Toward the Contemplative Technopedagogy Framework: A Multi-Site Analysis of Pedagogy and Digital Technology in Contemporary US Higher Education

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ABSTRACT

This dissertation argues for integrating contemplation into pedagogical decisions regarding digital technologies in US higher education. Digital technology permeates contemporary US higher education. Despite the ever-increasing presence of digital technology, various higher education stakeholders give inadequate attention to matters of pedagogy. The uncritical adoption or dismissal of digital technology at any scale can substantially influence higher education teaching-learning environments. Contemplative approaches to digital technology and pedagogy provide the potential to positively shape the trajectory of higher education technopedagogy.

Scant research exists regarding the influence of contemplation on technopedagogy. Therefore, this dissertation combines a critical empirical analysis of the use of digital technology in contemporary US higher education with practical interventions to demonstrate the value of contemplative technopedagogy. A science and technology studies (STS) toolkit is used to investigate four research sites at three interconnected levels of analysis – *national*, *institutional*, *experimental teaching-learning environments*. National level analysis focuses on discourse (1993-2016) within *The Chronicle of Higher Education* to understand the development of conceptions regarding digital technology and pedagogy in contemporary US higher education and uses inductive methods to create new knowledge, discourse, and practices by proposing the Contemplative Technopedagogy Framework. Institutional level analysis involves ethnographic case study research to examine the sociocultural dynamics significant to the development and dissemination of a particular technopedagogical ideology at Virginia Tech's Faculty Development Institute that championed the educational promise of digital technology without sufficient consideration of pedagogy. Experimental teaching-learning environments level analysis presents two practice-oriented case studies of academic librarian as technopedagogical innovator. Each involves collaboration with actors across campus(es) and a novel application of the Contemplative Technopedagogy Framework to exemplify the roles that librarians can play to stimulate contemplative approaches to technopedagogy amidst a changing landscape in US higher education.

Taken together, the manuscripts in this dissertation explore how technopedagogical ideologies are created, contested, and disseminated within and beyond communities in US higher education. Findings from this multi-site analysis of technopedagogy demonstrate how a contemplative approach to digital technology can more effectively and holistically augment teaching and learning in US higher education.

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GENERAL AUDIENCE ABSTRACT

Digital technology is an increasingly common feature in college and university classrooms across the United States. Despite the ever-increasing presence of digital technology in higher education, too little attention is given to matters of pedagogy. Immediate acceptance or rejection of digital technology can seriously influence teaching and learning within higher education. Contemplation, or being attentive to a topic by thinking thoroughly about it, provides the potential to positively shape the future of higher education technopedagogy, or decisions about teaching with digital technology.

Little is known about the influence of contemplation on technopedagogy. Therefore, this dissertation first analyzes the use of digital technology in contemporary US higher education. It then provides examples from four research sites to demonstrate the value of contemplative technopedagogy. The four research sites are studied at three interconnected levels – *national*, *institutional*, and *experimental teaching-learning environments*. At the national level, the conversation about digital technology and pedagogy (1993-2016) within *The Chronicle of Higher Education* was analyzed to understand the practice of technopedagogy in US higher education. Data from that analysis led to the development of the Contemplative Technopedagogy Framework with the goal of helping people, centers, and institutes across higher education to improve teaching with digital technology. At the institutional level, the history of Virginia Tech's Faculty Development Institute (FDI) was analyzed to learn how technopedagogy was conveyed across campus for over 20 years. Due to various internal and external pressures, FDI created technology-focused faculty development programs with little attention to pedagogy. At the experimental teaching-learning environments level, two collaborative case studies applied the Contemplative Technopedagogy Framework to demonstrate how contemplation can be incorporated into teaching-learning environments in US higher education that use technopedagogy.

Taken together, the manuscripts of this dissertation argue for a contemplative approach to technopedagogy in US higher education. The Contemplative Technopedagogy Framework is offered as a tool to improve teaching and learning with digital technology. Findings from this multi-site analysis of technopedagogy demonstrate how a contemplative approach to digital technology can improve teaching-learning environments in US higher education.

Dedication

For Finnegan. May you always find time for a thoughtful pause.

For Carmen. This adventure would not have been the same without you.

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Finnegan, you are fantastic! Thank you for motivating me to finish!

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Attribution

Portions of this dissertation are the result of collaborations with researchers at Portland State University and Montana State University. The dissertation author would to acknowledge and thank his co-authors for their participation throughout the various research processes. Details of collaborations are provided below.

Manuscript 3: Applying Attributes of Contemplative Technopedagogy to a Social Media Assignment

Justin D Shanks, dissertation author, initially conceived of and designed the research and social media assignment. Collaborator, Scott Young[1] provided input regarding research design and iterative social media assignment development. Shanks led manuscript composition. Young contributed to drafting and revising the manuscript. Shanks and Young collected study data. Both authors analyzed and interpreted data.

Manuscript 4: Teaching Undergraduate Students to Visualize and Communicate Public Health Data with Infographics

Justin D Shanks, dissertation author, initially conceived of and designed the research and infographic assignment. Collaborators Betty Izumi[2], Christina Sun[3], Allea Martin[4], and Carmen Byker Shanks[5] provided input regarding research design and infographic assignment development. Shanks led manuscript composition and Izumi, Sun, Martin, and Byker Shanks contributed to drafting and revising of the manuscript. Shanks and Byker Shanks collected pilot data. Izumi, Sun, and Martin collected study data. All authors analyzed and interpreted data.

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Introduction:

Interrogating Technopedagogy

Nearly twenty years ago, education technology scholar Paul Michael Privateer opened his discussion about the future of higher education with the quip that "it may seem odd that an article concerned with the future of higher education should begin with an analysis of technological phenomenon" (1999, p. 60). Today, it is not so odd. Nearly any conversation about the future of higher education must include a technological component. Emerging digital technologies (e.g., cloud computing, mobile learning, massive open online courses (MOOCs), gamification, 3-D printing, etc.) exhibit a growing influence in contemporary higher education (Johnson et al., 2013).

Still, despite widespread prevalence and popularity of digital technology use in US higher education, educators, administrators, and other higher education stakeholders give too little attention to matters of purpose and method. Digital technology can undoubtedly broaden and augment teaching and learning, but at the same time can narrow and diminish the experiences of educators and learners. Digital technologies can create new terrain, foster collaboration, and inspire self-directed learning. However, if not utilized with contemplation, the same digital technologies can retrace well-trod and pre-determined paths, reinforce rigid educational hierarchies, and reduce opportunities for deep engagement.

Undoubtedly, these emerging digital technologies influence how learners learn (Wesch, 2013). Yet, it is equally important to consider how digital technologies reorient other aspects of higher education. Thus, it is important to interrogate sociocultural

conceptions about the purpose and practice of teaching. In order to embrace a critical, contemplative, and engaging pedagogy, it is necessary to understand ideologies and discourses about teaching with technology. As the historian of technology Nathan Ensminger writes, “It matters who built these instruments, and how, and for what purposes; it matters how these instruments are used, and by whom” (2012, p. 754).

This dissertation combines a critical empirical analysis of the use of digital technology in contemporary US higher education with practical interventions to demonstrate the value of contemplative technopedagogy. Building upon scholarship from science and technology studies, this dissertation focuses on the pedagogy-technology relationship from the vantage that human action both shapes and is shaped by technology. No longer is it novel within higher education research to state that digital technology is an ever-present feature in higher education pedagogy (Drabinski, Clark, & Roberts, 2011). However, there exists a scholarly gap with respect to understanding how historical, social, and institutional values influence the relationship between digital technology and pedagogy in contemporary US higher education.

This dissertation argues that higher education technopedagogy should be understood by simultaneously examining the complex sociocultural ecosystems in which it exists. It uses the science and technology studies (STS) toolkit to build upon recent scholarship from diverse disciplines that asks questions about when, which, to what extent, how, with whom, and for what purpose to integrate digital technologies into teaching-learning environments (Boisselle, Fliss, Mestre, & Zinn, 2004; Cook-Sather, 2001; Newson, 1999).

Reshaping practices of teaching with digital technology in US higher education is complex and requires input, testing, implementation, and approval from diverse stakeholders in higher education. Given the diversity of actors and breadth of interests, an interdisciplinary approach to research is required in order to produce new scholarly understandings of digital technology and teaching that can also be translated into improved technopedagogical practices and educational outcomes. The research herein asserts that practices of teaching in contemporary US higher education are influenced by discourses about and ideologies regarding digital technology. Findings from this research attest to the importance of understanding how historical, social, and institutional values influence the relationship between digital technology and pedagogy in contemporary US higher education. Furthermore, the research demonstrates how a contemplative approach to digital technology can more effectively and holistically augment teaching in US higher education.

Background

The inspiration for this dissertation stems from the conviction that those individuals, institutions, and organizations involved in contemporary higher education need to pay closer attention to digital technologies, but must do so in a reflective manner.

Various technologies enter and exit teaching-learning environments throughout history in higher education pedagogy. Scholars from diverse disciplines have examined ways in which the introduction of the pencil (Petroski, 1994), slide projector (Kavita et al., 2015; Muttappallymyalil et al., 2016; Reiser, 2001), radio (Finn, 1972; Reiser, 2001), electronic hand-held calculator (Banks, 2011; Hamrick, 1996), computer (Bork, 1984;

Center for Social Organization of Schools, 1983; Reiser, 2001), Internet (Hannah, 1998; Harris et al., 1998; Hillesheim, 1998), and more recent digital technologies (Dabbagh & Kitsantas, 2012; Garrison & Kanuka, 2004; Roblyer et al., 2010) influence educational environments. This dissertation examines the pedagogical considerations associated with integration of diverse forms of digital technology into contemporary US higher education. In proposing a contemplative approach to technopedagogical matters in higher education, this dissertation builds upon theories and thinkers that advocate for the integration of reflection into the educational sphere.

It is important to make purposeful decisions about the possible role(s) of digital technology in teaching-learning environments. Philosopher and social critic, Ivan Illich (1971) emphasized, "Technology is available to develop either independence and learning or bureaucracy and teaching" (p. 77). Examining the consequences associated with a paradigm that positions technology as a human tool for prescribed dissemination of information, humanist and cultural critic Neil Postman (1993a) suggested technology itself is not problematic. The trouble lies with cultural beliefs about technology. Postman lamented the shortcomings of technology to generate radical and substantive changes in society and education.

The uncritical adoption of technological artifacts and practices often leads to dissatisfactory or dysfunctional results. Mathematician, learning theorist, and educational-technology innovator, Seymour Papert (1993), deplored the prevailing culture of education technology that cast computers in the "remarkably Schoolish mold" (p. 162) that kept students focused on the cognitive, information delivery side of education at the

expense of experimentation and creativity. Computers and other digital technology are far more than information delivery. Breaking free from such a “Schoolish mold,” digital technology can facilitate communication and bolster creativity. Preeminent media theorist and philosopher, Marshall McLuhan (1964), pronounced that technologies “are 'make happen' agents, but not 'make aware' agents.” Perhaps no point is more critical when talking about digital technology in contemporary US higher education.

With new expectations from learners and society as well as the changing technological landscape, contemporary US higher education is at a critical moment (Bork, 1984; Davidson & Goldberg, 2010; Papert, 1987; Philip & Garcia, 2013; Privateer, 1999; Selwyn, 2015; Selwyn, 2016). Contemporary higher education is awash in what cultural anthropologist and key technopedagogical thinker Michael Wesch refers to as “nearly infinite information” (2013, p. 73). Set in a context where “co-creators of the learning environment” (2013, p. 75) must “address why, facilitate how, and let the what generate naturally from there” (2013, p. 73). Analyzing how oneself, others, and technology connect with information production, validation, location, accessibility, utility, and ownership helps students acknowledge their role in the production of information and mapping of knowledge.

Neither higher education nor society needs information machines, but instead creative engagers. Higher education should not be in the business of “directing how much weight and, therefore, value one must give to information” (Postman, 1993b, p. 73). The focus should be on using information to build relationships within and among communities of learning – physical, digital, spatial, etc. As on-demand and seemingly infinite

information becomes the norm (in higher education and in daily life), “it becomes less important for students to know, memorize, or recall information, and more important for them to be able to find, sort, analyze, share, discuss, critique, and create information” (Wesch, 2013, p. 69). Rather than wondering how to best deliver information, educators should seek to engage individuals (and communities) in the learning process. Learning isn't something done to students. Teachers are not content broadcasters any more than students are content receivers. Both are content creators-processors-sharers.

Acknowledging the multifaceted history of technology and pedagogy and adding to the understanding of this dynamic relationship, this dissertation joins the scholarly conversation with a focus on research sites and pedagogical ideologies associated with digital technology in the 21st century. Located at the intersection of technology studies, pedagogy studies, and higher education studies, this dissertation investigates technopedagogical ideologies in distinct, yet overlapping communities within contemporary US higher education. This dissertation asks scholars and practitioners to thoughtfully engage in technopedagogical decisions at all scales or any site within contemporary US higher education. Such a contemplative approach to matters of teaching with digital technology is a step toward realizing more reflexive and purposeful higher education teaching-learning environments.

Theoretical and Conceptual Framework

This dissertation is informed by theories and concepts from pedagogy, contemplation, and science and technology studies (STS). These theories and concepts are made relevant to the higher education setting both within this introduction as well as

within each manuscript. This portion of the introduction to the dissertation identifies the underlying theories and concepts that tie the manuscripts together. Because this dissertation explores how particular technopedagogical cultures develop at four sites within contemporary US higher education, the specific theories and concepts relevant to each manuscript are explored within latter portions of this introduction as well as within each of the four individual manuscripts.

Pedagogy and Technopedagogy. Pedagogy marries the theory of education with the practice of teaching (Lusted, 1986). The manuscripts of this dissertation ask questions of and suggest new approaches to technopedagogy, or those pedagogical decisions made in the presence of digital technology (Newson, 1999).

Engaging with a range of voices, this dissertation presents a historically-grounded, praxis-oriented analysis of how particular technopedagogical cultures develop within particular contexts within contemporary US higher education. Educational sociologist Janice Newson's (1994, 1999) research regarding efforts to technologize higher education and the associated subordination and (de)construction of faculty roles provides a foundation for this dissertation's interdisciplinary investigation of digital technology and pedagogy. Moreover, Newson's primacy in the critical inquiry of technopedagogy is significant for this dissertation's analysis of pedagogical matters uniquely associated with the integration of digital technology into higher education teaching-learning environments.

Changes in the technosocial environment present opportunities for changes in educational practices and environments. The dramatic changes to education spurred by digital technology are on par with significant changes within teaching-learning

environments associated with the transition to print culture (McLuhan, 1962, 1964; Illich & Sanders, 1988). Critical theorist and educational philosopher Douglas Kellner (2004) took this a step further to suggest that digital technologies make possible the educational reconstruction and social reform argued for by radical reformers such as Illich and Freire.

Educator, philosopher, and prominent critical pedagogy theorist, Paulo Freire was cautiously positive about emerging media and digital technology. So long as the technologies facilitated liberation and did not perpetuate domination, Freire saw the use of and education about emerging media and digital technology as tools for empowering and emancipating citizens. Indeed, Freire aptly explained, "it is not the media themselves which I criticize, but the way they are used" (1972, p. 136). It is within this critically optimistic conversation that this dissertation proposes the integration of contemplation in order to positively alter the trajectory of technopedagogy in US higher education.

Analysis of discourse surrounding the roles of digital technology in higher education reveals varying conceptions of intellectual and pedagogical augmentation. Entering the 1960s educational computing arena as "guests or immigrants" Papert (1993) and colleagues acted like people of their time and "conformed to a set of methods, tastes, and critical standards" (p. 162) thereby shaping how they thought about the (possible) uses of computers in education. Similarly, in their critically optimistic assessment of the political, sociocultural, and technological aspects of learning, Douglas Thomas and John Seely Brown (2011) explained, "For most of the twentieth century…education has been seen as a process of transferring information from higher authority to (the teacher) down to the student" (p. 31). This model is quite evident in Papert's description of "classical"

era educational computing. The model relies upon a teacher explaining content and transferring knowledge to students. In this sense, augmentation via computer is viewed as increased quantity of knowledge rather than "using modern technology to give direct aid to an individual in comprehending complex situations, isolating the significant factors, and solving problems" (Engelbart, 1962).

As any casual observer can explain, much has changed in the computing landscape since engineer and early computer innovator Douglas Engelbart's seminal report "Augmenting Human Intellect" (1962). Among the many changes, computers and associated digital technologies have come to possess an increasingly significant stake in US higher education. Still though, Engelbart's guiding vision and probing questions remain prominent talking points within contemporary US higher education discourse (Campbell, 2006). Pedagogical scholar and innovator, Gardner Campbell (2006) echoes Engelbart and prompts further consideration that digital technologies augment human intellect "because they permit high-speed calculations… [and] externalize our own cognitive processes in a way that allows us to reflect and build upon them to a previously unimaginable extent" (Campbell, 2006, p. 28). Investigating how computers and other digital technologies are thought to augment higher education illuminates the shifting conception of augmentation as well as that of technopedagogy.

Recognizing how the shaping power of sociocultural norms places the teacher and learner in scenarios where the purpose and utilization of digital technology is negotiated within particular educational settings. This dissertation's investigation of contemplation and technopedagogy engages with the concerns and ambitions of pedagogical theories

and thinkers to repeatedly investigate how conceptions of augmentation influence technopedagogical practices.

Contemplation and Pedagogy. Former senior researcher at Michigan State University's Institute for Research on Teaching, Margret Buchmann (1989) succinctly described contemplation as "thinking well." Generally speaking, contemplation is the practice of being attentive to a topic by thinking thoroughly about it. Contemplative practices are diverse and include mindfulness exercises, self-reflection, and concentration or focus. When merged with pedagogy, contemplation aims to cultivate outcomes such as: creativity, non-judgment, compassion, commitment, and reflection (Burggraf & Grossenbacher, 2007; Shapiro, Brown, & Astin, 2008; Zajonc, 2006, 2013).

Due in part to the recognized benefits it brings to teaching and learning, the practice of contemplative pedagogy in higher education has increased in recent years (Levy, 2006). Terms such as contemplative (Gunnlaugson, Sarath, Scott, & Bai, 2014), thoughtful (Privateer, 1999), mindful (Varlotta, 2017), and critical (Miller, 2017) have appeared sporadically in pedagogy research since the late 20th century. Often used interchangeably, each term denotes the importance of thinking critically about the whys and hows of pedagogy. However, little research has been published regarding ways in which contemplation can integrate with and benefit technopedagogy.

While research about contemplation in education has seen a resurgence during recent years, historian Brian Stock (2006) suggested that contemplation has deep roots in education that reach back to Ancient Greece. Philosopher and contemplative education scholar, Patricia Fay Morgan (2015) similarly concluded that contemplation has a

longstanding, but not always visible presence in education. Morgan argued that the most recent resurgence (what she called the third wave) of interest in contemplative educational practices began with the establishment of The Center for Contemplative Mind in Society (CMind) in 1995.[6] She further identified five primary influences that shaped the current reemergence of contemplative educational practices and scholarship: (1) Buddhist and Hindu philosophy; (2) transpersonal psychology; (3) medicine, psychology, business and sport psychology, and meditation research; (4) Yoga in the West; and (5) cognitive and neuroscience and meditation research.

Acknowledging the rich historical background, cultural traditions, and religious practices that are embedded within contemplation, this dissertation makes a purposeful decision not align itself with one tradition over another or to prescribe specific practices instead of others. This decision was made in order to present contemplation in an inclusive and approachable manner. In doing so, this dissertation explores possibilities for uniting contemplation and technopedagogy and also provides a framework for purposeful and engaged thinking regarding digital technology use in contemporary US higher education.

Science and Technology Studies. "Technologies live in complex ecologies. The meaning of anyone depends on what others are available" (Turkle, 2011, p. 188). Technology is far more than information delivery, at its best technology facilitates

[6] In addition to her description of the current wave of interest in contemplation in education, Morgan (2015) identified and summarized the two waves that preceded the third wave. The second wave began with the establishment of three institutions of higher education that focused on contemplation: California Institute of Integral Studies (CIIS) San Francisco in 1968, Maharishi University of Management (MUM) in 1971, and Naropa University in 1974. Morgan argued that the initial contemporary interest in contemplation in education in the West (i.e., the first wave) began as Chinese immigrants introduced Buddhism to the US in the 1840s.

communication and creation. More importantly, technology is wrapped in a set of cultural practices. “We make our technologies, and they, in turn, shape us...Technologies, in every generation, present opportunities to reflect on our values and direction” (p. 19). Instead of merely conceding to the ubiquitousness of digital technology in higher education, acknowledging the aforementioned complexity requires an examination of the whys, hows, and consequences when making technopedagogical decisions in contemporary US higher education.

