own proclivity for or against technology, our goal should be greater involvement. As Selfe (1999) stated, it is time to stop allocating the "the responsibility of technology decisions—and often times the responsibility of technology studies—to a single faculty or staff member who doesn't mind wrestling with computers or the thorny, and the unpleasant issues that can be associated with their use" (p. 412). When we hear the "e-literacy" myth bandied about in department meetings as an excuse to rationalize lack of involvement, we should inject a counterpoint to the conversation. When "curriculum competition" yields conversations that we "simply don't have time to teach composition, AND technology," be willing to discuss the myriad ways we can inject technohumanism into the classroom without sacrificing our composition and rhetoric "core." When we meet with department administrators, we should be direct in our questions about how technology training and technology competencies might play into curriculum development, teacher evaluations, and tenure.

Refining "Pro-textual" Approaches to Research

As composition and rhetoric scholars, I have found that we seem very willing to apply technology viewpoints to subject areas that interest us—writing, reading, information gathering, rhetoric, and textual analysis. Yet when it comes to researching "multiliterate" functional, critical, and rhetorical elements surrounding the technologies themselves, the picture gets a bit murkier. As evidenced earlier by Lawless and Pellegrino (2007), Moran et al., (2008), Reddy et al., (2003), and Selber (2004), there is currently no defining body of research on technology teaching and pedagogy, particularly in humanities settings. There are likely a number of reasons for this, but one of them, in my observation, is that humanities research on technology subjects often sidesteps these issues in favor of the "textual" kinds of topics we are comfortable with.

This is not entirely surprising, since as Judy Moreland, technology education researcher at the University of Waikato in New Zealand, and Alister Jones, Waikato's Dean of the School of Education observed in 2000, teachers who find themselves outside of their comfort zones in the classroom—tackling technology issues for which they are largely untrained—habitually revert to their ingrained, pedagogical subculture. "The strategies developed by teachers in their classrooms when implementing technological activities [are] often positioned within that particular teacher's teaching and subject subculture" (p. 289). These subcultures directly influence the way teachers structure lessons and develop classroom strategies, and as a result, teachers end up with strategies and learning outcomes "more closely related to their particular subject subculture than to technological outcomes" (Moreland & Jones, 2000, p. 289).

While Moreland and Jones (2000) observed this phenomenon in the classroom, this same "drift" becomes apparent in humanities-centered technology research. We feel comfortable in our "textual" worlds, a culture of critical analysis, rhetorics, and language studies we both cultivate and celebrate. This trend, however, has led to gaps in approaches to humanities technology issues. For example, in my research I identified topical trends examining the effects of technology on writing style and rhetoric (Chandler-Olcott & Mahar, 2003; Miller & Shepherd, 2004; Reinking, 1997); some analyzed personal and historical contexts to establish user attitudes toward technology (Duffelmeyer, 2000; Hawisher, Selfe, Moraski, & Pearson, 2004; Kirtley, 2005); some analyzed the effects of word processors on the writing process (Goldberg, Russell, & Cook, 2003; Sudol, 1991); others still analyzed ICTs' effects on basic reading comprehension (Moran, et al., 2008). Yet little scholarship directly addressed the question of *how to teach technology.*

As identified by Moreland and Jones (2000), when it comes to unfamiliar technological issues we are programmed to revert to a sub-culture with which we are comfortable. This manifests itself in research through what I call a "pro-textual" bias, or approach, that emphasizes the creation of "texts" or other digital "products" that are the end result of computer use, but often disregard the multiliteracy requirements imposed by the hardware and software during creation. Pro-textual critiques are excellent at examining learning models adapted to teach *with* technology, compare student learning processes, and analyze the results of texts produced with computers. Too often, however, pro-textual research is missing functional, critical, and rhetorical ICT perspectives that might better promote the "body of knowledge" we currently lack.