To better understand the complexly interdependent relationship between science, technology, and society, the STS toolkit includes historical, sociological, and philosophical methods. STS scholars investigate the ways in which technological discourses, conceptions, and practices are imbued with politics (Winner, 1977), power dynamics (Raymond Williams, 1985), sociocultural context (Marx, 1997; Rosalind Williams, 2002), and other elements that shape and are shaped by human actors (Schatzberg, 2006).

This robust assortment of interdisciplinary tools affords STS scholars opportunities to probe the complexities of “scientific and technical knowledge, and of the processes and resources that contribute to that knowledge” (Sismondo, 2007, p. 13). Embracing a common methodological principle that emphasized the dynamic permeability of boundaries between the social, scientific, and technical, Pinch, Bijker, Hughes, Latour, and Callon’s Social Construction of Technological Systems (SCOTS)[7] was a foundational

[7] Not only the title of the seminal social constructivism text (Bijker, Hughes, & Pinch, 2012), the term denotes the collective focus on social construction as expressed in the book by three overlapping, yet distinct approaches to a new framework for considering the social and technical: Pinch and Bijker’s Social Construction of Technology (SCOT), Hughes’s Large-Scale Technological Systems (LTS), and Latour and Callon’s Actor-Network Theory (ANT). Although often referred to as SCOTS, any such reference may result in confusion and/or conflation given the acronymic closeness to the aforementioned SCOT.

step toward the formation of new academic terrain now known as STS. Since then, STS has matured to provide a robust vocabulary and detailed conceptual framework to illustrate how science, technology, and society operate in a seamless web with permeable and negotiable relationships between arenas, actors, and artifacts. Where fuzzy connections once held together a loose assortment of speculations, there now exists the precise language and theoretical sophistication to articulate the intricacies of these dynamic technoscientific[8] relationships.

Social Construction of Technology. The Social Construction of Technology (SCOT) posits that all issues in technoscience emerge from dynamic social, political, economic, and environmental conditions (Bijker, Hughes, & Pinch, 2012; Sismondo, 2007). Hughes (2012) explains that technological systems "evolve in accordance with a loosely defined pattern" (p. 50). How digital technology is used in higher education is contingent upon the social construction of what technology (both the specific technological item as well as technology as an overarching concept) is expected to do.

[8] Frequently championed by a diverse array of scholars and simultaneously critiqued in equal measure, the term technoscience finds its way into a variety of discussions. Despite its prevalence, technoscience is not always a well articulated concept. While it does not serve the immediate interests of this introduction to trace the origin, expression, and contention of the term during the preceding decades, I do wish to clarify my use of the term herein. First coined by French philosopher Gilbert Hottois (1982, 1987), technoscience is largely concerned with contextual contingencies associated with the creation of (meta)physical artifacts (i.e. knowledge or object). Not merely the fields of technology and science compounded, the term technoscience refers to an innumerable number of variables that affect the creation of knowledge and objects. That said, technoscience does help transgress the conceptual boundaries often dividing the technological from that which is scientific. Technoscience seeks to acknowledge the various processes that influence the practices and principles of science and technology. By providing an escape from rigid binaries, technoscience offers a hybridized approach to the study of science, technology, and the various other influences. In short, it is more productive to think about science and technology as intermingling phenomena rather than discrete and isolated entities. Aware of the significant and multiple relations among the technical, historical, economic, social, political, and scientific among other categories technoscience Latour (1987, 2004), Haraway (1991), and others have written at length about the utility of technoscience as a concept and analytical framework. Please begin any exploration of technoscience with a review of the bibliographic entries for Haraway, Hottois, and Latour.

Following suit, digital technology can be used to either preserve the rigidly hierarchical information-dissemination model of education or to advance the aims of a more learner-centered, adaptive, and creativity-oriented paradigm. It seems obvious that the problem does not reside within the technology, but within conceptions of technology.

Intellectual History of Technology. Technology changes. Society changes. Discourse changes. Conceptions change. The intellectual history of technology offers scholars a conceptual framework for understanding ways in which technology is portrayed over time and provides a powerful tool for analyzing discourse about such topics. Technology is "difficult to define and to understand...it is full of contradictions...and rich with unintended consequences" (Hughes, 2005, p. 1), in part due to the variables that shape and are shaped by the conceptions of human actors (Schatzberg, 2006) such as power dynamics (Raymond Williams, 1985), sociocultural contexts (Marx, 1997a; Rosalind Williams, 2002), and politics (Winner, 1977). In short, how humans talk about technology influences how humans think technology can and should be used. The talking and the thinking have and continue to change. This dissertation specifically focuses on digital technology; a wide array of electronic, data-oriented tangible objects and intangible networks (e.g., desktop computers, Internet, laptops, audiovisual recording software, tablets, social networking services). The manuscripts herein explore how portrayals of digital technology and conceptions about digital technology have changed within contemporary US higher education.

Making and Doing. This research brings critical attention to representations of and knowledge about technopedagogical practices that arise from dynamic conditions within

contemporary US higher education. In order to do so, this dissertation emphasizes STS's role as a "making and doing" (inter)discipline that facilitates engaged, action-oriented, and reflexive research. Moreover, this approach to research has much to offer via translation of scholarship into practice, but also has much to learn from those same practices (Downey & Dumit, 1997; Downey & Zuiderent-Jerak, 2016; Jensen, 2007; Zuiderent-Jerak & Jensen, 2007). As an engaged and self-reflexive STS maker-doer, I foster a new hybrid identity as an STS-informed, library-based practitioner scholar.

Structure and Method

Adhering to the guidelines established by the Virginia Tech Graduate School, this dissertation follows the manuscript format option.[9] Utilizing the manuscript format allows for timely dissemination of separate, but interconnected manuscripts that address topics pertinent to pedagogy and digital technology in contemporary US higher education. The manuscript format departs from the traditional dissertation style in that each manuscript must be publishable as an independent entity and adhere to prescribed guidelines for the intended peer reviewed journal. As such, individual manuscripts may reiterate concepts also featured in other parts of the dissertation. Therefore, the introduction and conclusion to the dissertation provide content to more strongly bond the research presented within the four independent, yet interconnected manuscripts.

The four manuscripts of this dissertation are expected to be of interest to an interdisciplinary practitioner scholar audience. Moreover, the manuscript dissertation

[9] For more about Virginia Tech Graduate School electronic thesis and dissertation (ETD) formatting, style, and other guidelines, visit "Graduate School ETD Guidelines" (http://etd.vt.edu/guidelines/index.html) or Virginia Tech Libraries "ETD LibGuide" (http://guides.lib.vt.edu/ETDguide).

format results in scholarship that can readily appeal to and be used by diverse audiences. Further, the four manuscripts demonstrate how these diverse audiences can benefit from an STS approach to understanding pedagogy and digital technology and how STS can benefit from greater scholarly attention to matters of technopedagogy. Additionally, a collection of manuscript publications intended for diverse audiences affirms my interdisciplinary academic path and contribute to my academic career as an interdisciplinary practitioner scholar. Therefore, this dissertation contains five sections, with sections two, three, and four containing separate, but interconnected manuscripts in publishable or already published form.

There are various levels and sites for analyzing ideologies regarding digital technology and pedagogy in contemporary US higher education. The four manuscripts of this dissertation provide a focused analysis of unique, but overlapping communities within contemporary US higher education. With an analytical framework featuring four nested research sites, this project specifically examines technopedagogical ideologies at three levels: **National**, as expressed in the publications of *The Chronicle of Higher Education*; **Institutional**, as embodied in the foundation and operation of Virginia Tech's Faculty Development Institute; and **Experimental Teaching-Learning Environments,** as exemplified by the "making and doing" of an STS practitioner scholar located in a library in contemporary US higher education.

Given the design of this project, multiple methodologies are employed to identify, collect, analyze, and interpret data pertinent to each research question. Data collection for each manuscript involves a combination of keyword searches, literature reviews,

archival research, and open-ended interviews. Discourse, thematic, and content analysis were utilized to make meaning of the data collected. Each manuscript of this document provides details regarding particular methodologies and specific data sources for each research site.

This dissertation's three interconnected levels of analysis address how technopedagogical ideologies are created, contested, and translated within and beyond communities at four research sites. To accomplish its stated objectives, this dissertation relies upon three levels of research questions and goals:

National. The first manuscript demonstrates how the discourse about and use of digital technology in teaching and learning has been imparted to educational professionals through a non-disciplinary, non-peer-review publication that provide news, information, and best practices pertinent to higher education. Articles within *The Chronicle of Higher Education* are written by and for everyday academics and contain topics significant to conceptions and practices of technopedagogy in higher education. This historical and discursive research led to the development of the Contemplative Technopedagogy Framework, which provides a structure for educators to simultaneously consider the positive and negative aspects of a digital technology in context. In its nascent form, the Contemplative Technopedagogy Framework provides an approachable introduction to using a contemplative approach when making pedagogical decisions about digital technology in higher education.

Institutional. The second manuscript outlines the economic, sociopolitical, and institutional dynamics significant to the development and dissemination of a particular

technocentric technopedagogy in US higher education through an in-depth case study of the Faculty Development Institute (FDI) at Virginia Tech (VT). FDI shaped an institution-wide technopedagogical ideology and subsequent technopedagogical practices at VT for more than 20 years. FDI aimed to be both pedagogical and technological, but ultimately disseminated a technocentric pedagogical ideology due to contextual dynamics that shaped its formation, purpose, and evolution. Ultimately, institutes such as FDI should endeavor to mindfully balance technology and pedagogy when developing and disseminating programming for large-scale faculty development.

Experimental Teaching-Learning Environments. Manuscripts three and four translate philosophies and ideologies from science and technology studies (STS), pedagogy, contemplation, and library studies by way of case study examples of collaboration between academic librarians, non-library faculty, and students to stimulate contemplative technopedagogical innovation in contemporary US higher education. Manuscript three translates mixed methods research and aforementioned interdisciplinary theories into practice using Tumblr as a demonstration of how the Contemplative Technopedagogy Framework can aid in creating more self-reflexive and engaging teaching-learning experiences. Manuscript four uses an infographic assignment to further distill the Contemplative Technopedagogy Framework into practitioner-oriented language for adoption across health education disciplines. Together, these manuscripts provide practical examples of the accessibility and applicability of the Contemplative Technopedagogy Framework. Moreover, manuscripts three and four demonstrate my ability to build upon interdisciplinary theory and original research to engage in “making

and doing" as a library-based STS practitioner scholar (Downey & Zuiderent-Jerak, 2016; Zuiderent-Jerak, 2015).

Joining the Scholarly Conversation and Putting the STS Toolkit to Work

The following portion of the dissertation introduction further explicates how the aforementioned background research, theories, and concepts are woven into the objectives, analyses, and outcomes of each of the three sections of the dissertation. Additionally, this portion of the introduction elucidates the role that contemplation plays in each of the three sections.

Section 1 – Visions of Technopedagogical Ideologies. Conceptions about the purpose and practice of teaching influence the roles expected of technology in higher education. Discourses on digital technologies and pedagogies in higher education draw on diverse perspectives and (inter)disciplines, including educators, scientists, technologists, and historians. With an in-depth analysis of textual discourse, this section investigates the development of conceptions regarding digital technology and pedagogy in contemporary US higher education. "Integrating computer technology into classrooms demands the participation of all sorts of people on campus" (Fraiberg, 2001, p. 422).

Scholarly inquiry pertaining to technology and education takes many forms and follows various theoretical and conceptual approaches. As a translational endeavor from an STS practitioner scholar, the research and recommendations from this dissertation are intended to shape the understanding of, research about, and practice within the interconnected fields of technology and higher education. To accomplish such goals, this

section utilizes the STS toolkit to investigate how CHE authors portray technology, pedagogy, and contemplation.

Discourse is powerful. Indeed, discourse shapes conceptions, which subsequently influence action (Foucault, 2002; Woolgar, 1986). Discourse about digital technology and pedagogy influences conceptions about the topics. Conceptions can either preserve old paradigms or present new models of what is possible with respect to digital technology and pedagogy in higher education. Subsequently, these conceptions influence pedagogical practices with digital technology. To better understand the discourse about digital technology and pedagogy as well as the shaping power of that discourse, the manuscript within this section presents a full-text review of 1345 articles with in-depth analysis of a randomized and representative sample of 137 articles from *The Chronicle of Higher Education* (CHE). Drawing upon articles across more than two decades (1993-2016), this in-depth discourse analysis of CHE seeks to inductively answer two questions: (1) How has or has not the conception of digital technology in higher education pedagogy changed from 1993-2016? and (2) To what extent do CHE articles address attributes of contemplation with regard to technopedagogy?

Contemplation in and of itself is a conception that can find its way into conversations regarding pedagogical considerations involving the integration of digital technology, otherwise known as technopedagogy (Newson, 1999). In short, contemplation involves reflective thinking about a topic (Buchmann, 1989). When contemplation is absent, it becomes far easier to make uncritical decisions about pedagogy with technology. When contemplation is a key component of the decision-

making process, it is far easier to ponder when, which, to what extent, how, with whom, and for what purpose to integrate digital technology into the teaching-learning environment. Findings from this case study are pertinent to those interested in technology, pedagogy, and/or faculty development across contemporary US higher education.

As an endeavor in practice-oriented scholarship, this section studies the discourse within CHE and uses inductive methods to create new knowledge, discourse, and practices by proposing the Contemplative Technopedagogy Framework. Higher education must concern itself with the ways in which contemplation can inform technopedagogy. Yet, little scholarly work has been conducted to frame technopedagogy with contemplation. Research findings can advance an understanding of the conversation about technology and pedagogy in higher education and provide a framework for a more contemplative approach to discussing, evaluating, and utilizing digital technology in higher education. Ultimately, this manuscript aims to use discourse within CHE to inductively outline a framework that can be vetted by practitioner scholars and everyday academics for its ability to promote contemplative decisions about when, which, to what extent, how, and for what purpose to integrate digital technology into the teaching-learning environment. The initial Contemplative Technopedagogy Framework is a first step toward developing a grounded theory; it lays a foundation from which to build, test, inform, implement, and, ultimately shape contemplative technopedagogical practices, as demonstrated in sections two and three of this dissertation.

Section 2 – How Technopedagogical Ideologies are Institutionalized. The goal of this section is to better understand the sociocultural dynamics significant to the development and dissemination of technopedagogies in US higher education. Specifically, the ethnographic case study examines how Virginia Tech's Faculty Development Institute (FDI) functioned as a site for the production and dissemination of a particular technopedagogical ideology. Recognizing the shaping power of economic, sociopolitical, and institutional elements, this section utilizes the STS toolkit to investigate how FDI at Virginia Tech developed and disseminated a particular technopeadogical ideology. To accomplish this aim, the STS toolkit features historical, sociological, and philosophical methods to examine the interdependent relationship between science, technology, and society. More precisely, STS provides an interdisciplinary apparatus for contemplating how faculty development has the potential to shape the practice of teaching with technology in contemporary US higher education. This section relies most heavily upon the archival research (found within the history drawer of the toolkit) and ethnographic case study (co-located within the sociology and history drawers) portions of the STS toolkit in order to understand the contextual conditions that led to the formation of a faculty development program with a specific purpose that disseminated a technology-focused pedagogy which evolved to reach all corners of Virginia Tech. Findings from this case study are pertinent to those interested in technology, pedagogy, and/or faculty development across contemporary US higher education.

More than just an analysis of FDI at VT, this ethnographic case study of particular technopedagogical ideologies and practices at one specific institution, provides an up-

close look at themes and concerns applicable to US higher education more generally. When formulating a pedagogical framework, it is not enough to simply acknowledge the presence of technology in higher education. As MIT professor of STS Sherry Turkle (2011) succinctly explained, “Technologies live in complex ecologies” (p. 188). Looking closely at FDI offers insight into how the perceptions about and intentions for technology and teaching are realized within complex university ecosystems. This manuscript offers research findings that are applicable to faculty development across US higher education and emphasize the importance of utilizing a contemplative approach in order to make purposeful decisions about technopedagogical matters amidst diverse contextual pressures.

Computing technology is widely used within teaching-learning environments across contemporary higher education. As such, researchers have been keen to identify pedagogical best practices and understand impacts of such decisions on teaching and learning. If technology is understood as one part of the dynamic teaching-learning environment and pedagogy takes a more engaged and active role in higher education, then institutions and educators are better equipped to make contextually appropriate decisions about the possible role(s) of digital technology.

Problems associated with technology in education result from a lack of understanding about technology itself. Other problems are caused by the limits of the technological way of approaching education. Problems associated with technology in education will not be solved by less technology or by more technology. Problems do not reside within the technology, but our conceptions thereof.

"Technology has been proffered as a tool that can ensure that teachers teach students the right way. Such innovations are rooted in underlying assumptions that reduce teaching to a discrete sets of knowledge and tasks that can presumably be better delivered and assessed by technology" (Philip & Garcia, 2013, p. 301). Still though, "These changes in person-to-person interaction, and in particular the pedagogical implications of mediating social relationships through new technologies, are rarely at the center of the most prevalent adoptions of educational technologies" (2013, p. 302). Thus, it is important to understand from where and how such assumptions developed. Analyzing how artifacts, discourses, conceptions, and actions interact not only provides a better understanding of the ecological complexity, but also grants a better foundation for praxis. This is not a call for banishing technology from higher education nor the uncritical adoption. This is an argument for a contemplative approach.

This section utilizes archival research, discourse analysis, and interview methodologies to understand the contextual dynamics and trace the formation, purpose, dissemination, and evolution of one institution's dominant conceptualizations regarding technology and teaching in contemporary US higher education. The ethnographic case study examines how Virginia Tech's FDI functioned as a site for the production and dissemination of a particular technopedagogical ideology. Moreover, this section demonstrates how faculty development initiatives are imbued with the power to shape perceptions of technology and practices of teaching. Following suit, when envisioning and operationalizing faculty development programs of the future, it is necessary to examine

economic circumstances, sociopolitical dynamics, and institutional culture. Doing so will enable more comprehensive and contemplative technopedagogical decisions.

Section 3 – Experiments in Contemplative Technopedagogy. Digital technologies enter and exit higher education teaching-learning environments. Roles and expectations of student, teacher, and university are routinely renegotiated within sociocultural, institutional, and pedagogical contexts. The changing technosocial environment demands that educators think contemplatively about technologies and proactively about pedagogies.

"It is daunting to think that universities have existed in the West since medieval times and in forms remarkably similar to the universities that exist today" (Davidson & Goldberg, 2010, p. 4). There exists a real need for broad, deep changes within the fabric of contemporary US higher education amidst a changing sociotechnical landscape. "Our present educational system is not viable" (Postman & Weingartner, 1969, p. xv). A different model is needed – one unfettered by ingrained and outmoded cultural assumptions regarding the purpose of digital technology and practice of teaching in contemporary higher education. The two manuscripts that comprise this section – "Applying Attributes of Contemplative Technopedagogy to a Social Media Assignment" and "Teaching Undergraduate Students to Visualize and Communicate Public Health Data with Infographics" – are a step in that direction.

From where will a new pedagogical model arise? Small, localized change is fabulous. A cadre of idealistic thinkers is making key contributions to re-visioning teaching

in contemporary US higher education. Names such as Campbell,[10] Groom,[11] Mazur,[12] and Wesch[13] are synonymous with educators seeking to enrich learning experiences using diverse technologies with thoughtful pedagogies. Yet, their praxes and philosophies remain remarkable because these individuals exist as educational outliers. How can more educators become technopedagogical innovators? Might the key to cultivating technopedagogical innovation lie within one of higher education's longstanding organizational units?

With an extensive history associated with collecting, storing, seeking, and gathering information, the academic library has long served as locus for scholarly investigation and knowledge production. Its ubiquity across US higher education in conjunction with historical purpose, ongoing operation, and future trajectory make the academic library a site ideally suited for cultivating a new technopedagogical framework. Emerging technologies are transforming higher education. Roles and expectations of student, teacher, and university are routinely renegotiated within sociocultural, institutional, and pedagogical contexts. It is within such a fluid environment that we must identify sites and sources that facilitate pedagogical innovation.

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[10] Walter Gardner Campbell – Vice Provost for Learning Innovation and Student Success, Dean of University College, and Associate Professor of English at Virginia Commonwealth University; named "Top 50 Innovators in Education in 2012" by *Center for Digital Education and Converge Magazine*; also, a leader in the critical theory and practice of online teaching and education innovation in the digital age.

[11] Jim Groom — Director of the Division of Teaching and Learning Technologies and Adjunct Professor at University of Mary Washington; also, creator of the internationally celebrated community-based approach to online learning ds106 (http://ds106.us).

[12] Eric Mazur — Balkanski Professor of Physics and Applied Physics at Harvard University and Area Dean of Applied Physics; also, early advocate and developer of peer instruction

[13] Michael Wesch — University Distinguished Teaching Scholar and Associate Professor of Cultural Anthropology at Kansas State University; also, 2008 CASE/Carnegie US Professor of the Year

Connecting organizations, institutions, people, ideas, and information, digital technology permeates all aspects of contemporary US higher education. This dissertation provides an interdisciplinary arena for understanding the past, present, and possible future of teaching with technology in higher education. Looking to adjust the trajectory of technopedagogy, this section demonstrates how a contemplative approach to digital technology can more effectively and holistically augment teaching and learning in US higher education.

Marrying the professional and conceptual interests of with Science and Technology Studies (STS) with those of library and information science engages with the technological and pedagogical as a theoretical lens as well as a praxis-oriented framework. An engaged and reflexive field of inquiry, STS is attentive to ways in which theoretical inquiry both shapes and is shaped by the intervention of ethnographic social research (Downey & Dumit, 1997; Downey & Zuiderent-Jerak, 2016; Jensen, 2007; Zuiderent-Jerak & Jensen, 2007). As Downey and Zuiderent-Jerak (2016) emphasize, as a "'making and doing'" discipline, STS is simultaneously interested in the scholarly study of actors and practices as well as in the "reflexive learning from those actors and practices" (p. 225). Such an approach combines action-oriented and descriptive modes of ethnographic social research. Engaged, action-oriented, and reflexive ethnographic social research has much to offer to the practices it studies, but also has much to learn from those same practices (Zuiderent-Jerak, 2015). The aim then is to not only change practice, but to also produce new sociological knowledge (Zuiderent-Jerak, 2015). Following this perspective, the two manuscripts of this final section seek to not only

understand technopedagogical practices in contemporary higher education, but to also shape those practices.

Amidst the changing academic and sociocultural milieu, libraries are aiming to reinvent themselves in order to meet the needs and expectations of institutions, scholars, and students, among other patrons. “Over the next decade or two, academic and research libraries either will get better or worse. They will not remain the same. Libraries will change; this is inevitable…’We are in a period of substantial and far-reaching change. Our society is changing. Higher education is changing’” (Lynch, 1982, p. 124). Despite the fact that Lynch’s remarks are nearly 40 years old, her attentiveness to the forthcoming “greater information overload” (Lynch, 1982) and subsequent need for libraries to reconsider their primary functions also accurately reflects contemporary attention to “the increasing integration of librarians and libraries into the teaching and learning program of the college or university” (J. K. Lippincott, 2015). As Elmborg (2011) states, “Along with technical imperatives have come a series of human questions about the impact of new technologies on our ways of teaching, learning, and thinking” (2011, p. 339). An on-campus multidisciplinary space long identified with inquiry, “the library is not only a physical destination and an institutional cornerstone, but also is a gravitational force in the digital scholarly life of the campus” (Ashton, 2013, p. 141). Echoing Lynch, Joan Lippincott (2015) suggests the future of academic library, “the greatest opportunities for librarians lie in deeper connections to the curriculum, adapting to new modes of pedagogy, linking technology-rich and collaborative spaces in libraries to learning, and ensuring that individuals who enrich the library’s role in teaching and learning are on staff.”

In response to changes within and beyond higher education, US academic libraries "have renovated — or are planning to renovate — their space to create information or learning commons, incorporating technologies and collaborative spaces" (J. Lippincott, Vedantham, & Duckett, 2014). The American Library Association's (ALA) *Standards for Libraries in Higher Education* (*SLHE*) guides academic libraries in advancing and sustaining their role as partners in educating students, achieving their institutions' missions, and positioning libraries as leaders in assessment and continuous improvement on their campuses. The core of this document identifies nine principles (as well as a series of performance indicators for each) that are expected of all accredited libraries. However, *SLHE* also acknowledges, "each library must respond to its unique user population and institutional environment" (Association of College and Research Libraries, 2011, p. 6). Indeed, the "academic library is shaped by its environment," (Lynch, 1982, p. 124) but the academic library in turn shapes its environment.

To that end, developing a new approach to teaching within contemporary US higher education requires an understanding of the origins, implementation, and current technopedagogical practices of contemporary US academic libraries. The two manuscripts that comprise this section encourage reflective dialogue to engender more deliberate approaches to educational technologies via thoughtful consideration of academic libraries as sites of technopedagogical innovation.

This section presents two instances of library and librarian as technopedagogical innovator. Each manuscript involves a novel application of the Contemplative Technopedagogy Framework introduced in "Section 1: Visions of Technopedagogical

Ideologies." The co-authorship of manuscripts three and four, led by the dissertation author (an STS practitioner scholar situated within an academic research library) and co-authored by an academic librarian (manuscript three) as well as three public health faculty members and one graduate student (manuscript four), demonstrates how the integration of attributes of the Contemplative Technopedagogy Framework can enrich collaboration and subsequently stimulate engaged and innovative approaches to teaching with digital technology in higher education environments. Furthermore, the collaborative authorship of the manuscripts comprising this section represents a purposeful decision which acknowledges that changing technopedagogical practices in higher education is hard work that requires participants from many locations across campus(es).

How might contemporary ideologies about pedagogy and digital technology in higher education be enriched by the integration of the Contemplative Technopedagogy Framework developed by a library-based STS practitioner scholar? There remains a need to better understand how the academic library is ideally situated to guide technopedagogical innovation. More than simply a situation where new technologies usher in new pedagogies, the changing technosocial environment demands that educators think contemplatively about technologies and proactively about pedagogies. Building upon the two previous analyses of organizational and institutional contexts, "Applying Attributes of Contemplative Technopedagogy to a Social Media Assignment" and "Teaching Undergraduate Students to Visualize and Communicate Public Health Data with Infographics" provide case study examples of how an academic library can engage in collaboration involving librarians, faculty, and students to stimulate

technopedagogical innovation. The two manuscripts of this section help to contextualize the roles that librarians and libraries can take amidst the ongoing technological changes occurring throughout US higher education.

Moving Toward the Contemplative Technopedagogy Framework

Studying technopedagogical cultures unearths salient conceptualizations of digital technology and pedagogy in contemporary US higher education. Findings also advance practitioner understanding and knowledge with the ultimate goal of effective implementation to augment learning through its application. This dissertation studies technopedaogy at four sites within three interconnected levels of analysis to understand how ideologies about purpose of digital technology and practice of teaching are created, contested, and translated. Research findings draw critical attention to the nature of conceptions of and knowledge about technopedagogical practices that arise from dynamic conditions within contemporary US higher education. This examination of higher education pedagogy is applicable to various communities within US higher education, but of particular concern to those scholars and practitioners interested in digital technology and pedagogy. The four manuscripts that follow demonstrate the importance of understanding the dynamic relationship between digital technology and pedagogy in contemporary US higher education and introduce a contemplative framework for making decisions about digital technology in higher education teaching-learning environments.

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Manuscript 1

Toward A Contemplative Technopedagogy Framework:

A Discourse Analysis

Abstract

Digital technology features prominently in the higher education ecosystem, affecting the ways in which educators think, communicate, and teach. This research applies discourse analysis to articles published within *The Chronicle of Higher Education* (CHE) to understand: (1) The ways in which conceptions of digital technology in higher education pedagogy have changed and the ways in which they have remained consistent from 1993-2016 and (2) The extent to which CHE articles addressed attributes of contemplation with regard to technopedagogy. Research findings indicate that during the previous 23 years digital technology was portrayed as an overwhelmingly positive addition to higher education pedagogy. Less than half of articles analyzed contained attributes of contemplation. This historical and discursive research inductively led to the development of the Contemplative Technopedagogy Framework, which provides an approachable introduction to using attributes of contemplation when making pedagogical decisions about digital technology in higher education.

Keywords

pedagogy, technology, contemplation, *The Chronicle of Higher Education*

Journal

In preparation for submission to the *Journal of Transformative Education* (*JTED*)

Introduction

From the personal computers in the 1980s to contemporary cloud computing, digital technology is an ever-present feature of higher education. Given the omnipresence of digital technology throughout the higher education landscape, there exists a deeply ingrained and widespread assumption that digital technology not only will be, but in fact should be used for purposes of teaching.

Course management systems (CMS) are championed for enabling instructors to easily and efficiently distribute course information and content to students via the Internet (Harrington, Gordon, & Schibik, 2004). Over 90% of universities and colleges in the US and UK utilize CMS (Browne, Jenkins, & Walker, 2006; Hawkins & Rudy, 2007). Walking into nearly any classroom on an American college campus, observers are likely to see students and faculty reading from and typing upon various models of laptop computers. During the 2015-16 academic year, 95% of students owned a laptop and used it for coursework (Brooks, 2016). The prevalence of CMS and laptops are two brief examples that illustrate how digital technology has become ingrained within the infrastructure and daily practice of higher education.

While CMS and laptops are relatively recent technologies, the evolving nature of technology is not a new conversation in the history of higher education. Education has a longstanding relationship with various technologies from paper and chalkboards to televisions and laptops (Kidwell, Ackerberg-Hastings, & Roberts, 2008). The integration of technology in effort to mechanize, automate, or otherwise improve education has been a topic of inquiry since the Ancient World (Buck, 1989). Technology and its role in higher

education is routinely reimagined (Office of Educational Technology, 2017). Since the late 20th century, the predominant focus of the voluminous research regarding the roles of technology in higher education has been on digital technology. For example, along with the Internet came bold predictions that online environments and software applications would transform teaching practices across higher education (Blin & Munro, 2008, p. 475).

The constantly changing nature of technology in higher education lends itself to another conversation focused on thinking critically about the *whys* and *hows* of pedagogy with technology. Since the late twentieth century, terminology such as *contemplative* (Gunnlaugson, Sarath, Scott, & Bai, 2014), *thoughtful* (Privateer, 1999), *design* (Reeves, Herrington, & Oliver, 2005), *mindful* (Varlotta, 2017), and *critical* (Miller, 2017) appear sporadically throughout higher education literature and convey the importance of contextual considerations in regard to pedagogical considerations uniquely associated with the integration of digital technology, otherwise known as technopedagogy (Newson, 1999).

Literature focused on contemplative practices in higher education warns about the uncritical adoption of technology without regarding the *whys* and *hows* of its pedagogical application (Hargittai, 2010). Much of the literature discusses contemplative practices with respect to student learning (Fisher, 2017; Hart, 2004). Hart (2004) explains that introducing contemplation into the classroom can deepen a student's awareness, concentration, and creativity. There is decidedly less attention to matters of contemplative practices with regard to pedagogy. Buchmann (1989) stresses that "teacher thinking must be expanded beyond planning and decision making" to also include processes of

contemplation. Even less literature addresses the role of contemplative practices with regard to technopedagogy in higher education. Levy (2007) discusses how the contemplative practice of "slow-time" can enhance learning, teaching, and research by countering "fast-time," which he sees as directly related to ever-present digital technology.

More than simply a situation where new technologies usher in new pedagogies, the changing technosocial educational environment demands that educators think contemplatively about technologies and pedagogies. Digital technologies are not only transforming what it means to be a student, but also what it means to be a teacher.

Developing a new approach to teaching within contemporary higher education requires understanding discourse regarding the promise, potential, and peril of digital technology. Moreover, it is important to know the extent to which this discourse incorporates attributes of contemplation. This manuscript will encourage reflective dialogue to engender more deliberate approaches to digital technologies via contemplative consideration of technopedagogy.

Among the most prominent spaces where the larger conversation about digital technology and pedagogy in higher education takes place is within the pages of *The Chronicle of Higher Education* (CHE). Based in Washington, DC, CHE is the "No. 1 source of news, information, and jobs for college and university faculty members and administrators" ("About The Chronicle," 2017). This electronic database was selected because it is frequently accessed by higher education professionals, with 12.8 million pageviews and 1.9 million unique visitors a month, and technology and pedagogy are significant themes in its publications. Originally started in 1966 as a print newspaper, CHE

integrated an online newspaper in 1993. CHE is now offered both in print format (published weekly during the academic year and less so from May until August and December) and in digital format (published each weekday). As a non-disciplinary, broadly comprehensive publication addressing higher education news, information, and concerns, CHE provides an exemplary research site for understanding conceptions of digital technology and integration of contemplation for pedagogy in contemporary higher education. During the previous three decades, CHE articles have excitedly introduced new technologies, skeptically bemoaned changing ideologies, and shared various best practices. CHE articles are written by and for everyday academics – those pedagogical practitioners who are routinely faced with decisions about when, which, why, how, and to what extent to use digital technology in their teaching.

In analyzing CHE articles, this manuscript answers two questions: (1) In what ways have conceptions of digital technology in higher education pedagogy changed and in what ways have they remained consistent from 1993-2016? and (2) To what extent do CHE articles address attributes of contemplation with regard to technopedagogy? This two-fold inquiry is important to execute in tandem – a new framework for teaching with digital technology should build upon an understanding of the preceding discourse. These questions are answered through a discourse analysis of a representative and randomized set of CHE articles. Research findings provide an understanding of the conversation about technology and pedagogy in higher education and help to guide the next phase of this conversation toward a more contemplative approach to discussing, evaluating, and utilizing digital technology in US higher education. Ultimately, this manuscript outlines a

framework that will aid everyday academics in making contemplative decisions about when, which, to what extent, how, and for what purpose to integrate digital technology into the teaching-learning environment.

Conceptual Framework

This manuscript investigates the portrayal of technology, pedagogy, and contemplation using an interdisciplinary science and technology studies (STS) lens. STS integrates historical, sociological, and philosophical methods to better understand the interdependent relationship between science, technology, and society (Bijker, Hughes, & Pinch, 2012; Felt, Fouché, Miller, & Smith-Doerr, 2016; Sismondo, 2007). More specifically, this analysis of CHE is informed by theories and thinkers from history of technology, social construction of technology (SCOT), higher education studies, pedagogy, and contemplation. This manuscript draws upon tools of discourse analysis developed within STS and the intellectual history of technology, in order to analyze what CHE authors mean when they write about technology in higher education (Coeckelbergh, 2017). STS provides a critical, self-reflexive form of discourse analysis trained upon social construction of technoscientific phenomena.

Discourse influences conception and conception subsequently influences action (Foucault, 2002; Woolgar, 1986). Conceptions about the roles expected of digital technology influence the purpose and practice of higher education pedagogy. Examining how digital technology is thought to augment higher education pedagogy illuminates the shifting conception of augmentation as well as that of pedagogy (Campbell, 2006;

Engelbart, 1962). Conceptions define the parameters of what people think can or should happen with respect to digital technology and pedagogy in higher education.

Contemplation in and of itself is a conception that can find its way into the conversation regarding the purpose and practice of higher education technopedagogy. By either its absence or presence, the conception of contemplation influences technopedagogical actions. Worst case scenario, in the absence of contemplation, educators make uncritical decisions about pedagogy with digital technology. Best case scenario, contemplation is a key component of the decision-making process regarding the purpose and practice of higher education technopedagogy. While such conceptions can and do arise from multiple sources, textual publications are key sources for the dissemination of conceptions regarding digital technology and integration of contemplation in higher education pedagogy.

Key Terms

The analysis and subsequent argument set forth in this manuscript rely upon a shared understanding of the coming together of three key terms.

Technology. As Hughes (2005, p. 1) explains, “Technology is messy and complex. It is difficult to define and to understand...it is full of contradictions...and rich with unintended consequences.” Used to refer to household appliances as well as ethereal software applications, technology is a term with a “tricky history” (Oldenziel, 2006). Moreover, technology is infused with power dynamics (Raymond Williams, 1985), sociocultural context (Marx, 1997; Rosalind Williams, 2002), politics (Winner, 1977), among other variables that shape and are shaped by the conceptualizations of human

actors (Schatzberg, 2006). More than merely the mechanistic, not exclusively the domain of engineering, nor purely about progress, this manuscript understands technology as one aspect of a complex sociocultural ecosystem. More specifically, this manuscript is interested in the subcategory of digital technology. This is not an effort to place the digital in opposition to the material. Indeed, the functional capability of digital technology requires the operation of physical hardware within the material world. In this manuscript, digital technology refers to the full gamut of electronic, data-oriented tangible objects and intangible networks (e.g., desktop computers, Internet, laptops, audiovisual recording software, tablets, social networking services, etc.).

Pedagogy. Broadly understood, pedagogy is the theory of education and practice of teaching (Lusted, 1986). The ways in which teachers teach are classified into and informed by pedagogical theories and strategies. This manuscript is interested in technopedagogy, which critically engages with pedagogical considerations uniquely associated with the integration of digital technology (Newson, 1999). The integration of digital technology into pedagogy should cause stakeholders in higher education to contemplate decisions about when, which, to what extent, how, with whom, and for what purpose to integrate digital technology into the teaching-learning environment (Boisselle, Fliss, Mestre, & Zinn, 2004; Cook-Sather, 2001; Newson, 1999).

Contemplation. Contemplation involves thinking carefully, deeply, and attentively about a topic. This approach to "thinking well" (Buchmann, 1989) covers a range of activities, from self-reflection to immersive concentration. As Levy (2006) reminds us, higher education has strong contemplative roots and "scholarship at its best involves

focused, sustained, and receptive inquiry that is undeniably contemplative." For the purposes of this manuscript, contemplation refers to practices of purposeful and engaged thought.

Contemplative technopedagogy [or digital technology and contemplative pedagogy]. The integration of contemplation into pedagogy takes many forms and diverse meanings. *Contemplative pedagogy* emphasizes the value of incorporating mediation and other mindfulness exercises in coursework to enhance student attention and learning, and is sometimes wrapped into spirituality (Shapiro, Brown, & Astin, 2008; Zajonc, 2013). Other educators have incorporated contemplation into curriculum through activities that provoke reflection, compassion, commitment, non-judgement, and creativity (Burggraf & Grossenbacher, 2007; Zajonc, 2006).

While it is important for scholars to engage in contemplative research and for students to have time and guidance for contemplative inquiry, higher education must also concern itself with the ways in which contemplation can inform technopedagogy. However, little research has been conducted to frame technopedagogy with contemplation.

Methods

This manuscript investigates how the conceptions about technology and pedagogy have been imparted upon higher education professionals through articles published in *The Chronicle of Higher Education* (CHE). Articles were selected for this literature review systematically from CHE, based upon methods suggested by Booth, Papaioannou, and Sutton (2012). An extensive mock keyword search was first conducted to determine the

list of words that would yield the most comprehensive and relevant articles related to the research questions. Initial keywords included: CMS, computer, digital, education, instruction, learn, learner, LMS, pedagogy, teach, teacher, techno, technology (Figure 1).

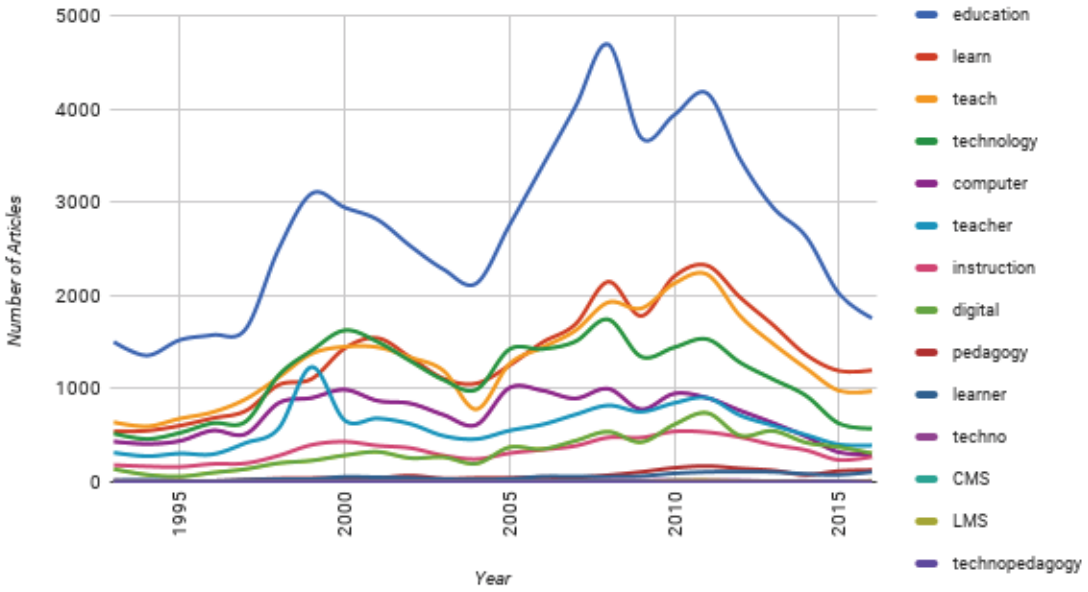

Figure 1. *The Chronicle of Higher Education* Articles with Search Keywords, 1993-2016

The specific keywords were chosen because of their frequency of use in popular press and higher education discourse. Each keyword was entered into a separate search and the author reviewed titles and abstracts of 250 articles from the search results return for each keyword. Some search terms yielded almost synonymous articles. For example, searching for keyword “teach” returned results nearly identical to the search for keyword “technology.” Other search terms were too general and did not yield useful results. For example, searching for keyword “education” returned nearly every article contained in the CHE database because the search term is contained in the publication’s name. Ultimately, keywords that yielded articles most relevant to the research questions were

selected. Subsequently, keywords were combined to further fine-tune the articles yielded by search results: “teaching” + “technology”, “digital” + “technology”, “pedagogy” + “technology” (Figure 2).