Before continuing, I want to state that I realize I am potentially treading on thin academic ice here. I am hardly in a career or academic position to do much more than metaphorically raise my hand meekly in the corner, and offer a quiet, "Um, well, I think I've sort of noticed this . . . have you?" But in the spirit of that argument . . . Um, well, I think I've noticed this "pro-textual" bias, and I think we could build a better body of ICT literacy knowledge by making some subtle re-adjustments to research topics.

I have three specific examples of the "rhetorics" I have commonly encountered that point to a "pro-textual" bias. In sharing these examples, the goal is not to take away from the research done, but merely to point out that there are opportunities for (in the vein of a popular Google social media network) "Rhetoric+," where the "+" represents more concrete technology examinations.

Donna Alverman, Distinguished Professor of Language and Literacy Education at the University of Georgia, provided an excellent summary of the character of what I would call a "pro-textual" approach. These approaches embody a train of thought that examines "the socially mediated ways of generating meaningful content through multiple modes of representation (e.g., language, imagery, sounds, embodied performances) to produce digital texts (e.g., blogs, wikis, zines, games, personal web pages) for dissemination in cyberspace" (Alverman, 2008, p. 9). The purpose in doing these kinds of analyses, she stated, was if young people have a "penchant for creating online content," then teachers need to account for it in "how we teach and research adolescent literacy both now and in the future" (Alverman, 2008, p. 9). The recurring theme here is that the "lens" focuses on the *content*, but not the systems that enable the *production* of the content.

The Director of Stanford's Program in Writing in Rhetoric, Andrea Lunsford (2006), echoed a similar ethos in "Writing, Technologies, and the Fifth Canon." In the mid-2000s, Lunsford (2006) began searching for ways to change Stanford's Program in Writing and Rhetoric curriculum to include a more diverse set of "discursive modalities" (p. 177). In redesigning a two semester-long course, Lunsford (2006) and her colleagues aimed to build "analytic and research-based argument strategies" involving "oral, visual, and multimedia rhetoric" (p. 172). Their desire was to build courses where students could "identify, evaluate, and synthesize materials across a range of media and to explore how to present these materials effectively in support of the students' own arguments," (Lunsford, 2005, p. 172). Students were expected to analyze how "purpose, audience, and context help shape decisions about format, structure, and persuasive appeals" for digital documents, and "to reflect systematically on oral, visual, and multimedia rhetoric and writing" (Lunsford, 2006, p. 172).

Clemson University Distinguished Professor of Teacher Education David Reinking, also former Head of the Department of Reading at the University of Georgia, published "Me and My Hypertext" in 1997 in an early attempt to draw attention to hypertext as a medium, and the ways its conventions define different reading conventions from traditional, linear texts. "I think hypertext is a particularly good example of how a technology of reading and writing always affects the way we communicate and disseminate information, how we approach the task of reading and writing, and how we think about people becoming literate" (Reinking, 1997, p. 629).

In the cases of Alverman (2008), Lunsford (2006), and Reinking (1997), the research reflects on digital technologies but only insofar as they represent a locus within "traditional" literacy and rhetorical studies. Note the verbiage common in each: oral, visual and multimedia rhetorical purpose; audience and context; format, structure, and persuasive appeals. The focus is predominantly on the *text itself*—the finished communication product. There is obviously more to these three particular peer-reviewed articles than I have encapsulated here, yet while all three writers address the "textual" implications of using digital tools, none engage with the underlying technology "ecosystem" that underpins the digital content being produced. The technology is relevant, and certainly regarded as a key component to the studies being done, but is ultimately just a backdrop to the "real" subject at hand—classic rhetoric, language, and writing studies. Alverman (2008) outlined a compelling case for computers becoming places for building student identity and "creating meaningful texts (p.11). Lunsford

(2006) detailed courses were students were asked to use computers to build audio podcasts, videos, and design interactive Web pages, with the intent that students would learn how rhetorical styles change from mode to mode. Reinking's (1997) piece wanders across a multitude of topics across the hypertextual "landscape," and the "navigational problems" it poses compared to traditional, linear reading styles (p. 628). Such ideas should "lead us to reflect about how technology affects reading and writing, which in turn affects our conceptions of literacy and how it should be taught" (Reinking, 1997, p. 630).