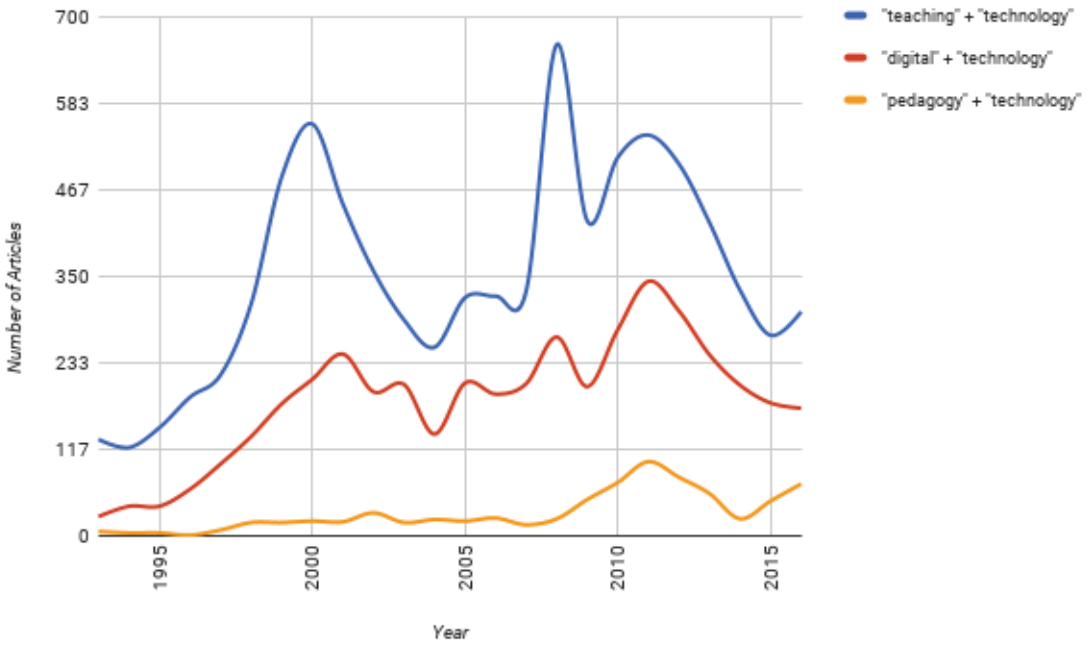

Figure 2. Articles with Combined Search Keywords in *The Chronicle of Higher Education*, 1993-2016*

*Note: “teaching” + “technology” yielded 8,346 articles; “digital + technology” yielded 4,362 articles; “pedagogy” + “technology” yielded 748 articles

The search string “teaching” + “technology” was selected as most appropriate to answer research questions. Database search results indicated that search strings “digital” + “technology” and “pedagogy” + “technology” were duplicative of results obtained from the combined search terms “teaching” + “technology”. The search string “technology” + “teaching” yielded the largest quantity of articles (8,436) that were relevant to the research questions.

Articles were collected from 1993 to 2016. The earlier date was selected because it denotes a major shift in access to articles when CHE integrated an online format in 1993. The latter date was selected as the upper bound in order to capture the most recent full year of articles. Initially, all 8,436 titles and article abstracts were reviewed to determine if they focused upon technology and pedagogy in US higher education. Articles with titles or abstracts that focused on non-US higher education institutions, student learning outcomes, administration, finance and budget, research, technology with no mention of pedagogical application, pedagogy outside of higher education, or published in a non-text (audio or video) format were excluded. After the preliminary inclusion and exclusion, a database of 1,345 URLs was generated and sorted by year.

To analyze what CHE authors mean when they write about technology in higher education, this manuscript draws primarily upon the methodological framework of discourse analysis developed within STS (Coeckelbergh, 2017, pp. 88–89). STS provides a critical, self-reflexive form of discourse analysis trained upon the social construction of technoscientific phenomena.

Thematic and content analysis methods were used to understand how CHE articles portray technology and pedagogy as well as the integration of contemplative attributes. The author used thematic analysis to inductively develop themes in a systematic way (Guest, MacQueen, & Namey, 2012). Thematic analysis was used to generate data inductively to elucidate conclusions from the data itself, rather than a deductive approach, which applies a theory or hypothesis to the data to draw specific conclusions. Content analysis was used to systematically quantify words within an

established theme and analyze the distribution, frequency, and direction of words (Krippendorf, 2012; Lasswell, Lerner, & Pool, 1952; Weber, 1990). Kline's (2006) research regarding the emergence of "information technology" as a keyword, provided an additional model of STS-specific content analysis. Together, these methods make it possible to identify how the conversation about technology, pedagogy, and contemplation in higher education has or has not changed over the past few decades.

To gain an understanding of the potentially emerging themes about technology, pedagogy, and contemplation in higher education, the full text of each article (n = 1,345) was read and field notes produced. Based upon methods suggested by Neuendorf (2016) for digital media research, 10% of articles per year (n = 137) were randomly selected for full content and thematic analysis from each year, 1993 through 2016.

Content and thematic analysis generally occurs until data saturation is reached; saturation occurred once the 137 articles were analyzed. The randomly selected articles were read, open coded, and data were extracted into the codebook. For each article, the codebook identified URL, year, date, author, title, purpose or summary, technologies identified, best practices for teaching, and sample quotes for specific themes and respective sub themes (described in "Results and Discussion" section). Themes and sub themes were used to systematically generate categories that describe the discussion around technology, pedagogy, and attributes of contemplation in higher education as it exists in CHE from 1993-2016.

Results

A total of 137 articles written by 78 unique authors (with 60 authors contributing only a single article) (Appendix 1) from 1993-2016 were analyzed via in-depth content analysis. On average, 5.7 articles per year were analyzed, with a range of 1 to 14 articles per year (Appendix 2). Technologies discussed in the articles included personal computing devices, social media, online learning, world wide web, email, video conferencing, e-portfolios, and mobile technology. The purposes of the articles ranged from technology reviews, best practices, and lessons learned to contemplation about technology use in a specific classroom or across campus to the role of technology in education and society more broadly. Two recurring themes and 14 sub themes were generated from the research to describe conceptions regarding technology and pedagogy in higher education as well as if and how attributes of contemplation were integrated into discussions of technology and pedagogy.

Theme 1 - conception of technology and pedagogy. The CHE article author's Conceptions of Technology and Pedagogy (Figure 3) were categorized into sub themes: Positive, Negative, Positive and Negative, or Neutral.

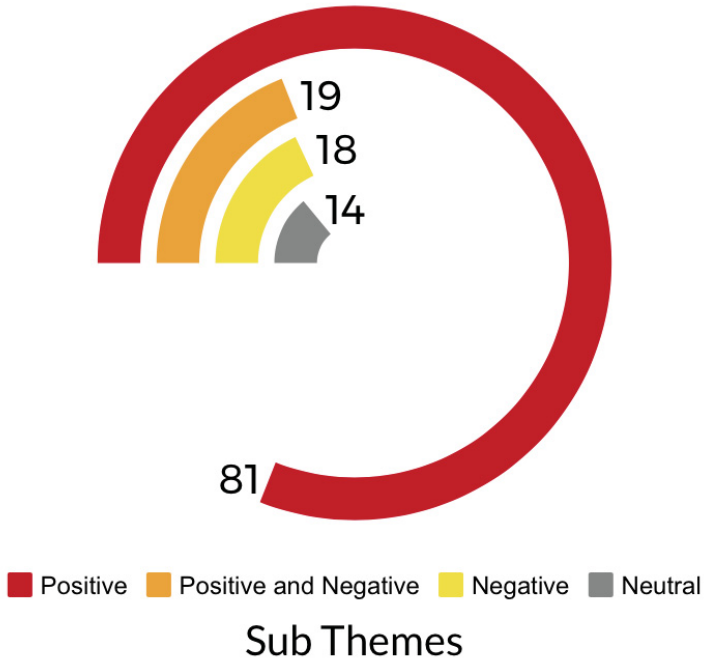

Figure 3. Sub Themes Generated from Discourse Analysis of *The Chronicle of Higher Education* for Conceptions of Technology and Pedagogy Theme*

*Note: Numbers in the above graphic indicate number of articles associated with each sub theme

It is critical to understand how the promises and/or shortcomings of digital technology for teaching are conveyed in higher education. Overwhelmingly, CHE article authors had a positive conception of digital technology for teaching. The author(s) portrayed digital technology as an asset to higher education teaching-learning environments in 81 articles. Many of the Positive portrayals championed the ways in which digital technology was certain to improve instruction. "And the technology is improving instruction, officials of the two colleges say. 'It has dynamically changed the way that we teach and the way that students learn'" (Young, 1998). Nearly equal amounts of articles portrayed digital technology as Negative (n = 18), Positive and Negative (n = 19), or Neutral (n = 14). Articles that were overtly critical or outrightly dismissive, such as

Pyenson's (2011) disappointment about the changing face of higher education, were categorized as Negative. "We are already well on the way to being enslaved by gadgets, and America's second- and third-tier institutions of higher learning are being reduced to the level of trade schools for producing technicians to fix those gadgets. *Homo sapiens* and *Homo ludens* have, in our time, been displaced by *Homo faber*." Articles featuring a more well-rounded critique of both the benefits and costs of digital technology were categorized as Positive and Negative. Maloney (2007) provides a fine example of this approach when discussing CMS. "The problem is not the idea of a course-management system itself...nor the various uses of such systems, many of which serve their purposes quite well. Rather, the problem is that most course-management systems were developed at a time when the Internet was seen primarily as a mechanism for information delivery. Course-management systems were not created to enhance learning, but to make it easier for a faculty member to deliver materials to students. Some articles focused entirely on communicating survey data or introducing new a digital technology without forecasting its utility or evaluating its effectiveness. Articles without a value statement about technology in higher education were categorized as Neutral.

Theme 2 – attributes of contemplation in pedagogy and technology. Attributes of Contemplation (Figure 4) were expressed via 9 sub themes: Teaching Mindfulness, Iterative Design, Pedagogy Focused Faculty Development, Being Present, Connecting, Functional Evaluation, Intentionality, Pedagogy First, Technosocial Dynamics, or No Attributes of Contemplation. Few articles explicitly mention contemplation or its various

synonyms, nevertheless attributes of contemplation exist beneath the surface influencing conception of technology and guide technopedagogical practice.

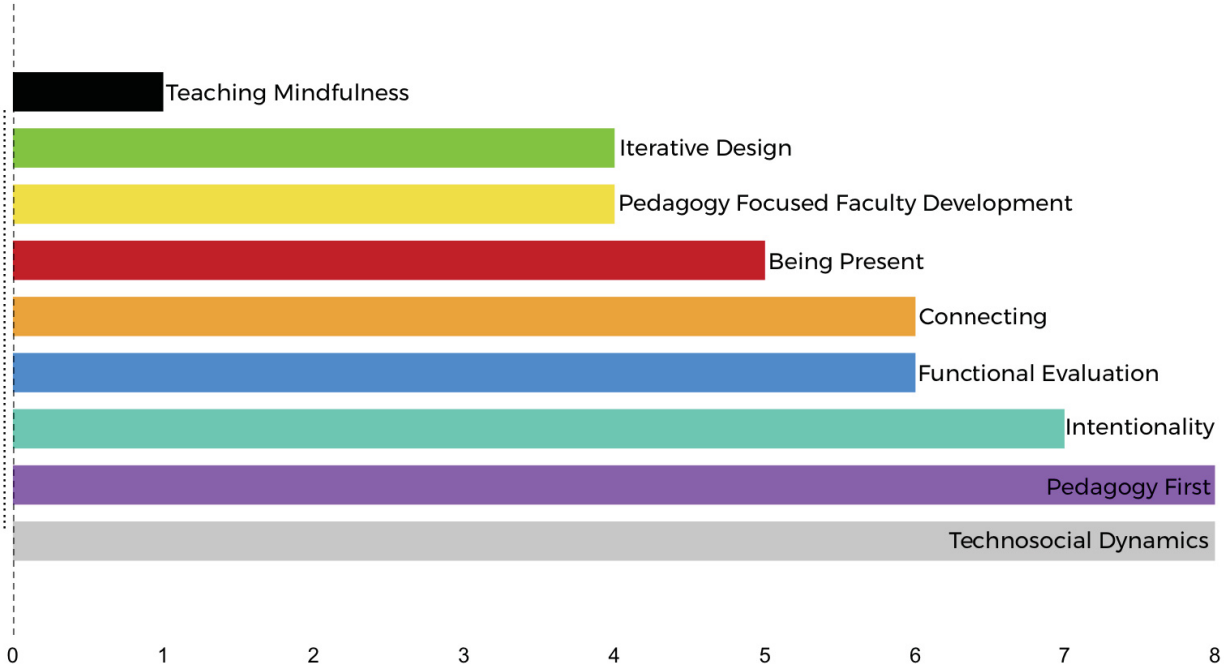

Figure 4. Sub Themes Generated from Discourse Analysis of *The Chronicle of Higher Education* for Attributes of Contemplation in Pedagogy and Technology Theme*

*Note: The above bar chart only includes articles that were coded as contemplative. An additional 88 articles were coded as not contemplative.

No attributes of contemplation. Approximately 64% (n = 88) of articles analyzed contained no mention of attributes associated with contemplation. Articles in this category did not discuss technology purposefully or with engaged thought about pedagogical dynamics. Nearly half of all articles in this category were also categorized as portraying technology positively in Theme 1.

Pedagogy first. One of the largest sub themes (n = 8) emphasized the importance of tailoring technology to suit pedagogy, rather than tailoring pedagogy to suit technology. Farman (2012) acknowledges the multitude of technology choices, but simultaneously

illustrates how his pedagogy influences decisions about the use of any digital technology in the teaching-learning environment. “From my perspective, as an educator, I must respond those practices that have become pervasive in the lives of my students, demonstrate that there are many ways to use these tools, and, ultimately, show them how to analyze and critique their own everyday practices. I am taking small steps toward figuring out the best techniques to achieve those goals.”

Technosocial dynamics. The other large sub theme (n = 8) included articles that critically evaluated the relationship between technology and society, both within and beyond the classroom. Turkle (2004) captures this interdependent relationship between society, technology, and higher education in her assessment of the shaping power of information technology. “The tools we use to think change the ways in which we think. The invention of written language brought about a radical shift in how we process, organize, store, and transmit representations of the world. Although writing remains our primary information technology, today when we think about the impact of technology on our habits of mind, we think primarily of the computer.”

Intentionality. Seven articles conveyed the importance of engaged and purposeful thinking when making decisions about the suitability of a technology for use in a teaching-learning environment. Faced with expanding class sizes, Mark Sample (2011) purposefully sought out digital technology that would enable him to maintain a student-centered environment in order to build an engaged learning community. “My classes are student-centered, hands-on, and discussion-oriented, and I rarely hold forth in any kind of lecture mode. Rather than looking at the shift from a smaller class to a supersized class

as a hardship, I see it as a challenge: How do I continue to engage students on a dialogic and experiential plane when institutional momentum seems to curtail all but the most traditional forms of pedagogy?"

Connecting. Connecting (n = 6) was an attribute of contemplation focused on cultivating authentic relationships between members of the teaching-learning environment. These articles discussed the pros and cons of using digital technology as a technopedagogical strategy to develop a relationship between teacher and learner. "At its best, Mr. Wesch believes that interactive technology—and other methods to create more active experiences in the classroom—can be used to forge that kind of relationship between teachers and students where professors nurture rather than talk down to students (Young, 2012).

Functional evaluation. Functional Evaluation (n = 6) occurred when an article assessed particular features of a specific technology with relationship to pedagogical aims. These quasi-case studies examined how a specific digital technology did or did not work well in a particular course. Wymer (2006) provides an in-depth analysis of her experience using instant messenger to communicate with students instead of email. "Consider, though, what it means to invade that technological space. Students use new technologies as a way to express themselves and their individuality. They develop identities related to those technologies, and those identities are not always the ones they would like to bring into the classroom."

Being present. Avoiding the distractive potential of technology in the classroom in order to focus on the teaching-learning environment was the central tenet of Being

Present (n = 5). A major theme running throughout contemplation research is the necessity of being present in the face of constant distraction. In response to banning digital technology in her classroom in hopes of enhancing in-class attentiveness, Mandell (2015) discusses the reaction from students, “Simply requesting that students put away their phones was an exercise in futility. Adding a line in the syllabus that there would be grade penalties for unprofessional use of technology brought about no change in their habits of swiping and clicking. They meant no disrespect.”

Iterative design. Iterative Design (n = 4) requires the educator to accept the iterative nature of teaching with technology. Acknowledging that the educator is constantly learning about technology and how to potentially use it for teaching, Saltzer (2011) discussed the evolving nature of her gamification class website, “So with the summer almost upon us, I’ll be taking my notes from this semester and working on crafting a more playful, collaborative iteration for the fall.”

Pedagogy focused faculty development. It is common for American universities to include programs or centers that teach faculty how to use digital technology for teaching. Four articles articulated a need for such centers to first cultivate pedagogical expertise before emphasizing the integration of digital technology into the teaching-learning environment. In an article that explores various courses for teachers to learn how to effectively teach online, an administrator for one course explains, “The ones who come in expecting that it will require little work have their eyes opened pretty quickly," he says. "We help them understand that it's a classroom, not a Web site” (Gose, 2010).

Teaching mindfulness. A single article explained the benefits of mindful technology practices learned during a course titled, “Information and Contemplation” at University of Washington. “It began with an assignment that required students to spend 15 minutes to half an hour each day observing and logging their e-mail behavior. The idea, an outgrowth of meditation, is to note what happens in the mind and body” (Parry, 2013). In the face of device distraction and information abundance, there exists a need to sharpen focus and strengthen attention. In this course, the professor teaches students about meditation techniques in order to help still their minds and cultivate attentive focus.

Discussion

Why is digital technology expected to revolutionize higher education? This mindset is symptomatic of the larger sociocultural assumption that digital technology will fix whatever needs repair, now and in perpetuity. CHE articles from 1993-2016 suggest a strong desire to change higher education. The revolutionary (or at least renovative) aims of CHE articles are echoed within higher education research (Green & Gilbert, 1995; Office of Educational Technology, 2017). Moreover, digital technology is seen as a primary means to achieve this end.

Technology in higher education is not problematic in and of itself. Rather, the issue lies with our sociocultural (mis)conception of technology’s role within higher education. Basic problems associated with technology in higher education result from a lack of understanding about technology. Other problems are caused by limited scope and often prescriptive ways of approaching education. Problems associated with technology in higher education will not be solved by less technology or by more technology. Echoing

McLuhan, Postman (1969, p. 204) suggests "that media study become an integral part of all your classes. No matter what 'subject' you are teaching, media are relevant." To realize the full gravity (with respect to digital technology in higher education) of Postman's mention of McLuhan, it is important to recall that McLuhan (1964) considered media as any and all technological extensions of human bodies and minds that control the shape and form of association and action. Problems do not reside within the technology, but our conceptions thereof.

An unexamined embrace of digital technology and associated pedagogical practice is a surefire recipe for disaster, or at least dissatisfaction. If digital technology is to positively augment higher education, it must involve contemplation. A contemplative technopedagogy has the potential to change what it means to be a teacher, which in turn can change what it means to be a learner. Digital technology is far more than information delivery. Digital technology can enable communication and creation. A contemplative technopedagogy creates an educational environment that builds connections and changes norms within and among communities of learning – physical, digital, spatial, conceptual, etc. What follows is an introduction to the Contemplative Technopedagogy Framework (Figure 5) which aims to facilitate purposeful and engaged approaches to pedagogical practices involving digital technology in higher education.