On the surface, there is nothing seemingly untoward, ignoble, or disingenuous about any of these sets of material. Yet none of the three is really addressing *teaching technology*, in the multiliterate sense.

This pattern repeated itself during lengthy research stints for this article. I personally encountered dozens of other examples that follow the same train of thought—examination of the digital "texts" and "rhetorics," but without delving into the *systems* of production. Discussions of "modes of discourse" and "persuasive appeals" are not irrelevant, but they are not linked to the kinds of knowledge frameworks that students need to make the leap to multiliteracy.

Finding Rhetoric+

There are, however, a few examples that do make the leap in linking the textual to broader multiliteracies. For example, Robert E. Cummings (2006), Founding Director of the University of Mississippi's Center for Writing and Rhetoric, suggested there may be a link between the act of computer programming and traditional composition. To Cummings (2006), programming languages are more than "just a means for the computer to perform tasks"; they become frameworks which organize the ways in which programmers "organize their ideas about processes" (p. 433). Programming and writing, then, inhabit very similar spaces and mental processes. "The act of applying the logic of a programming language to a problem refines that problem, positions it in a new light, and reveals the biases or faults of the thinking that first framed the issue as a problem" (Cummings, 2006, p. 433). John Naughton (2012) espoused something very similar, arguing that the fix for the "ICT literacy category error" requires getting students more hands-on, "hard" experience with coding and what he calls "computational thinking."

> It's about understanding the difference between human and artificial intelligence, as well as about thinking recursively, being alert to the need for prevention, detection and protection against risks, using abstraction and decomposition when tackling large tasks, and deploying heuristic reasoning, iteration and search to discover solutions to complex problems. (Naughton, 2012)

In early 2013, Code.org (Code, 2013), a U.S. non-profit organization, made waves with its five-minute documentary video that quickly went viral on the Internet (the video received over seven million views in the first four days it was posted). Featuring a multitude of technology leaders, including former Microsoft CEO Bill Gates and Facebook CEO Mark Zuckerberg, the video highlighted the evolution of "code" from its nascent roots in back-door campus labs to being a dominant form of social organization.

I admit to being skeptical of a documentary produced by a handful of powerful people with a lot to gain from its message, but one thing that did resonate was the idea that learning code is now a form of empowerment. As Rushkoff (2010) suggested, learning code changes users from being simple "text producers," to actual controllers and designers of the communications spaces themselves. This goes hand-in-hand with another problem inherent to "pro-textual" approaches—they cast computer users into a particular role. When ICT literacy is measured as the ability to "design, author, analyze, and interpret material on the Web and other digital environments" (Hawisher, et al., 2004, p. 642), it casts users as creators of *texts*, but not as producers and controllers of *technologies*. When teachers engage in research and activities that promotes "textual" concerns as the primary focus, it necessarily implies to users that computers may be viewed as something to be *used*, but not something that can be mastered, shaped, and controlled.

This has distinct side effects on user approaches to ICTs. If a user's primary role is to search for, read, and create digital texts, then functionally a computer becomes viewed as little more than a digital data repository—a massive, paper-less library linked to a highly elegant typewriter. These metaphors are not unsuited to computers, but as demonstrated previously highlight only a fraction of the personal computer's assumed "social and intellectual environment" (Postman, 2005, p. 84). Constructing users as "textual authors" is a valid metaphor, but ignores a multitude of ICTs' functional and cultural dimensions, most of which exist long before the user sits down to write a school paper, blog, or send an email.

This is not to say that the act of "creation" of text and the use of technology cannot be integrated. The act of creating an HTML "hypertext" lets users build content, while also asking them to engage with the medium's basic architecture, one with certain access controls, one that favors certain kinds of communication over others, one that favors certain use conditions over others.

To be clear, I am not suggesting that we swap out our composition classes for programming ones—but it is not difficult to imagine how a composition class might synthesize text creation assignments into broader technologies perspectives. We need to refocus on new kinds of research that avoids "celebrating technology, but only insofar as it can support the more traditional goals of textual studies" (Selber, 2004, p. 11). Ultimately we do not need to abandon our "pro-textual" biases, we need to supplement them.

PART VI – CONCLUSION

Ultimately this text is a call to action. Our society needs students and citizens who are literate in more than "surface level" technology activities. Our formal education systems must change to incorporate functional, critical, and rhetorical multiliteracies, and educators must commit to providing programs, curricula, and classrooms where we are not simply teaching *with* technology, but *teaching technology*.

Those of us in the humanities must embrace our role as standard-bearers of Technocultural Humanism. Hiring practices and teacher development incentives must change. Educators must be prepared, groomed, and directed to work within evolving ICT literacy frameworks. Teachers in existing disciplines who are unable to meet needed requirements must receive better training and teacher development. Multi-disciplinary ICT literacies must be inculcated in teachers, mandated institutionally, and rigorously designed and budgeted.

These changes must come from two directions. First and foremost, we must open critical dialogues with school administrations. Some teachers will be unable, due to lack of training, to meaningfully participate in these dialogues as much as they might like. This is unavoidable, but cannot deter others from engaging.

Second, we must start building a true body of research encompassing how technology should be taught. There are not enough studies, not enough groundwork to determine what works and what does not. We must address the fallacy that teaching *with* technology is the same as *teaching technology*, and we cannot assume that students are learning everything they need to know about technology away from the classroom. If technology literacy research is to change, it must come from the perspective that technology literacy is a holistic and ultimately humanist endeavor, one that reaches into rhetoric, composition, culture, design, and inter-textuality as much or more than it does into silicon circuitry.

I look forward to participating in these challenges in the months and years to come.

REFERENCES

Abrami, P.C. (2001). Understanding and promoting complex learning using technology. *Educational Research & Evaluation, 7*(2), 113-136.

Alverman, D. (2008). Why bother theorizing adolescents' online literacies for classroom practice and research? *Journal of Adolescent and Adult Literacy, 52*(1), 8-19.

Apple, M.W. (1998). Teaching and technology: The hidden effects of computers on teachers and students. In L.E. Beyer & M.W. Apple (Eds.), *The curriculum: Problems, politics, and possibilities* (pp. 314-338). Albany, NY: New York University Press.

Banks, A.J. (2006). *Race, rhetoric, and technology: Searching for higher ground*. Mahwah, NJ: Ehrlbaum.

Barbrook, R. (2007). *Imaginary futures: From thinking machines to the global village*. London, United Kingdom: Pluto Press.

Bauerlein, M. (2008). *The dumbest generation*. New York, NY: Penguin.

Breuch, L.K. (2002). Thinking critically about technology literacy: Developing a framework to guide computer pedagogy in technical communication. *Technical Communication Quarterly, 11*(3), 267-288.

Brown, C., Murphy, T.J., Nanny, M. (2003). Turning techno-savvy into info-savvy: Authentically integrating information literacy into the college curriculum. *Journal of Academic Librarianship, 29*(6), 386-398.

Chandler-Olcott, K., & Mahar, D. (2003). "Tech-savviness" meets multiliteracies: Exploring adolescent girls' technology mediated literacy practices. *Reading*

Research Quarterly, 38(3), 356-385. Retrieved from http://www.jstor.org/stable/4151823.

Code.org (2013). About. Retrieved from http://www.code.org/about.

Cummings, R.E. (2006). Coding with power: Toward a rhetoric of computer coding and composition. *Computers and Composition, 23*, 430-443.

D'Ianazio, F. (1984). "Are Computers a Home Appliance?" *Compute!,* (August 1984), 126.

Dilger, B. (2000). The ideology of ease. *The Journal of Electronic Publishing, 6*(1). DOI: 10.3998/3336451.0006.104.