Toward a Contemplative Technopedagogy Framework

Some articles from CHE are attentive to the roles that attributes of contemplation can play when making pedagogical decisions about digital technology. More than half of CHE articles analyzed contain no attributes of contemplation. Non-contemplative

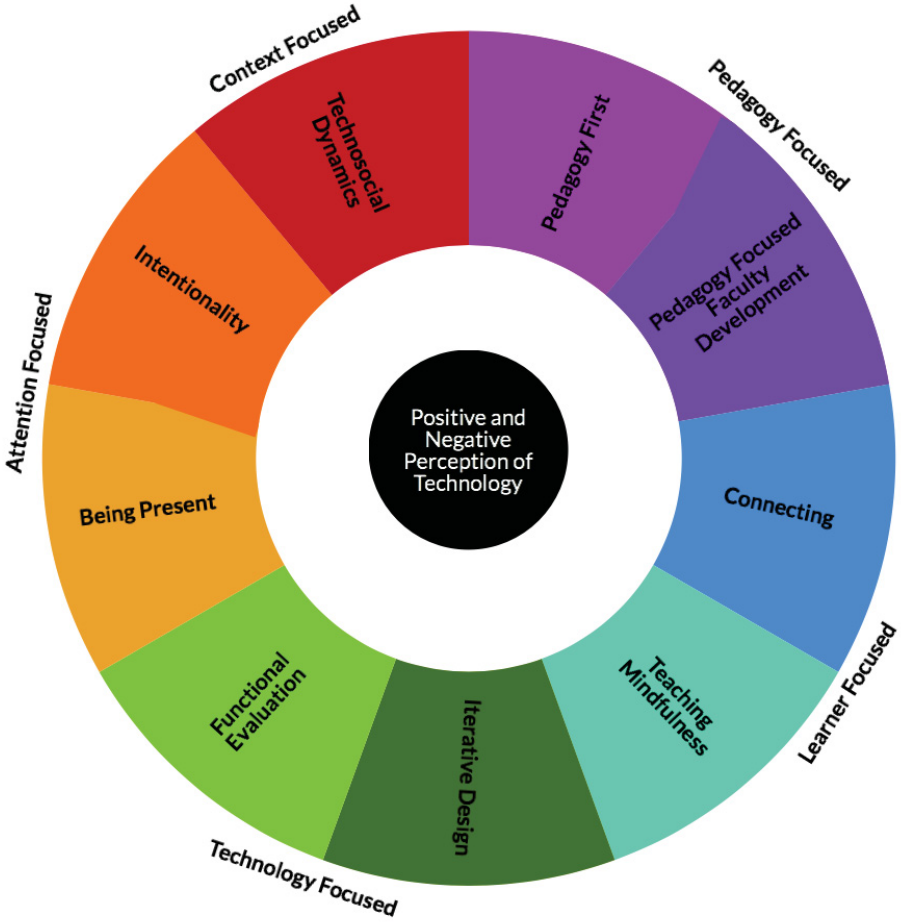

Figure 5. Contemplative Technopedagogy Framework Generated from Discourse Analysis of *The Chronicle of Higher Education*, 1993-2016

technopedagogical approaches can lead to uncritical adoption or knee-jerk dismissal of digital technology – either of which can have substantial and long-lasting consequences within teaching-learning environments. Contemporary pedagogies need to pay closer attention to digital technologies, but must do so in a purposeful and engaged manner. This discussion does not posit a new theory of higher education pedagogy. Rather, it articulates ways in which educators can become more contemplative about their techopedagogy instead of immediately and uncritically adopting of dismissing digital

technology. There is both need and opportunity to create a contemplative technopedagogy framework within higher education and this is a step in that direction.

Analysis of CHE articles determined that the portrayal of digital technology has not dramatically changed from 1993-2016. Portrayals are overwhelmingly positive. Evangelists remain pitted against skeptics. Scattered amidst the polemic rhetoric were some contemplative thinkers. Discourse analysis identified nine attributes of contemplation significant to digital technology and pedagogy in higher education. Examining the attributes provides a framework for making purposeful decisions about when, which, and to what extent to use digital technology. The most constructively critical articles were those categorized as "Positive and Negative" in Theme 1. Therefore, the hub of the Contemplative Technopedagogy Framework requires an educator to simultaneously consider both the positive and negative aspects of a digital technology. Findings from the research indicate that an adaptable mindset is foundational to engaging in contemplative technopedagogy. Surrounding the hub are the nine attributes of contemplative technology grouped into five areas of focus: Pedagogy Focused, Learner Focused, Technology Focused, Attention Focused, Context Focused.

Pedagogy focused. In many ways, contemporary higher education works from the assumption "that learning remains in a 'centered' activity with large numbers of students routinely focused on the teacher as well as a limited selection of carefully selected repositories of knowledge such as textbooks" (Raschke, 2003, p. 4). The Pedagogy Focused area of the Contemplative Technopedagogy Framework emphasizes that a pedagogy should guide digital technology decisions, not vice versa. Moreover, this

area calls for the reorientation of institutional faculty development initiatives to focus on pedagogy first and then digital technology.

Learner focused. Digital technology should foster connections and not create distractions within the teaching-learning environment. Digital technology has the power to connect. It has "expanded the ability of average citizens to express our ideas, circulate them before a larger public, and pool information in the hopes of transforming society," (Jenkins, 2008, p. 273) thereby facilitating opportunities for a widespread and bottom-up participatory culture. Within a participatory educational culture each learner "builds a trail of his interest through the maze of materials available to him" (Bush, 1945). Gender specificity aside, this is a remarkable description of how we might recast higher education with a contemplative technopedagogy. Digital technology has the power to distract. McLuhan (1960) wondered, "With learning and teaching becoming the business of everybody, round-the-clock, and round-the-globe, what becomes of the older roles and relations of teacher and student?" In the contemporary higher education ecosystem, it is important to cultivate a technopedagogy that encourages all participants in the teaching-learning environment to connect with each other and also practice mindfulness use of digital technology. In this environment, teachers and students engage and disengage with technology when appropriate.

Technology focused. The Contemplative Technopedagogy Framework requires a commitment from the educator to be both learner and teacher. Digital technology is constantly evolving. So too should an educator's knowledge of that digital technology and the ways it might or might not be applied to the teaching-learning environment. If a digital

technology is new to the teacher, it may or may not be new to the learner. Teachers should show learners what they already know, share perspectives on the pros and cons, and ask learners how they might (or already do) use the digital technology. Teaching is not about "telling students answers," (Postman & Weingartner, 1969, p. 194) but about working with learners "to find and address problems that are real and significant to them" (Wesch, 2013, p. 73). Moreover, the Technology Focused area requires teachers to examine how a specific digital technology did or did not work well during a particular course. Building, changing, tweaking, or removing an assignment is necessary in response to evaluating a specific technology's value to the teaching-learning environment.

Attention focused. Digital technology can engage and enrich, but also distract. The Attention Focused area calls for educators to focus less on the polemic rhetorics of disruption and revolution and turn attention to matters of intentionality. Gazzaley and Rosen (2016, p. 181) suggest that "there are two approaches by which we can diminish the negative impact of interference on our lives: changing our brains and changing our behavior." Being present requires *us* to calm our frantic thoughts and change the way our brains operate through contemplation, practicing mindfulness, and being thoughtful about *which*, *when*, *why, how*, and to *what extent* to integrate digital technology into the teaching-learning environment. Changing our behavior requires *us* to think and act intentionally with regard to digital technology and pedagogy.

Context focused. Digital technology features prominently in the higher education ecosystem. Learners come into higher education with a lifetime of experience with digital

technology and are perceived as comfortable with the ubiquity of digital technology. The kinds of assumptions teachers make about digital technologies and about learners drastically influence the teaching-learning environment. It is important to probe assumptions and understand preconceived notions about human and technological actors. An unexamined embrace or discarding of digital technology is a surefire recipe for disaster, or at least dissatisfaction. Following suit, when formulating a Contemplative Technopedagogy Framework it is not enough to simply acknowledge the presence of technology in higher education. “Technologies live in complex ecologies. The meaning of anyone depends on what others are available” (Turkle, 2011, p. 188). It is necessary to carefully examine the whys, hows, and consequences of technopedagogical decisions within the larger sociocultural context.

Conclusion

This research identified that contemplation is largely absent from discourse about pedagogy and digital technology in US higher education as represented within *The Chronicle of Higher Education*. This discourse not only captures individual sentiments, but is indicative of institutional ideologies regarding digital technology and teaching. A framework is needed to encourage stakeholders at all levels of higher education (e.g., educators, institutes, universities) to make purposeful and engaged decisions about integrating digital technology into teaching-learning environments. The Contemplative Technopedagogy Framework introduced in this manuscript is a step in that direction.

It's about promise, but also about problems. The either/or binary is outmoded. It is not a matter of entirely dismissing digital technology or wholeheartedly embracing digital

technology. Higher education requires a dynamic both/and approach. We must acknowledge and address the pros and cons of digital technology in tandem. Digital technology holds great promise as catalyst for learning. However, a pedagogical shift is required to realize this potential. As this close analysis of CHE indicates, it is not only about new technology or new curricula, but the need for a cultural shift with regard to how we see technology and pedagogy in higher education. Digital technology can be an asset if it is adopted with a contemplative technopedagogy.

Acknowledging the complex interrelations among digital technology and pedagogy the Contemplative Technopedagogy Framework holds promise for higher education's two most relevant social groups – learners and teachers. Both groups can utilize this framework to foster a more transformative educational environment. Not a prescriptive approach to higher education, this is an outline of a normative vision to guide pedagogical engagement with technology. Rethinking the purpose and practice of digital technology in higher education will (and rightly must) call into question sociocultural conceptions of education, learning, knowledge, teaching, and pedagogy. Quite simply, contemplation can bring a higher quality to technopedagogy.

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Manuscript 2

‘If We Build It They Will Come’:

The Mixed Results of Technocentric Faculty Development

Abstract

Faculty development programs that focus on educational technology hold the power to shape the practice of teaching with technology in contemporary United States higher education. These programs are important research sites for exploring how digital technologies are thought to augment pedagogy in higher education. Research examined the formation, purpose, dissemination, and evolution of Virginia Tech’s Faculty Development Institute (FDI) over 20+ years in order to demonstrate the influence that faculty development programs have on technopedagogical ideologies in higher education. The in-depth discourse analysis of archival findings and ethnographic research related to FDI demonstrate how economic circumstances, sociopolitical criticism, and institutional decisions gave rise to a technocentric technopedagogical ideology within Virginia Tech’s FDI. Furthermore, this technocentric faculty development exhibited long-lasting effects that shaped perceptions of digital technology and pedagogical practices across Virginia Tech. Research findings are applicable to faculty development across US higher education and emphasize the importance of utilizing a contemplative approach in order to make purposeful decisions about technopedagogical matters amidst diverse contextual pressures.

Keywords

Faculty development, Virginia Tech, Technology, Pedagogy, Technopedagogy

Journal

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Introduction

Digital technology is an increasingly prominent feature of the contemporary teaching landscape (Drabinski, Clark, & Roberts, 2011). That said, there remains a scholarly gap with respect to understanding how historical, social, and institutional values influence the relationship between digital technology and higher education. Looking at how digital technologies are thought to augment pedagogy in higher education illuminates the shifting conception of augmentation as well as that of pedagogy. It is important to build upon the current understanding of technology in education and develop a more nuanced understanding of why, how, and to what ends technology was, is, and might be used to augment higher education. Such inquiries lead to the realization that analyzing digital technology in higher education is about more than looking at one product or another. The prominence and possible roles of digital technology in higher education involve decisions made by human actors informed by ideologies. To understand digital technology in higher education requires an analysis of technopedagogical ideology.

Today, it is common for American universities to include programs or centers focused on educational technology. Similarly, programs or centers concentrated on pedagogy-focused professional development of faculty are ubiquitous. Often, these activities occur within the same unit (Diaz, Garrett, Kinley, Moore, & Schwartz, 2009; Hewson, Copeland, & Fishleder, 2001; Persellin & Goodrick, 2012; Reder, 2007). However, neither the presence nor the integration of such activities has a long history. Examining when, where, and why such units developed and how they subsequently evolved reveals much about underlying assumptions regarding digital technology in

higher education. Tracing the formation, purpose, dissemination, and evolution of one institution's dominant conceptualizations regarding digital technology and teaching in contemporary US higher education not only provides an in-depth look at a specific technopedagogical ideology, but also demonstrates how models of faculty development shape perceptions of digital technology and practices of teaching across contemporary US higher education.

There are various scales, questions, and sites for analyzing ideologies pertinent to digital technology and pedagogy in contemporary US higher education. Research that comprises this dissertation specifically examines technopedagogical ideologies at an institutional level, as embodied in the foundation and operation of Virginia Tech's Faculty Development Institute (FDI). Discourse analysis of archival findings and ethnographic research reveal how FDI functioned as a site for the production and dissemination of particular technopedagogical ideology at Virginia Tech over time. Research results first describe FDI's primacy within the context of the development of centers with similar aims and then explore the formation, purpose, dissemination, and evolution of an institutional culture of technopedagogy within FDI. Results from this research about Virginia Tech's FDI illuminate the importance of sustaining a contemplative approach to technopedagogical matters in the midst of contextual pressures, including economic circumstances, sociopolitical criticism, and institutional decisions.

Conceptual and Theoretical Framework

Built upon an interdisciplinary theoretical foundation, this research views the formation, purpose, dissemination, and evolution of technopedagogy through a science

and technology studies (STS) lens. More specifically, this historical and ideological analysis of Virginia Tech's FDI is informed by theories and thinkers from history of technology, social construction of technology (SCOT), higher education studies, and pedagogy. An inductive approach was utilized to understand and generate historical, social, and ideological context of the case study, FDI, and its technopedagogy.

Science and Technology Studies and Higher Education Studies. All contemporary issues in technoscience emerge from an historical trajectory and a variety of social, political, economic, and other environmental circumstances and ideological contexts. Hughes (2012) posits that large modern technological systems such as higher education are complex, multifaceted, highly adaptable, and involve a variety of human and artifactual components to solve problems and/or achieve goals. It is important for education and technology researchers to investigate the interplay of human and artifactual components in order to understand the formation and evolution of such "heterogeneous networks" (Akrich, 1992; Sørensen, 2009). Tracing the trajectory (i.e., formation, purpose, dissemination, evolution) of technopedagogy is critically important for understanding the establishment of dominant conceptualizations regarding digital technology and teaching in contemporary US higher education.

Technologists, pundits, administrators, and other stakeholders have long presented digital technologies as instructional tools to ensure teachers teach students the *right* way. Such perspectives are "rooted in underlying assumptions that reduce teaching to discrete sets of knowledge and tasks that can presumably be better delivered and assessed by technology" (Philip & Garcia, 2013, p. 301). How teachers and students

appropriate technology influences the formation, purpose, dissemination, and evolution of the technologies just as the technologies do the circumstances. In short, “It matters who built these instruments, and how, and for what purposes; it matters how these instruments are used, and by whom” (Ensmenger, 2012, p. 754). Moreover, person-to-person interaction and pedagogical implications “are rarely at the center of the most prevalent adoptions of educational technologies” (Philip & Garcia, 2013, p. 302). Thus, it is important to understand from where and how such assumptions developed.

Looking closely at the functions of digital technologies in education shows how the relationship is “reciprocal and many-sided” (Mumford, 2010, p. xv). It is not only about new technology or new curricula, but the need for a cultural shift with regard to how higher education actors view digital technology and education. Englebart’s 1962 report “Augmenting Human Intellect” was a watershed moment for digital technology. His vision to bolster “human intellectual effectiveness” via “an integrated domain” (Engelbart, 1962) aided in the development of many personal computing technologies and frameworks that students and teachers rely upon daily. Englebart dreamed “of making computer technology as powerful and as natural an extension of human capabilities as writing or talking” (Naugthon, 2000, p. 217).

Under the reign of an ideology “uniting eighteenth-century models of learning with nineteenth-century notions of organizational management,” (Privateer, 1999, p. 60) Papert experienced computers as educational tools to merely transfer knowledge. Since Papert’s (1993) self-described classical era of educational computing, education has moved from a predominately paper-based to a largely online digital culture. Although the

new culture of teaching and learning “embrace[s] what we don’t know, come up with better questions about it, and continue asking those questions in order to learn more and more,” (Thomas & Brown, 2011, p. 38) the effective use of computing technologies for teaching and learning requires a “change of mind...a reorientation of wishes, habits, ideas, goals” (Mumford, 2010, p. 3).

Close observation of higher education practices involving digital technologies identifies varying conceptions of intellectual augmentation. Recognizing the shaping power of sociocultural norms and institutional conventions places teacher and learner in scenarios where the purpose and utilization of digital technologies is negotiated within particular educational settings. More specifically, to examine the full breadth of the education-technology relationship is to understand: How digital technology is used in higher education is contingent upon the social construction of what such technology is expected to do. The kinds of assumptions teachers make about digital technologies and about learners drastically influence the educational environment.

Methods

To examine how FDI functioned as a site for the production and dissemination of technopedagogical ideologies at Virginia Tech, this research uses the methodological framework of discourse analysis developed within STS (Coeckelbergh, 2017). Information for discourse analysis was obtained via ethnographic interviews with key stakeholders (i.e. founders, directors, administrators, etc.) from Virginia Tech’s FDI and corroborated with archival data. The mixed methodology approach is supported by inductive methods, where findings are validated by triangulation and knowledge is co-

constructed between research and participant, enriching the density of a concept (Flick, 2007). This study was approved by Virginia Tech's Institutional Review Board and participants consented to an anonymous interview process. De-identification of interviews afforded participants freedom to report personal perspectives tied to their professional positions.

Archival Research. Archival research methodologies (Hill, 1993; Howell & Prevenier, 2001) were used to locate and organize documents that elicit a historical frame for FDI at Virginia Tech. Aligned with an inductive approach, the researcher finds, verifies, codes, compares, and analyzes source information to shape a historical perspective (Howell & Prevenier, 2001). Virginia Tech University Archives were searched for historical records that elicited specific information pertaining to technology and pedagogy situated within or tangential to FDI at Virginia Tech. Documents that did not focus on technological and pedagogical development or translation within FDI were excluded from final record analysis.

Ethnographic Interviews. Ethnographic interviews enabled the close examination of ideologies and tacit knowledge within the organization that were otherwise unexpressed in official publications and archival documents. As Seidman (2013) suggests, interviewing is a way to understand the lived experiences of others and how they make meaning of those experiences. A semi-structured interview protocol was developed by the researcher. The goal of the semi-structured interview protocol was to simultaneously engage with the ongoing scholarly conversation about technopedagogy

while also addressing the particular institutional context important to FDI's foundation and evolution.

Questions were developed from a review of literature about higher education and the development of technopedagogical ideologies and also incorporated the aforementioned archival research. The question set aimed to be comprehensive and open-ended, while remaining brief enough to maximize participant investment. The semi-structured interview encompassed the following topics: educational training and background; history of involvement at FDI; initial attraction to working with FDI; role changes of personnel over time; effectiveness and influence of FDI on pedagogy; views about the relationship between technology and pedagogy; necessity and adequacy of FDI at the time and over time; challenges and circumstances surrounding FDI's emergence; organizational location of FDI within Virginia Tech; models, theories, and policies guiding FDI; funding; accomplishment of mission and goals of FDI and the university; evolution of FDI over time.

Interview participants were selected based upon their role in either establishing or evolving FDI. Additional participants were contacted for an interview based upon recommendations from consenting interviewees. Participants were contacted for interviews via email and/or telephone. Interviews were conducted via video conferencing. As Murthy (2008) concludes, this medium allows the researcher an additional access point to the participant. The audio recording of data allowed for thorough interpretation of the discourse. Immediately following each interview, the researcher developed themes, categories, subcategories, exemplary quotes, and compiled notes following the constant

comparison method (Charmaz, 2006). Interview participants continued to be recruited until data saturation was achieved (Creswell, 2013). The ethnographic method was used to inform and validate archival research findings that describe the institutional production and transmission of technopedagogical ideologies within Virginia Tech's FDI.

Discourse Analysis. Thereafter, discourse analysis methodologies to systematically examine and interpret ethnographic interviews and archival documents (Coeckelbergh, 2017; Guest, MacQueen, & Namey, 2012). Discourse analysis of archival research provides the opportunity to produce a rich, historical description of how particular pedagogical culture and approach to digital technology developed at FDI. Document text was analyzed for emergent linguistic and symbolic themes relevant to digital technology and pedagogy at Virginia Tech. With specific attention to the historical development of FDI, themes were then placed into categories and subcategories and revised to produce an understanding of the written production and dissemination of technopedagogical ideologies at Virginia Tech.

Data Summary. Archival research yielded 81 total documents ranging from magazine publications to e-mails to newspaper articles. Document dates ranged from 1985 to 2016 and were prospective or reflective about the emergence, success, challenges, or changes within or surrounding FDI. Emerging themes and subthemes from discourse analysis of archival documents included: when, why and whom was involved in the foundation of FDI; expressed purpose and goals of FDI; why and how decisions were made; what and how information was translated; and the impact of FDI on

technopedagogical ideologies and practices at Virginia Tech; and how FDI as an organization changed over time.

The information gained from ethnographic interviews enriched and clarified archival data to provide a complete picture of the production and dissemination of technopedagogical ideologies at Virginia Tech. The five interviews conducted with FDI administration, FDI program coordinators, and university administration were an average of 68 minutes, ranging from 61 to 83 minutes.

Emerging from the ethnographic interviews, archival data, and discourse analysis were defined economic, social, and institutional structures that ultimately shaped the formation, purpose, dissemination, and evolution of a particular technopedagogical ideology within FDI.

Faculty Development in the United States

Analyzing the history of technopedagogy in faculty development is pivotal to understanding the establishment of dominant conceptualizations regarding digital technology and teaching in contemporary United States (US) higher education. Today, nearly all universities in the US feature a center, institute, office, or other organization dedicated to the professional enhancement of faculty who are operating in a technologically robust educational environment. However, such centers have only a brief history. In the US, faculty development is catchall term for nearly all piecemeal activities or systematic efforts to enhance effectiveness and/or expertise. Since the late 1960's, the various iterations of faculty development fall into three broad and overlapping areas: instructional improvement, organizational development, and personal development. In

the late 1980s new computing technologies promised to transform teaching and learning via automation, communication, and other forms of computer-aided instruction (Duderstadt, Atkins, & Houweling, 2002; Kidwell, Ackerberg-Hastings, & Roberts, 2008; Reiser, 2001). Such changes to the technological landscape simultaneously ushered in confusion and apprehension. In response, US colleges and universities began to integrate digital technology training into existing faculty development programming (Lewis, 1996; Millis, 1994). During the 1990s, institutions raced to establish offices to help faculty better operate within higher education's newly emerging technological age.

Given that Virginia Tech's FDI was founded to help "faculty acquire teaching strategies that leverage instructional technologies to improve student learning," and it served as "the cornerstone of a large-scale, continuing strategy to systematically promote innovative, informed uses of technology in daily practice for faculty," (A. H. Moore, Moore, & Fowler, 2005, p. 11.4) FDI is an ideal research site for understanding how faculty development shapes the practice of teaching with digital technology in contemporary US higher education. Understanding when, why, and by whom FDI was founded offers a platform upon which a rich case study can be built.

Acknowledging and unpacking the history of FDI allows us to understand how faculty development worked at a given time and how the establishment and evolution of FDI depended upon unique alignment of particular people and circumstances. Assumptions present when policies, practices, and programs are established have a tendency to become embedded in standard operating procedures and persist well after their origins are forgotten. As Nespor (2006) succinctly explains, "Decisions made in the

face of historically specific pressures and opportunities congeal into organizational and institutional forms that eventually make them look natural and inevitable" (2006, p. 6). At times systematic and at other times rather ad hoc, the formation and evolution of FDI as well as the dissemination and purpose of its particular technopedagogy had long-lasting influence on the theory and practice of teaching at Virginia Tech.

Faculty Development at Virginia Tech

Beginning with three pilot workshops during the summer of 1993, FDI sought to provide opportunities for all Virginia Tech faculty to rethink teaching methods and improve instruction through the use of digital technology. One of four functional areas that comprised Virginia Tech's Instructional Development Initiative (IDI), FDI was founded to help "faculty acquire teaching strategies that leverage instructional technologies to improve student learning," and served as "the cornerstone of a large-scale, continuing strategy to systematically promote innovative, informed uses of technology in daily practice for faculty" (A. H. Moore et al., 2005, p. 11.4).

Since its inception, Virginia Tech's FDI has maintained two major objectives:

1. "Provide the opportunity for all faculty…to participate…to motivate faculty to investigate, create, and use creative, innovative, productive instructional strategies that acknowledge…the enormous potential of the digital age."
2. "Provide participants who complete the program with access to state-of-the-art learning technologies, the knowledge and discernment to use them wisely…and [leverage] learning technologies in every part of their work as intellectuals."

These objectives are expressed within the organization's foundational documents as well as every version of its website.[14] Beginning with this very public pronouncement of intentions provides an entry point for examining less visible components of the organization. Ambitious and multifaceted, FDI's objectives are richly laden with historical and social context that gave rise to a particular pedagogical ideology.

However, this declaration and the two-pronged FDI mission statement become more informative when situated within the economic circumstances, sociopolitical criticism, and institutional decisions integral to FDI's foundation. Looking closely at the formation, purpose, dissemination, and evolution of FDI's technopedagogy illustrates how the interplay of economic circumstances and sociopolitical criticism led to institutional decisions that in turn cultivated a particular technopedagogical ideology. Returning to the 1990s enables an examination of these emergent and overlapping themes that gave rise to FDI at a particular time, in a specific shape, with expressed technological and pedagogical goals. Influencing and influenced by one another, these four interdependent themes tell the story of technology-focused faculty development at Virginia Tech.

FDI's Formation. In her forward-looking historical review of faculty development, Rosemary Park explains, there is "no dearth of forms of potential faculty development to meet the needs of society and of higher education" (1979, p. 31). Although delivered during a 1978 conference, Park's statement rings true of faculty development throughout

[14] Using the Internet Archive Wayback Machine, it was possible to review 170 archived dates of the FDI website from 2000.10.18 to 2015.10.28. The 170 archived dates available for FDI via Internet Archive Wayback Machine correspond to the number of times http://fdi.vt.edu was crawled by the Wayback Machine, not how many times the site was actually updated. Additional details and archived website information are available at http://web.archive.org/web/*/fdi.vt.edu.

its history. In the mid-1990s, faculty development could have taken any number of forms at Virginia Tech. A combination of economic conditions and sociopolitical criticism led institutional administrators to make particular decisions that gave rise to a technology-focused vision of faculty development.

Like much of the nation, economic conditions in Virginia during the early 1990s were far from robust. Indeed, when the US moved into a recession in 1989-90, tax revenues in Virginia dropped for the first time since the 1930s (Miller, 1994). In response to decreased revenue and in effort to delay tax increases, Virginia, as did other states, elected to reduce higher education funding to balance the budget (Benjamin, 1995). Further problematizing economic circumstances, the Commonwealth of Virginia was not only dealing with the consequences of a nationwide economic recession, but also reeling from vastly overestimated revenue projections. Faced with a rather substantial budget shortfall and a mandate to balance the budget, Governor L. Douglas Wilder ordered severe funding cuts to higher education ("Surviving Financial Austerity," n.d.).

For Virginia Tech specifically, the Wilder administration's funding cuts equaled a budget reduction of roughly $20,000,000 or about 5.5% per year ("Virginia Polytechnic Institute and State Faculty Senate," 1990a). From 1990-96, Virginia Tech suffered a total of $46.7 million in budget cuts. As a result, Virginia dropped to 43rd in the country with regard to state funding for higher education ("Surviving Financial Austerity," n.d.). James McComas, then President of Virginia Tech, publicly denounced Wilder's sweeping budget reductions as an assault on higher education. McComas's vocal criticism resulted in strained relations with Richmond.

Minutes from Faculty Senate meetings indicate the stark reality of dire economic conditions at Virginia Tech. Numerous faculty positions were held vacant, resulting in larger student to faculty ratios and reduced course offerings. In response to a question regarding the possibility of offsetting any loss of positions (caused by the base budget reduction) with additional positions likely to be granted by the General Assembly, Provost Fred Carlisle explained that this was unlikely. New positions were justified in the university's original budget request in order to strengthen undergraduate instruction. Alas, the number of previously authorized new positions would be insufficient to offset the impending loss of faculty positions due to budget cuts. When pressed by faculty senators, the Provost "guesstimated" that budget reductions might amount to the loss of as many as 50 positions (“Virginia Polytechnic Institute and State Faculty Senate,” 1990a). Indeed, the budget became so strained that there was administrative clarification that “the University will attempt to meet its contractual obligations to faculty” (“Virginia Polytechnic Institute and State Faculty Senate,” 1990b).

At the same time government funding continued to drop, student enrollment continued to rise (Nespor, 2006, pp. 34–35). While the university was able to offset $16 million during that same period by raising student tuition, the cuts caused serious personnel and infrastructural changes. Throughout Virginia Tech, there was a palpable fear about budget cuts and resulting lack of investment in people and tools necessary to fulfilling the university’s mission. Former president *pro tempore* of the Virginia Senate John Chichester (2002) poignantly captures the sentiment, “The commonwealth was asking much of its institutions of higher education, and yet, the fundamental question of

whether it was giving the tools needed to accomplish their tasks remained unanswered" (2002, p. 23). For example, "Budget cuts in the Computing Center mean prospects for a system upgrade are slim for three to four years. Demand for computer time already exceeds the supply, work is not getting done, and the problem can only get worse. Replacement of old, worn-out equipment will have to be postponed, resulting in more frequently [sic] failures" ("Virginia Polytechnic Institute and State Faculty Senate," 1990b).

In tandem with not-so-great economic circumstances, during the 1990s Virginia Tech was also dealing with vocal criticism from taxpayers and elected representatives. Faculty were criticized for spending too much time conducting research while dedicating too little attention to teaching undergraduates. In 1993, newspapers across Virginia simultaneously published a 5-day front page series titled, "A College Education: At What Cost?" Among its various criticisms was an attack on state-funded universities for allowing professors to spend time doing research while only teaching two or three courses a semester (Nespor, 2006, p. 46). An article from *The Roanoke Times* lamented, "Professors from at least four Virginia universities spend less time in the classroom every week than most people spend in their office every day" (Walzer, 1993).

Concerns that Virginia Tech was not fulfilling the tripartite land-grant mission to simultaneously teach, conduct research, and provide outreach abounded. Or as representative Rick Boucher (1993) chided, "Universities must define a new mission that maximizes their contributions to society. They must respond to the challenge to do more with less — to operate more efficiently during times of constrained budgets…Above all,

universities must reaffirm — by action, not by rhetoric — that education is their primary mission."

In the face of fiscal instability and diminishing budgets, Governor Wilder required state supported universities and colleges to rethink their organization and operation. In response to Governor Wilder's request to reorganize and to address public criticism regarding faculty instruction time, Virginia Tech's restructuring plan "recognized faculty as a core asset and cited investment in faculty development as a way to recover and regain momentum" (J. F. Moore & Head, 1999, p. 17). As an administrator explained, with a shrinking budget and growing public criticism, it would have been easy to not spend money. However, the people behind FDI were able to convince upper administration it was not the time to cut the budget for technology, but rather an opportunity to restructure via strategic investment in technology.

In the winter of 1993 a small group from Information Systems "was granted a one-hour pitch meeting" to convince President McComas, Provost Fred Carlisle, and Chief Business Officer (CBO) Minnis Ridenour of the utility, effectiveness, educational merit, and fiscal responsibility of a new technology-driven, pedagogy-focused program. During the ambitious pitch meeting, rather lofty promises were made to the CBO, Provost, and President. Individuals involved in planning FDI "guaranteed" that an institutional commitment to the FDI model for 4, 5, or 6 years would dramatically reduce the amount of money spent on computing technology. FDI's promise to leverage computing technology in order to create operational efficiencies, improve teaching, and enhance learning and to do so within a budget shortfall was understandably appealing to Ridenour,

Carlisle, and McComas. FDI's technological vision responded to Governor Wilder's request to reorganize and addressed public demand to focus on faculty instruction.

The rather stark economic conditions were front and center for those within Information Systems. It was in fact a lack of money that provided an opportunity to start this technology-focused faculty development program. As one interview participant emphasized, the budget crisis was actually quite helpful for convincing university administrators to back FDI both politically and financially. "It might have been harder to do if times were great and we weren't stressed about financial pressures." Ultimately, those behind FDI were able to convince Virginia Tech administrators of the "imminent sea change in the way we leverage technology in teaching and learning." Moving forward, Virginia Tech's goal was to simultaneously enhance student learning and improve instruction through technology-focused faculty development.

Clearly attentive to ongoing social criticism and economic constraints, McComas offered his administrative and financial support for this new initiative with one stipulation – that the technology-focused faculty development program provide direct benefits to Virginia Tech students. While McComas agreed with the notion that FDI presented unique opportunities to leverage computing technology to boost faculty capacity writ large, he stressed that such an initiative must benefit Virginia Tech students.

In the late 1980s and early 1990s, digital technologies of all sort were at the forefront of conversations about and within education. "To use new technologies well, teachers not only need access to them, but they also need opportunities to discover what the technologies can do, learn how to operate them, and experiment with ways to apply

them. For teachers to make informed choices and wise uses of technology, they must be literate and comfortable with a range of educational technologies" (U.S. Congress, Office of Technology Assessment, 1995, pp. 5–6). At the same time Virginia Tech's budget was shrinking, there existed a growing desire to modernize the university and incorporate the latest digital technologies. A faculty senate meeting during the period points to the breadth and urgency of such conversations at Virginia Tech. "Also discussed were faculty access to networks, in-service training for faculty and students on networks" ("Virginia Polytechnic Institute and State Faculty Senate," 1990a).

Fiscal reality, sociopolitical criticism, and technopedagogical objectives compelled Virginia Tech to develop strategic methods for doing more with less. In 1993, Virginia Tech implemented the university-wide Instructional Development Initiative (IDI) that aimed to make significant use of instructional technology (EDUCAUSE Learning Initiative, 2005). Years before IDI was officially underway, the University Task Force on the Impact of Digital Technology in the Classroom was convened to develop strategies for integrating digital technology into the teaching-learning processes. "The task force looked at the current educational model and the changes new technologies will impose on that model" (Virginia Polytechnic Institute and State University, 1989, p. 1). The Task Force report determined that using instructional technologies would require expanded support to train faculty (Virginia Polytechnic Institute and State University, 1989, p. 15) and ensure equal access to digital technology across campus units.

Designed to provide opportunities for all faculty to continuously participate in intensive workshops centered on the integration of instructional technology into the

curriculum, IDI began with three faculty development pilot workshops in summer 1993. Collaboratively funded and supported by Provost Carlisle and Vice President for Information Systems Erv Blythe, the pilot workshops marked the beginning of FDI. In the workshops, faculty were able to learn "to take advantage of the use of instructional technology in their teaching" (Virginia Polytechnic Institute and State University, 1995, p. 2).

An institution-wide faculty development program required strong support from all levels of administration. Among those making the pitch for FDI to Ridenour, Carlisle, and McComas were individuals from the Educational Technologies group. The subsequent relocation of Educational Technologies from Learning Resources (an academic entity) into the Information Systems (an administrative entity) hierarchy further reinforced the technology-focused foundation of FDI. A joint effort of the Office of the Provost and the Vice President for Information Systems, from its inception FDI straddled the academic and technological realms of Virginia Tech. The top down support certainly bolstered FDI's ability to successfully integrate into the technological and pedagogical framework of the university.

In order to fund a new systematic, technology-focused, university-wide faculty development Provost Carlisle "twisted deans' arms to give up a fraction of their equipment funds" in order to pool monies with promise of getting more in return. This service-oriented value-added argument was persuasive and resulted in FDI receiving the largest operating budget within the Educational Technologies division. In FDI's first three years, $10 million dollars was invested into technopedagogical advancements such as infrastructure,

workshops, and curriculum development (EDUCAUSE Learning Initiative, 2005). One-part pedagogy and one-part technology, from its onset, faculty development at Virginia Tech was defined by its technology-centric ideology.

FDI's Purpose. From its inception, FDI sought to provide all Virginia Tech faculty with the "knowledge and resources to use instructional technology to enhance the quality of their teaching and transform courses" (J. F. Moore & Head, 1999, p. 17). Embedded within the expressed two-pronged purpose (i.e., knowledge and resources) of FDI are latent objectives. Not directly expressed, but nonetheless significant to the initiative's operation, these latent objectives guided the practices, principles, and programming of FDI. When asked to explain the mission of FDI in their own words, key stakeholders emphasized two interdependent areas of operational importance. In order to accomplish expressed objectives of reducing costs of instruction, directly impacting students, while equipping faculty with digital technology resources and knowledge FDI set out to (1) construct a technological infrastructure and (2) build a conceptual infrastructure. FDI leadership posited that concurrent construction of technological and conceptual infrastructures would "create an environment where faculty basically had no excuses."

Initially focused on marrying technology and instruction, the mission of FDI would evolve over time to address much more than its initial technopedagogical scope. Undergirding its endeavors, FDI focused on implementing a systematic framework for the inclusion of digital technology into all aspects of higher education. To this end, FDI cultivated a pedagogical philosophy predicated on the necessity of technology.

Attentive to the interplay of technological tools and human behaviors within complex and multifaceted technological systems, FDI leaders emphasized the necessity to concurrently build technological and conceptual infrastructures. To realize integration of digital technology throughout the entire university, it was necessary for FDI to facilitate the development of technological infrastructure to make hardware, software, and support readily available. When FDI was establishing itself during the mid-1990s, computing hardware, software, and support was rather sparse at Virginia Tech. Existing computing activity operated on a mainframe model. Almost exclusively used for administrative purposes, computing technology was unfamiliar to most faculty and was rarely utilized within the classroom.

FDI envisioned technological infrastructure as a "technology envelope," surrounding each workshop participant. Providing workshop participants with computing hardware and software, network connectivity, and expertise was requisite to building skills and knowledge. So keen to envelope workshop participants, FDI installed an Ethernet connected desktop computer while faculty attended workshops. Upon returning to their offices, participants were conceptually enriched and technologically equipped to begin applying new computing skills and knowledge. The only thing FDI asked of faculty in return for the technology envelope was that they participate in workshops and act as evangelists across campus for FDI and its goals.

In addition to installing network-connected desktop computers in faculty offices, FDI also coordinated development of a campus-wide computing infrastructure. While faculty development was the focus, FDI understood that without an established computing

infrastructure, it would be difficult [if not impossible] to integrate computing technology into the instructional model. As an interview participant explained,

> We wanted to create the envelope that faculty and students would operate in and to put into practice what we were trying to teach in formal FDI workshops. If you couldn't go into a classroom and project something, then why the hell are we teaching them to do that!? And if we [VT] didn't have a place for students to work on a computer to an assignment, what was the point?

To build capacity and cultivate interest among Virginia Tech faculty, FDI initially focused on computing technology skills development. Eventually, FDI hoped to focus more on supporting pedagogical exploration via computing technology. Before diving deeply into technopedagogical inquiry, FDI deemed it necessary for faculty to become functionally competent with the breadth of available computing technologies. In short, faculty needed to become familiarized with computing technology before they could begin to think about its pedagogical potential. This knowledge and skills gap created individualistic involvement in FDI — to receive a monetary stipend, to acquire hardware and software, to address individual concerns and questions.

In addition to creating "commonalities that were centrally supported to help shape an environment not to constrain people, but free them from the barriers that were constantly interrupting and dissuading them from using technology," FDI proactively sought to foster a conceptual infrastructure to affect a paradigm change. In order to "foster the adoption of technology within breadth of teaching practice at VT," FDI needed to facilitate a cultural shift with regard to digital technology and teaching. All interview

participants described the infusion of technological skills and practices necessary to "systematically take people from one place to another using the best instructional design models had at the time." Since "most faculty have never been taught how to teach, FDI was designed to present information about technology in a way that provided models for faculty to use tech, but also understand theory behind good teaching practices and model the good practices."

Among its expressed objectives, FDI set out to encourage faculty to use computing technology for instructional purposes. That said, interviewees made it clear that FDI participants wanted to engage with the technology, but did not want to be told how to teach. Overall, "faculty at large thought teaching was something they decided for themselves and what they did, they decided themselves." In the early years, it was "difficult to have conversation about different types of [technology and pedagogy] tools to improve teaching." Technology was viewed by FDI and Virginia Tech administration as the tool to improve pedagogy, but without explicit focus on instructional design. FDI "could not use the 'P word' – pedagogy was never really discussed per say, but always an underlying thing." It became apparent via feedback from FDI participants that many faculty thought pedagogy simply should not come from FDI. How then, was FDI able to cultivate a technopedagogical culture at Virginia Tech?

Disseminating a Technocentric Pedagogy. By the time the Digital Technology Task Force (DTTF) released its 1989 report, some sections of the university had already begun to integrate digital and computing technologies for research, teaching, and administration. Prior to the establishment of FDI in 1993, Virginia Tech offered some

"short courses" on software, hardware, word processing, and other "very skills based topics," but the courses were not offered systematically. While digital and computing technologies were in use at Virginia Tech during the mid 1990s, there was widespread concern about "demarcation along the lines of haves and have nots" (Virginia Polytechnic Institute and State University, 1989, p. 2).

The DTTF report provided a blueprint for the foundation upon which FDI was built within four years. At the time of its conception, FDI was not only attentive to unequal access to new digital technology, but proactively sought to create parity among departments. Among the benefits associated with FDI's location, structure, and funding model was its ability to reach across the university and systematically offer programming to faculty from all disciplines.