Duffelmeyer, B. (2000). Critical computer literacy: Computers in first-year composition as topic and environment. *Computers and Composition, 17*(1), 289-307.

Dvorak, J. (2006, Jan. 3). The computer appliance myth [Editorial]. Retrieved from http://www.pcmag.com/article2/0,2817,1907510,00.asp

Eldred, J. (2006, September). To code or not to code, or, if I can't program a computer, why am I teaching writing? [Review of the book Multiliteracies for a digital age, by S.A. Selber]. *College Composition and Communication, 58*(1), 119-125.

Flichy, P. (2007). *The internet imaginaire*. Cambridge, MA: MIT Press

Gallacher, I. (2007). "Who are these guys?:" The results of a survey studying the information literacy of incoming law students. *California Western Law Review, 44*(1). Retrieved from http://surface.syr.edu/cgi/viewcontent.cgi?article=1006&context=lawpub

Goldberg, A., Russell, M., & Cook, A. (2003). The effect of computers on student writing: A meta-analysis of studies from 1992 to 2002. *The Journal of*

Technology, Learning, and Assessment, 2(1). Available from http://www.jtla.org.

Goodson, I. F., & Mangan, J.M. (1996). Computer literacy as ideology. *British Journal of Sociology of Education, 17*(1), 65-79.

Gove, M. (2012, January). *Michael Gove speech at the BETT show 2012*. Retrieved from United Kingdom Department for Education Web site: http://www.education.gov.uk/inthenews/speeches/a00201868/michael-gove-speech-at-the-bett-show-2012

Griffith, T.L. (1999). Technology features as triggers for sensemaking. *The Academy of Management Review*, *24*(3), 472-488. Retrieved from http://www.jstor.org/stable/259137.

Gurak, L. (2001). *Cyberliteracy: Navigating the internet with awareness*. New Haven, CT: Yale University Press.

Hassan, R. (2004). *Media, politics, and the network society.* New York, NY: Open University Press.

Hawisher, G.E., Selfe, C.L., Moraski, B., & Pearson, M. (2004). Becoming literate in the information age: Cultural ecologies and the literacies of technology. *College Composition and Communication, 55*(4). 642-692.

Hignite, M., Margavio, T., & Margavio, G. (2009). Information literacy assessment: moving beyond computer literacy. *College Student Journal*, *43*(3), 812-821.

Horton, F.W., Jr., & Keiser, B.E. (2008, November / December). Encouraging global information literacy. *Computers in Libraries, 28*(10), 6-32.

James, J. (2008). Re-estimating the difficulty of closing the digital divide. *Journal of the American Society for Information Science and Technology, 59*(12), 2024-2032.

Kaminski, K., Seel, P., & Cullen, K. (2003). Technology literate students? Results from a survey. *Educause Quarterly, 3,* 34-40.

Kirtley, S. (2005). Students' views on technology and writing: The power of personal history. *Computers and Composition, 22*, 209-230.

Lakoff, G., & Johnson, M. (2003). *Metaphors we live by* (2nd ed.). Chicago, IL: University of Chicago Press.

Lanier, J. (2010). *You are not a gadget*. New York, NY: Vintage.

Lawless, K.A., & Pellegrino, J.W. (2007). Professional development in integrating technology into teaching and learning: Knowns, unknowns, and ways to pursue better questions and answers. *Review of Educational Research, 77*(4), 575-614. DOI: 10.3102/003465430730992

Lessig, L. (2006). *Code 2.0*. New York, NY: Basic Books.

Lunsford, A. (2006). Writing, technologies, and the fifth canon. *Computers and Composition, 23*, 169-177. doi:10.1016/j.compcom.2006.02.002

McGann, J. (2005). Culture and technology: The way we live now, what is to be done? *New Literary History, 36*(1), 71-82

McLuhan, M. (2003). *Understanding Media: The Extensions of Man* (Critical ed.). Berkeley, CA: Gingko.