Decreasing disparities in computing technology meant constructing an FDI that disseminated relevant skills, tools, and knowledge to address the wide-ranging technopedagogical needs of faculty. As one interviewee explained, "faculty have such diverse sets of needs. FDI tried to help with anything that joins with technology." FDI programming was designed to be diverse enough to remain relevant in a shifting technological landscape with specific disciplinary interests, but the overarching goal was always to "use technology in the best ways possible." Programming was designed to make digital technology familiar to faculty and thereby encourage frequent and widespread use. Through technology familiarization and skills development, FDI created a pedagogical environment built upon a culture of faculty development that operated from

the assumption and disseminated the ideology that good teaching required digital technology.

Praxis-oriented in its programming, FDI workshops were designed to increase participant knowledge and skills with the intention that participants could begin application immediately. Early workshops introduced e-mail, multimedia, developing classroom presentations, principles of computer-based instruction, discipline specific software, among other "core skills." While the initial four-year cycle focused on involving "have not" departments and cultivating basic computer literacy skills, FDI would rise to meet the changing demands resulting from rapid technological change during its lifespan (1993—2014). Although the first few cohorts deliberately focused on building capacity among arts, humanities, and social sciences faculty, by the end of FDI's first four-year cycle (1997-98), more than 90% of all full-time faculty at Virginia Tech had participated in FDI programming ("FDI Participation 93-97," 1997). FDI would continue to achieve near total participation throughout its operational history.

Throughout its history, FDI offered workshops on a range of topics that targeted development of diverse skillsets. Many workshops were created to address needs expressed by FDI participants. Feedback received during workshop sessions in previous years helped shape programming. Faculty were not shy about offering feedback for improvement during formal post-session feedback (first on paper, later online) and through informal anecdotal feedback. Indeed, FDI made a conscious effort to provide programming that "reflect[ed] the stated needs, interests and instructional objectives of the participating faculty" ("Instructional Development Initiative," 2002, p. 16).

Familiar with the changing landscape of digital technology in higher education and attentive to wants and needs of Virginia Tech faculty, high rates of participation and satisfaction were expected by FDI leadership. With programming designed to increase knowledge and develop skills, FDI aimed to decrease any "apprehension or fear factor" associated with technology-focused teaching. FDI leadership intended to build knowledge and develop skills in order to eliminate barriers and remove excuses inhibiting faculty from using new digital technology in their instruction. Unable to utter what one interviewee referred to as "the P word," FDI was hindered in its capacity to engage in direct conversations about pedagogy. Instead, FDI's approach to cultivating technopedagogy relied upon building technological infrastructure throughout the university and developing knowledge and skills among those responsible for teaching at Virginia Tech. FDI workshops focused on digital technology, yet this was not Educational Technologies first foray into skills development programming. As one interviewee commented, "when FDI began, it wasn't the start of our experience doing workshops." Leadership of FDI was "well versed in adult learning and teaching adults" and had "some understanding of how not to waste people's time."

After establishing widespread computing technology literacy, FDI planned to dive deeper into elements of teaching and learning during second and subsequent cycles. After about two years of FDI, computer literacy began to mushroom and workshop tracks were built to address the divergent needs of various user groups. Over time, FDI would grow to include more than 20 tracks ranging from introductory computer skills training to multimedia content creation. From 1993 to 2002, FDI conducted 205 customized

workshops involving 3500+ participants, with faculty participation increasing over time ("Instructional Development Initiative," 2002, p. 4). Although initially focused on the merger of computing technology and instruction, FDI would evolve to encompass a larger conception faculty development – of which technopedagogy was one component.

Perhaps more important was the role FDI played in the reallocation of equipment funding. FDI programming was significant, but giving "have not" departments, which "were not entirely computer savvy at that time and not flush with technology funding" access to hardware, software, and support was critically important. Whereas departmental equipment funds were previously allocated based on research activity, FDI's position within the Information Technology administrative hierarchy enabled more equitable distribution of funds for digital and computing technology. Prior to FDI, the "Music Department couldn't get a nickel of funding for equipment." FDI's ability to pool departmental equipment funds and offer a value-added service provided computing technology to Music and other historically under-funded and sparsely equipped departments with the hardware, software, support, and skills to not only change the way they conducted research, but also influence the ways in which they are able to engage with students and other issues of instruction.

To attract faculty participants, FDI utilized a robust and recurring incentive program. "As a result of attending the workshops, faculty participants receive a state-of-the-art computer with a network connection and a suite of appropriate software applications" ("Instructional Development Initiative," 2002, p. 6). Based upon financial calculations and enrollment projections intended to reach the majority Virginia Tech

faculty, the four-year cycle for computer refreshment allowed FDI to provide all workshop participants with hardware, software, networking, and support.

While there were some individuals within Virginia Tech (i.e., those who previously received large portions of the institution's equipment fund due to the nature of their research activity) who were displeased with reallocation of Virginia Tech's equipment fund for FDI activities, the widespread support for FDI was clear. As one interviewee emphasized, even after just a few years, with faculty advocates across the university and with political and financial support from upper administration, FDI became essentially untouchable. Nearly every single faculty member received some benefit from the program.

Providing hardware, software, networking, and support operated as a recruitment tool and effectively constructed an educational environment where teaching with digital technology was normative. After participating in FDI programming, faculty were equipped with the latest digital technology as well as newfound knowledge and skills. Moreover, faculty were expected to use this technology and knowledge.

With a robust and growing technological infrastructure, FDI incentivized participation in various technology-oriented workshops. High rates of participation across disciplines helped FDI to cultivate a conceptual infrastructure predicated upon the notion that digital technology is good and we need more of it, everywhere. All parts of FDI leadership maintained a focus on developing and disseminating a particular pedagogical philosophy and therefore cultivating a specific culture of higher education. This philosophy was not about pedagogy itself, but a pedagogy predicated on the availability and utility of

digital technology. This technology-focused pedagogy, or technopedagogy, intimately tied FDI programming to the institutional aims of establishing a modern, accessible, and supported digital technology infrastructure. In constructing a campus-wide technological infrastructure, conducting knowledge and skill building workshops, and providing faculty with computing hardware/software incentives, FDI made digital technology widely accessible, well supported, and highly encouraged. From its onset, FDI consciously sought to change pedagogies throughout Virginia Tech faculty by constructing a campus-wide digital technology infrastructure, cultivating computing knowledge and skills across disciplines, and equipping nearly every faculty member with up-to-date hardware and software. As one interview participant explained, FDI shifted pedagogical practices at Virginia Tech "by providing technology to faculty in a systematic way." FDI promoted a particular technopedagogy by creating an educational environment where digital technology was readily accessible and application of digital technology for instruction was not only normative, but expected.

Since the earliest days of FDI, Virginia Tech has extolled the organization's primacy and significance with regard to large-scale faculty development programs attentive to teaching and technology. In 1994, "Virginia Tech became one of the first universities to systematically train all faculty members in the use of instructional technology. The Faculty Development Institute later won an award from the Carnegie Foundation, the 1997 Theodore M. Hesburgh Award, and is now used as a model for many levels of teacher training" ("Recent Technological Firsts by Virginia Tech," 1999). As highlighted in the 1997-1998 President's Report, this was tremendous coup for Virginia

Tech and helped position the institution "…as a world-class leader in computing, information, instructional, and communications technology" ("A world-class leader in technology," 1999). Where technology permeates "just about every aspect of the university, including its instruction, research, and outreach activities…dramatically changing how the university operates, how it teaches, how the students learn…" (Torgersen, 1999). FDI's role was ensuring faculty had computing technology and skills necessary to use the technology effectively to engage students in learning. "As a nationally recognized program, FDI had a transformative impact on the university's instructional program by ensuring that faculty and students have the most efficient and effective learning environments and instructional technologies" ("About Us," 2016).

FDI's Evolution. FDI intended for its first four-year cycle (1993-1997) to focus on computing technology skills development and the second four-year (1997-2001) cycle to dive deeper into pedagogical aspects of technology-focused education. Archival resources, documentary evidence, and interviews indicate that the evolution of FDI programming was more complex. FDI secondarily responded to the ebb and flow of the university's changing teaching and research strategy and faculty needs. Sometimes the result of changing participant wants and needs. Sometimes the result of a changing technological landscape. Sometimes the result of a changing institutional profile. Attentive to the pulse of the university and aware that "faculty don't just wear one hat," FDI transformed over time in order "to be useful to faculty, whatever hat they're wearing at the moment."

After FDI's first few years of operation, it was "a given that everyone knew how to use email." As faculty computing knowledge and skills developed (as a benefit of FDI programming), portions of FDI's initial "core skills" programming became obsolete. Successful construction of interconnected technological and conceptual infrastructures made digital technology widely accessible, well supported, and highly encouraged, thereby requiring an evolution of FDI programming. Aware of the consequences of its infrastructural and programmatic successes, FDI constantly evolved to address the needs and wants of faculty participants.

As faculty became more familiar and proficient with digital technology, FDI programming moved from basics (e.g., email, listservs, basic computing skills, software tutorials, etc.) to higher octane topics (e.g., learning management systems, developing and delivering distance learning, multimedia content creation, learner-centered instruction, etc.). This is not to suggest that FDI eliminated "core skills" programming, but instead to illustrate that by developing infrastructure and systematically offering skills-based programming, over time FDI effectively boosted faculty capacity and shifted "core skills."

During its 20+ year history, FDI was involved in various endeavors tangential to teaching, but teaching was not always at the core of what was happening. FDI successfully spanned three university presidents, James McComas (1988-1994), Paul Torgersen (1993-2000), and Charles Steger (2000-2014). While each administration leveraged FDI's infrastructure to enhance faculty capacity, varying presidential priorities shaped the scope of FDI programming. In short, the McComas administration was more

attentive to fulfilling Virginia Tech's undergraduate education mission, the Torgersen administration focused on further modernizing the university's technological infrastructure, and the Steger administration placed greater emphasis on enhancing the university's research enterprise.

In the face of diminishing funding, vocal critique across the Commonwealth, and growing political oversight, Virginia Tech's 13th president, McComas placed major emphasis on undergraduate education from the beginning of his administration ("Surviving Financial Austerity," n.d.). The McComas leadership was significant for setting institutional priorities and creating an environment conducive to a broad reaching technopedagogical initiative such as FDI. Known as "The man hired to guide Virginia Tech back into smooth waters" ("Surviving Financial Austerity," n.d.), McComas's administrative priorities are a crystal clear reflection of then contemporary social concerns, political climate, and economic realities.

With the change of leadership, the university's focus shifted to research, FDI immediately started more programming about research. The transition to the Steger administration also signaled a significant transition in FDI's programmatic focus. Although it began "as a teaching/learning enhancement program," shifting institutional priorities made it clear that FDI "should enlarge its scope to directly address how information technologies can be useful in all aspects of faculty life" (A. H. Moore et al., 2005, p. 11.7). While still engaged in increasing faculty computing skills, FDI "immediately started offering more programming about research." So much in fact that in 2002, FDI began offering a programming track entirely devoted to "Research Presentation Tools" as well

as courses addressing the research applications of various hardware and software ("Instructional Development Initiative," 2002, p. 6). Under the Steger administration, FDI became an "engine to disseminate the research mission" and "help faculty get back in the research game."

Many within FDI were skeptical of the new research-focused programming and at times vocal in their objections that such a focus was "off-mission." Cognizant of diverse needs of faculty, FDI leadership emphasized the importance of programmatic flexibility in order to remain responsive to and relevant in a changing university context. As one interviewee explained, "It was a matter of needing to stay relevant, needing to be aware of environment, we could not be stuck in past." As participants, digital technology, and the institution continued to change, maintaining relevance became a guiding principle. "FDI became dropping place for all sorts of professional development." In short, FDI provided Virginia Tech faculty a centralized location for a broad swath of professional development programming. "While we can say it [FDI] was all about teaching, but no it wasn't" because it had to evolve in response to growing faculty needs, shifting technological landscape, and changing institutional context. FDI was attentive to all faculty development needs. Teaching was a component. Research was a component. Ever an undertone of maintaining relevance in order to stay in business, "be useful and relevant" became FDI's de facto mantra.

Highly regarded within and beyond Virginia Tech, FDI undoubtedly produced meaningful change in both the perception of digital technology and practice of pedagogy in higher education. Indeed, as an interviewee emphasized, FDI was responsible for

fostering an institutional culture where, “technology was not only accessible, but supported and encouraged.” FDI set out to systematically integrate computing technology into all aspects of faculty life at Virginia Tech. Quickly realizing that it was not possible to engage in conversations about teaching with digital technology without first developing technological skills competence, FDI worked diligently to develop technological skills among faculty. Familiar with the digital technology, faculty could thereafter begin to ponder pedagogical topics. As the technopedagogy focus evolved, circumstances required FDI to pivot and include programming to boost research capacity among faculty. After 20+ years, a very diversified and markedly different from the 1993 FDI morphed into Networked Learning Initiatives (NLI) “with a renewed focus of enhancing digital fluency for faculty, staff, and students” (“About Us,” 2016). Returning to skills-based programming, the FDI of the future resembles the FDI of old.

Success and Lasting Influence

Still though, what does this close analysis of FDI offer to those concerned about the future of higher education? Despite widespread prevalence and popularity of digital technologies in higher education, too little attention is given to matters of purpose and pedagogy. Undoubtedly, digital technology influences how learners learn (Wesch, 2013). Yet, it is equally important to consider how digital technologies reorient the practice of teaching. Results from this research about Virginia Tech’s FDI should nudge centers with similar aims as well as other higher education stakeholders to utilize a contemplative approach to technopedagogical matters amidst contextual pressures, including economic circumstances, sociopolitical criticism, and institutional decisions.

In speaking with key stakeholders, it became clear that no one within FDI set out with a particular pedagogical framework in mind. In other words, the university-wide project dedicated to pedagogical enrichment was absent a guiding pedagogical framework throughout its history. Research findings indicate the various ways in which FDI fostered and perpetuated a technocentric pedagogical culture of Virginia Tech for 20+ years. Although it recently morphed into a new organizational structure with a different acronym, FDI's influence remains. As one participant expressed, "by providing technology to faculty in a systematic way and providing faculty with the latest methods of teaching…[FDI] engrained technology into the university culture."

Of course, FDI founders had no way of knowing their organization would have such lasting and pervasive influence. Nevertheless, from the outset of such endeavors it is important to acknowledge how decisions about digital technology and infrastructure have serious and long-lasting implications for teaching and learning. An understanding of the power of faculty development programs to shape conceptions of digital technology and practices of pedagogy, should necessitate a contemplative approach to faculty development. As demonstrated by this analysis of FDI, a non-contemplative approach to faculty development can easily become swept along my contextual dynamics.

FDI has a complex history and mixed record. On the one hand, FDI and its technocentric programming was widely popular and provided opportunities for faculty across campus to rethink pedagogy and digital technology. On the other hand, FDI's popularity and technocentric faculty development did not necessarily enhance student learning or improve instruction. At its core, FDI held ambitious pedagogical goals.

However, FDI operated within a larger ecosystem that therefore required attention to non-pedagogical endeavors. In this way FDI was not unique, attempts to integrate digital technology into instruction with university ecosystems across the country have trod a similar path. Using contemplative practices as a framework to approach technopedagogy provides methods for stakeholders across all scales of US higher education to take a thoughtful pause and consider why, how, and to what ends digital technology is integrated with pedagogy amidst diverse contextual pressures (Buchmann, 1989).

Archival resources, documentary evidence, and interviews suggest that Virginia Tech faculty members were and remain committed to learning how to use digital technology effectively to improve their teaching and enhance student learning. In other words, FDI helped develop an institutional culture in which faculty development and technology-focused instruction became normative practices. Moreover, FDI's particular model of faculty development assumed and emphasized the necessity of digital technology in higher education. Simultaneous and ongoing construction of technological and conceptual infrastructures made this model appear natural and inevitable. Internalizing digital technology as an expected part of educational life, FDI helped to cultivate a pedagogical philosophy that was steeped in the necessity of digital technology in the higher education environment. An unintended consequence of this perceived naturalness and inevitability, led to the adoption of digital technology for teaching without contemplation. The mere availability of digital technology therefore required the integration of (available) digital technology into the pedagogical model.

What is less clear is the degree to which FDI programming improved instruction, transformed courses, or created effective pedagogy. Additionally, it remains unclear how FDI and Virginia Tech defined terminology (e.g., improved, enhanced, effective, etc.) or measured the reach and efficacy of FDI programming. While there is scant quantifiable in-depth analysis to specifically measure the success of FDI programming, anecdotal evidence, and proxy measures function as markers of success. Participation rates and informal anecdotal feedback point to FDI's accomplishments. Likewise, more tangible measures such as increased technological literacy and lasting technological infrastructure are also indicative of FDI's technopedagogical influence throughout Virginia Tech.

FDI was both early and prominent with regard to technology-focused faculty development. Among the aspects that set FDI apart, its large-scale and systematic approach to constructing technological and conceptual infrastructures available to all faculty cannot be overemphasized. Nevertheless, it is important to recognize that FDI is also a manifestation of institutional decisions to seek a technological fix for an economic and sociopolitical phenomenon. Operating with university support and a programming philosophy predicated on the assumption that digital technology would solve economic and efficiency problems while simultaneously enhancing teaching and learning, FDI was well positioned for success. When considering the historical significance and lasting influence of FDI, one must acknowledge that FDI operated with a *Field of Dreams* mentality. Ambitious, forward-looking, and with the best of intentions, FDI built a robust technological infrastructure with the expectation that faculty would come. As history

shows, expectations for faculty participation were exceeded. This is not intended to be overtly critical of FDI, but rather to draw lessons from the successes and challenges faced throughout 21 years of inclusive, far-reaching, and technology-focused faculty development. Indeed, from an institutional perspective, FDI was tremendously successful in creating an environment where computing technology widely available, well understood, and near universally utilized. Or perhaps best explained by one interview participant who provides an all-too-true analogy that puts FDI and its accomplishments into perspective, "Frankly, I think it [FDI] is more important than what we've done with football over the last 30 years. What higher praise is there at Virginia Tech?!"

From its inception, contextual factors set FDI on a path with a pre-determined destination (i.e., technocentric pedagogy). Economic circumstances, sociopolitical criticism, and institutional decisions continued to shape the evolution of FDI into an increasingly technology-focused institute with simultaneously decreasing attention to pedagogy. Analyzing the growth of a technocentric pedagogical ideology within FDI indicates that faculty development programs should emphasize contemplation and integrate pedagogy into all technological endeavors, while simultaneously considering how decisions impact entire educational cultures. Results from this inquiry lead to the realization that "the development of educational computing is not about one damn product after another...Its essence is the growth of a culture, and it can be influenced constructively only through understanding and fostering trends in the culture" (Papert, 1993, p. 161).

An instructive take-away from this historical analysis is that good teaching can certainly involve digital technology, but digital technology alone does not make great teaching. Faculty development centers present opportunities to cultivate self-aware and contemplative approaches to teaching with digital technology. However, to realize this capacity, such initiatives must emphasize critical engagement not only with technologies, but also with pedagogies. Leveraging expertise (both technical and pedagogical), adhering to core principles, and including pedagogies grounded in purposeful engagement are important components of a framework for large-scale systematic faculty development. Technology use must be informed by pedagogy. It is neither desirable nor effective for digital technology to drive pedagogy nor vice versa. Rather pedagogy and digital technology must evolve concurrently to develop collaborative communities of learning that are flexible, adaptable, responsive, but not reactionary. Neither immediately dismissive nor automatically embracing, faculty development centers must critically engage with emerging digital technology.

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Manuscript 3

Applying Attributes of Contemplative Technopedagogy to a Social Media Assignment

Abstract

With widespread prevalence of digital technology in contemporary higher education, researchers have been keen to identify best practices and understand impacts. Social media present opportunities to cultivate interactive, creative teaching-learning communities. However, inclusion of social media in a course does not necessarily equal deep or creative student engagement. Faculty play an important role in helping students critically and creatively engage with content, colleagues, and context. Utilizing a mixed-methods case study approach, this research explores how contemplative technopedagogy can aid in the development of social media assignments and positively influence student learning. While blogging has been studied as a pedagogical tool, Tumblr has not yet been studied as an educational technology. This research demonstrates how the integration of contemplative technopedagogical attributes can aid faculty in developing social media assignments with contextual awareness that enhance teaching and learning in contemporary higher education.

Keywords

Social Media, Pedagogy, Contemplation, Tumblr, Higher Education

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Introduction

In the early 20th century, Marshall McLuhan (1960) noticed a gap inhibiting him from fully connecting with his students—neither generational nor intellectual, but the consequence of different modes of learning. Nearly 75 years later, cultural anthropologist Michael Wesch (2013) identified a new kind of gap, writing that "most university classrooms have gone through a massive transformation in the past ten years...As we increasingly move toward an environment of instant and infinite information, it becomes less important for students to know, memorize, or recall information, and more important for them to be able to find, sort, analyze, share, discuss, critique, and create information" (p. 69).