McVee, M.B., Dunsmore, K., and Gavelek, J.R. (2005). Schema theory revisited. *Review of Educational Research* 75(4). 531-566.

Miller, C., & Shepherd, S. (2004). Blogging as social action: A genre analysis of the Weblog. In L.J. Gurak, S. Antonijevic, L. Johnson, C. Ratliff, & J. Reyman (Eds.), *Into the blogosphere: Rhetoric, community, and culture of weblogs*. Retrieved from http://blog.lib.umn.edu/blogosphere/blogging_as_social_action_a_genre_analysis_of_the_weblog.html

Moran, J., Ferdig, R.E., Pearson, P.D., Wardrop, J., & Blomeyer R.L. (2008). Technology and reading performance in the middle-school grades: A meta-analysis with recommendations for policy and practice. *Journal of Literacy Research, 40*(6), 6-58. DOI: 10.1080/10862960802070483

Moreland, J., & Jones, A. (2000). Emerging assessment practices in an emergent curriculum: Implications for technology. *International Journal of Technology and Design Education, 10,* 283-305.

Naughton, J. (2012, March 31). Why all our kids should be taught how to code. *The Guardian*. Retrieved from http://www.guardian.co.uk

Noble, D. (1998). The regime of technology in education. In L.E. Beyer & M.W. Apple (Eds.), *The curriculum: Problems, politics, and possibilities* (pp. 267-283). Albany, NY: New York University Press.

O'Hara, K., & Stevens, D. (2006). *Inequality.com: Power, poverty and the digital divide*. Oxford, United Kingdom: Oneworld.

Postman, N. (1992). *Technopoly: The surrender of culture to technology*. New York, NY: Vintage.

Postman, N. (1995). *The end of education: Redefining the value of school*. New York, NY: Vintage.

Postman, N. (2005). *Amusing ourselves to death* (20th anniversary ed.). New York, NY: Penguin.

Prensky, M. (2001). Digital natives, digital immigrants. *On the Horizon, 9*(5), 1-6. Retrieved from http://www.marcprensky.com/writing/Prensky%20-%20Digital%20Natives,%20Digital%20Immigrants%20-%20Part1.pdf

Reddy, V., Ankeiwicz, P., De Swardt, E., & Gross, E. (2003). The essential features of technology education: A conceptual framework for the development of OBE (Outcomes Based Education) related programmes in technology education. *International Journal of Technology and Design Education, 13*, 27-45.

Reinking, D. (1997). Me and my hypertext: A multiple digression analysis of technology and literacy [sic]. *The Reading Teacher, 50*(8), 626-643.

Rushkoff, D. (2010). *Program or be programmed: Ten commands for a digital age.* New York, NY: OR Books.

Selber, S.A. (2004). *Multiliteracies for a digital age*. Carbondale, IL: Southern Illinois University Press.

Selfe, C. L. (1999). Technology and literacy: A story about the perils of not paying attention. *College Composition and Communication, 50*(3), 411-436. Retrieved from http://www.jstor.org/stable/358859

Sudol, R.A. (1991). The accumulative rhetoric of word processing. *College English, 53*(8), 920-932. Retrieved from http://www.jstor.org/stable/377699

Terranova, T. (2004). *Network culture: Politics for the information age.* London, United Kingdom: Pluto Press.

Tornero, J.M.P., & Varis, T. (2010). *Media literacy and new humanism.* Moscow, Russia: UNESCO Institute for Information Technologies in Education.

Turkle, S. (1982). The subjective computer: A study in the psychology of personal computation. *Social Studies of Science, 12*(2), 173-205.

Turkle, S. (2005). *Second Self* (20th anniversary ed.). Cambridge, MA: MIT Press.

Warschauer, M. (2003). *Technology and social inclusion*. Cambridge, MA: MIT Press.

Wildman, T.M., and Burton, J.K. (1981). Integrating learning theory with instructional design. *Journal of Instructional Development, 4*(3), 5-14.

Wilhelm, A.G. (2004). *Digital nation*. Cambridge, MA: MIT Press.