The common thread running from McLuhan to Wesch is an emphasis on understanding learners and contemplating technology in context. Despite this shared focus, emerging technologies and modes of learning are not always evaluated critically. Investigating the relationship between learners and technologies enables the development of a teaching-learning environment that encourages deeper engagement with content, colleagues, and context. This critical approach is especially important in contemporary higher education environments, as "teaching today…is ubiquitously tied to digital technology, and the call to make it more so grows" (Drabinski, Clark, & Roberts, 2011, p. 3). With widespread prevalence and popularity of digital technology use in contemporary higher education, researchers have been keen to identify best practices and understand impacts of such decisions. This article demonstrates how attributes of Contemplative Technopedagogy Framework (Shanks, Forthcoming) can aid educators in

making purposeful and engaged pedagogical decisions involving digital technology. The utility of this approach is proven via two case studies that explore developing, testing, and revising assignments involving social media as a digital technology in higher education settings.

Digital Technology and Social Media Use in Higher Education

A growing cohort of Science and Technology Studies (STS) scholars have been keen to understand how theoretical inquiry both shapes and is shaped by the intervention of ethnographic social research (Downey & Dumit, 1997; Downey & Zuiderent-Jerak, 2016; Jensen, 2007; Zuiderent-Jerak & Jensen, 2007). Participatory and reflexive, such an approach combines action-oriented and descriptive modes of ethnographic social research. The aim then is to not only change practice, but to also produce new sociological knowledge (Zuiderent-Jerak, 2015). Engaged, action-oriented, and reflexive ethnographic social research has much to offer to the practices it studies, but also has much to learn from those same practices (Zuiderent-Jerak, 2015). From this perspective, the current study seeks to not only understand the practices of digital technology and social media in higher education, but to also shape those practices.

Recent studies point to a variety of positive outcomes associated with incorporation of social media platforms as digital technologies into the teaching-learning environment. Rinaldo, Tapp, and Laverie's (2011, p. 193) investigation of Twitter's pedagogical possibilities suggests that this social media platform leads to "higher involvement with the course material, greater involvement with the professor, and better organization of the course structure." The semester-long experimental study from Junco,

Heibergert, and Loken (2011, p. 128) describes how the integration of microblogging (i.e., Twitter) “can be used to engage students in ways that are important for their academic and psychological development.” Research from Ventura and Quero (2013) addresses how Facebook facilitates the use of new teaching resources, extends the classroom, fosters a less hierarchical teacher-student relationship, and increases the collaborativeness and flexibility of the teaching-learning process. These and other studies emphasize the growing use and increasing significance of social media as a digital technology within contemporary higher education.

Student engagement in university life can be mediated through social media, which can lead to greater student success (Brown & Burdsal, 2012; Gray, Vitak, Easton, & Ellison, 2013). Findings from Gray et al.’s (2013) study of social adjustment among college students indicate that social media platforms have the potential to serve as a medium for meaningful support by providing conduits to academic services and peer networks. Furthermore, Hung and Yuen (2010) demonstrate that students’ positive learning experiences with the use of social networks were highly related to information sharing and interactivity. These studies indicate that social media usage can serve to enhance and enrich the student experience. Access to and familiarity with information technologies, however, vary widely among students across demographic categories (Hargittai, 2010). Indeed, the application of social media holds promise for student success, but not every student or educator knows how to use social media for pedagogical purposes (Robinson et al., 2015).

Contemporary university students are often hastily lumped together into the catchall category as 'digital natives.' Conversely, instructors are routinely depicted as 'digital immigrants' (Fisk, 2015; Jones & Shao, 2011; Prensky, 2001). However, more nuance is required for a comprehensive understanding of the teaching-learning environment and its participants. While students regularly utilize digital technologies (e.g., computers, mobile phones, tablets, gaming consoles, social media) for various aspects of their personal lives, this does not necessarily nor effectively translate to creative and critical technological engagement in students' academic lives.

Educational technology research shows the changing nature of students' access to information and engagement in deep learning. For example, students utilize social media to research information that they already perceive as credible (Creighton, Foster, Klingsmith, & Withey, 2013) and successfully learn course content through social media platforms that extend the classroom (Northey, Bucic, Chylinski, & Govind, 2015). To engage with a new type of learner "…faculty must find ways that student technology skills can synergistically interact with disciplinary domain knowledge…Faculty will need to provide crucial supporting roles by helping students critically evaluate their effective and appropriate use of technologies" (Moore, Fowler, Jesiek, Moore, & Watson, 2008, pp. 6–7). From within the broader context of educational technologies and innovative pedagogies, the present study evaluates the pedagogical utility of Tumblr, a blogging platform.

Applying Contemplative Technopedagogy Attributes to Social Media

Social media have experienced substantial growth during the previous decade—in the amount of services, number of users, and variety of uses (boyd & Ellison, 2007). From a pedagogical perspective, social media provide opportunities for students to critically and creatively explore course themes. Additionally, students are provided opportunities to engage with course themes outside of the classroom in local, national, and global contexts via social media. Cooke (2015) found the use of social media as an educational technology can impact student motivation and goal orientation by providing better access to information. This paper proposes the integration of contemplative technopedogagy attributes into a social media assignment in order to bolster students' academic and professional careers by introducing them to larger global issues and facilitating interaction with others in their field.

Using social media, students can create a personalized arena for thoughtful, engaging intellectual exploration centered around the themes and concepts of the course. In describing what he calls "personal cyberinfrastructure," Campbell (2009, p. 58) stresses the importance of shaping "curricula to support and inspire the imaginations that students need…for creative citizenship in this new medium." To answer Campbell's aspirational call, educators can utilize attributes of contemplative technopedagogy when integrating social media into higher education teaching-learning environments. The present study builds upon Campbell's work by exploring how contemplative technopedagogy can aid in the development of social media assignments and positively influence student learning.

In succinct terms, pedagogy is the theory of education and practice of teaching (Lusted, 1986). Creating assignments, conducting courses, assessing student learning, among other actions of educators are informed by pedagogical theories and strategies. This manuscript is specifically interested in technopedagogy, which is uniquely associated with the integration of digital technology into teaching-learning environments. When considering digital technology, educators should take a thoughtful pause to contemplate *when*, *which*, *to what extent*, *how*, *with* whom, and *for what purpose* to integrate digital technology into the teaching-learning environment (Boisselle, Fliss, Mestre, & Zinn, 2004; Cook-Sather, 2001; Newson, 1999).

Contemplation involves thinking carefully, deeply, and attentively about a topic. Integrating contemplation into pedagogy takes many forms and has diverse meanings (Buchmann, 1989). Contemplative pedagogy emphasizes the value of incorporating mediation and other mindfulness exercises in coursework to enhance student attention and learning (Shapiro, Brown, & Astin, 2008; Zajonc, 2013). Educators can also integrate contemplation into curriculum through activities that provoke reflection, compassion, commitment, non-judgement, and creativity among students (Burggraf & Grossenbacher, 2007; Zajonc, 2006).

Higher education must also concern itself with the ways in which contemplation can inform technopedagogy. In this manuscript, contemplation refers to practices of purposeful and engaged thought. Following suit, contemplative technopedagogy refers to purposeful and engaged approaches to pedagogical practices involving digital technology. Non-contemplative technopedagogy leads to uncritical adoption or knee-jerk

dismissal of digital technology. Whether adoptive or dismissive, non-contemplative pedagogical decisions have substantial consequences for both educators and learners. While it is important for contemporary educators to pay close attention to digital technologies, they must incorporate attributes of contemplation into pedagogical decision-making. Contemplative technopedagogy is applicable in diverse scenarios. Contemplative technopedagogy is iterative and ongoing. Contemplative technopedagogy does not supplant, but rather supplements an educator's pedagogy. Contemplative technopedagogy provides a framework for making purposeful decisions about *when*, *which*, *to what extent*, *how*, *with* whom, and *for what purpose* to use digital technology in higher education teaching-learning environments.

The Contemplative Technopedagogy Framework (Shanks, Forthcoming) requires an educator to simultaneously consider both the positive and negative aspects of a digital technology. This mindset is foundational for engaging in contemplative technopedagogy. Attributes of contemplative technopedagogy are grouped into five areas of focus:

1. *Pedagogy Focused* – pedagogy should guide digital technology decisions, not vice versa.
2. *Learner Focused* – digital technology should foster connections and not create distractions within the teaching-learning environment.
3. *Technology Focused* – commitment from the educator to be both learner and teacher; evolving knowledge about a digital technology and ways it might or might not be applied to the teaching-learning environment.

4. *Attention Focused* – focus less on the polemic rhetorics of disruption and revolution and turn attention to matters of intentionality; think and act intentionally with regard to digital technology and pedagogy.
5. *Context Focused* – probe assumptions and understand preconceived notions about human and technological actors; examine the whys, hows, and consequences of technopedagogical decisions within the larger sociocultural context.

Why Tumblr?

Tumblr is a blogging platform where students can explore course themes, thoughtfully interact with colleagues' ideas, and connect with the verdant information landscape of the worldwide web. A large body of research exists that demonstrates the positive learning outcomes associated with reflective writing of this nature via traditional and social mediums (Ryan, 2013; Seale & Cann, 2000). Among several other blogging platforms, Tumblr was selected for this project due to ease of use, functionality, community-building aspects, freeform writing, multimedia integration, and content management system (CMS) supplements. With more than 374 million blogs and over 154 billion posts, Tumblr is a robust blogging platform ("About," 2017). While blogging has been previously studied as a pedagogical tool for higher education (Foster, 2015; Guerin, Carter, & Aitchison, 2015; Saeed, Yang, & Sinnappan, 2009), Tumblr itself remains unexplored. An extensive search of the open web, peer-reviewed publications, and grey literature yielded no results of Tumblr assignments in higher education courses, research about Tumblr usability in higher education courses, or instances of Tumblr used as a portion of an assignment in higher education courses. As such, this study developed a

Tumblr assignment utilizing attributes of contemplative technopedagogy. Researchers then examined the pedagogical utility of Tumblr by testing the students' ability to (1) utilize Tumblr to learn about course topics, (2) engage with colleagues in the extended online classroom, and (3) apply course materials to larger world issues.

Purpose of Research

This research seeks to demonstrate the utility of contemplative technopedagogy, evaluate the effectiveness of the Tumblr assignment, and develop pedagogical guidelines for using Tumblr as a blogging technology in higher education teaching-learning environments. This research uses a case study approach to explore the effectiveness of Tumblr as a digital technology and social media blogging platform to achieve learning objectives from two semester-long university courses.

Methods

Applying Contemplative Technopedagogy Attributes to Develop the Tumblr Assignment. The Tumblr assignment was formatively developed in one course and then tested in a second course at Montana State University. Attributes of contemplative technopedagogy were used throughout development, testing, and revision of the assignment in each course.

1. *Pedagogy Focused* – From the beginning, the development of the assignment was pedagogy focused as the authors decided to integrate Tumblr into the course structure as a method of facilitating student engagement with course content, colleagues, and sociocultural context.

2. *Learner Focused* – The Tumblr assignment was learner focused because it was purposefully presented and utilized in ways that intended to enhance, and not distract, student's ability to connect with course content, colleagues, and sociocultural context.
3. *Technology Focused* – In addition to facilitating enhanced connection for student learning, the authors maintained a focus on the need to understand and assess the digital technology itself. The Tumblr assignment provided opportunities for students and educators to discuss how usability and functionality of the platform did or did not aid in accomplishing learning objectives. Furthermore, the Tumblr assignment was revised based upon instructor reflection and student feedback.
4. *Attention Focused* – The authors focused specific attention on the fact that the Tumblr assignment was utilized as one component of the course to accomplish student learning outcomes and was not expected to revolutionize the teaching-learning environment in and of itself. The authors were intentional about designing the courses with a digital technology assignment that engendered a "personal cyberinfrastructure" for students to engage in thoughtful exploration around course themes. Further, the Tumblr assignment was designed to bridge course content and out of class exploration.
5. *Context Focused* – Successfully integrating Tumblr required authors to understand student's familiarity with this particular social media platform,

while also nudging students to be comfortable with non-traditional modes of exploration. The Tumblr assignment was thus adapted and revised in an iterative and ongoing process for each course.

Throughout each course, the Tumblr assignment required students to create and publish posts while also replying to and commenting on the posts of classmates. Students were subsequently asked to provide formal feedback in each course about their use of social media. Students also provided informal feedback through course discussions and other assignments. Findings from the first course were used to refine the assignment framework for the second course. Findings from the second course were used to create a new version of the Tumblr assignment.

What follows is an in-depth examination of the formation, implementation, and evaluation of the Tumblr assignment by course.

Case Study 1 – Community Nutrition. In fall 2014, 53 junior and senior level college students were enrolled in an upper-level community nutrition course with a learning objective to "develop a variety of communication skills sufficient to use in pre-professional practice" for dietetics accreditation. The instructor collaborated with the first author to develop and test the Tumblr assignment that would meet several learning outcomes, including: encourage critical thinking about community nutrition topics highlighted in course materials, improve professional technology use and writing skills, and develop student's ability to translate research to an interdisciplinary, non-expert audience (i.e. the public).

Several social media platforms were explored to determine the most appropriate tools for blogging use in the classroom. An assignment was developed that included Tumblr and Twitter and sought to determine if blogging and microblogging (i.e., condensed blog posts) were effective for encouraging student engagement, classmate interaction, and critical thinking about course topics. Due to its interface and functionality (described above), Tumblr was selected as the blogging platform. Twitter was also utilized to emphasize social media genre diversity and enable translation of Tumblr blog content into more concise 140 character Tweets.

For their Tumblr and Twitter assignment, students were asked to select a topic of interest related to course themes and conduct research throughout the semester. With guidance from the instructor and a university librarian, students created an annotated bibliography of three articles related to the selected research topic to familiarize themselves with available scientific literature. Then, the first author worked as a guest instructor with students to create their own Tumblr sites and Twitter accounts that would allow for critical reflection and content sharing regarding individual research topics and course concepts. During the fifteen-week semester, each student was responsible for at least 15 Tweets (one per week) and seven Tumblr blog posts (three before mid-semester and four by the end of the semester). Guidelines instructed students to write at least 300 words for each Tumblr post and provided creative methods for operating within Twitter's 140-character format. Students were encouraged to include, embed, or link to peer-reviewed journal articles, news media, blog posts, social media content, diagrams, figures, tables, photos, Wikipedia, popular press, or other information related to the

research topic. In an effort to foster ongoing dialogue, students were asked to space their Tumblr posts throughout the semester and not complete all posts immediately before due dates. Students were instructed about how to 'follow' other classmates' Tumblr and Twitter accounts and expected to engage with classmates' social media activity by commenting and sharing. Detailed instructions, examples, practice time, and expert review were provided to assist students with blog development and content creation in order to bolster effective communication and critical engagement. During subsequent class sessions, students met face-to-face with the first author and course instructor to discuss and ask questions about blog content and issues. Additionally, students were encouraged to contact and meet with the first author and/or instructor at any time. Students were also provided time to engage the entire class in informal discussion about Tumblr and Twitter best practices for learning as well as methods for improving the assignment.

Questions for case study 1. Formal feedback about the assignment was collected at the end of the semester. Quantitative evaluation questions asked students to rate their level of agreement (using a Likert scale: 1 = strongly disagree; 5 = strongly agree) with three statements about the assignment and two yes/no questions about social media usage (See Table 1).

Table 1. Descriptive Statistics for Twitter and Tumblr assignment from Community Nutrition at Montana State University, Fall 2014 (n=50)	
Section 1 - Level of Agreement (1 = strongly disagree; 5 = strongly agree)	
Question	**Post Test Mean±SD**
Tumblr and Twitter were useful for learning about nutrition topics	3.90±0.86
Tumblr and Twitter helped me to learn from colleagues about nutrition topics	4.02±0.80
Tumblr and Twitter helped me to apply course material to larger world issues learned in this course	3.94±0.77
Section 2 - Yes or No	
Question	**% Yes Post**
Have you ever used Tumblr before this course? “Used” defined as having an account or looked at Tumblr previously.	8%
Have you ever used Twitter before this course? “Used” defined as having an account or looked at Twitter previously.	24%

Students were also asked for qualitative responses to two open-ended questions about assignment structure with the aim of improving future iterations (See Table 2). Results of the evaluation are discussed below (See Results).

Table 2. Qualitative Questions and Thematic Analysis for a Social Media Assignment Used in Community Nutrition Undergraduate Course at Montana State University. (n=50)
Qualitative Questions
Question 1 - What do you now know that you wish you knew when you started using Tumblr and Twitter?
Question 2 - What else would you like to add about the Tumblr and Twitter assignment that I did not ask?
Thematic Analysis*

Theme	#MU	Example Meaning Unit
Usability	40	That you can post dates for later posts. This would help you write multiple posts and have them post at a later date. I really like the format of adding photos.
Depth and Detail	31	I like Tumblr [versus Twitter] better because you can write some real thoughts and information.
Scholarly Communication	11	I now know more about social media and how it can be helpful for learning new facts.
Community	8	It was interesting connecting with other organizations and programs that addressed my research issue.
Course Structure	5	I would have liked one social media tool, not two.

*Emergent major themes, number of meaning units in which theme was present (#MU), and example meaning units. Each response was counted and categorized as a single meaning unit.

Case Study 2 – Information Literacy. In spring 2015, 26 undergraduate students were enrolled in an introductory library science course. The learning objectives focused on finding, evaluating, and applying information resources for scholarly research. This course was taught by the second author, who collaborated with the first author and course instructor for Case Study 1 to develop and test the Tumblr assignment that would encourage critical thinking about information topics, improve the use of academic technology, and develop student's ability to locate and evaluate information resources.

For the social media component of the course, students were asked to coordinate weekly reading assignments and communicate responses through peer-learning networks using Tumblr. Following the results of Case Study 1 (discussed in more detail below), Case Study 2 focused on the application of Tumblr and did not include Twitter. Following the model provided by Case Study 1, the second author worked with students to create their own Tumblr sites that would allow for critical reflection and content sharing for individual research and course concepts. Students were initially separated into six groups of five students for small-group discussions via Tumblr. Hashtags were created for each group, and students were asked to focus discussion within assigned groups. The second author provided students with a thematic discussion structure, which included an overall topic for each week's discussion shaped around a small selection of readings related to information literacy. Each week, students were asked to produce one original post and two comments in response to classmates' Tumblr posts. Students were encouraged to explore ideas openly and without a prescribed word length, while incorporating external resources as appropriate to the discussion. The instructor for Case Study 2 was present throughout these discussions as a moderator who occasionally contributed responses in an effort to synthesize or connect ideas expressed by the students.

Questions for case study 2. In order to evaluate the student experience, a pre-test was incorporated into Case Study 2 that measured students' familiarity with and interest in social media at the onset of the course. Students completed this pre-test during Week 1 of the course. During Week 15, students completed a post-test (modeled on the

post-test of Case Study 1) to measure students' familiarity and interest with social media at the conclusion of the course. Quantitative evaluation questions asked students to rate their level of agreement (using a Likert scale: 1 = strongly disagree; 5 = strongly agree) with three statements about the assignment as well as two yes/no questions about social media usage (Table 3). Students were also asked for qualitative responses to two open-ended questions about assignment structure with the aim of improving the next version of the assignment (Table 4).

Data Analysis. Quantitative data was analyzed using SPSS (version 18.1). Qualitative data was analyzed by developing themes and subthemes (Krippendorf, 2012; Lasswell, Lerner, & Pool, 1952; Weber, 1990) from courses separately and collectively. For Case Study 1, survey questionnaires were released post Tumblr assignment. Descriptive statistics including means, percentages, and standard deviations were used to describe the post dataset. For Case Study 2, authors designed and collected pre and post questions. Descriptive statistics including means, percentages, and standard deviations were used to describe both pre and post datasets. An independent t-test was used to compare mean pre-test to post-test scores for questions addressing comfort, usefulness, and application variables. A bivariate Pearson Correlation was used to measure the strength of the relationship of social media use in comfort, usefulness, social media use in other courses, and application variables. Statistical significance was set at a two-sided alpha level of $p < 0.05$. This alpha level indicates that our results can be reported with 95% confidence within the scope of the study. Montana State University's Institutional Review Board approved this study.

Results

Case Study 1 – Community Nutrition. In total, 50 students completed the Tumblr and Twitter assignment post-test survey. Three students did not complete the survey questions due to absence. Students agreed that the Tumblr and Twitter assignments (Table 1):

- Were useful for learning about nutrition topics (3.9±.86)
- Helped the student learn from colleagues about nutrition topics (4.0±.80)
- Helped the student apply course material to larger world issues addressed in the course (3.9±.77)

Qualitative data helped illuminate student perspectives about the pedagogical usefulness of Tumblr and Twitter. Across qualitative data collected during Case Study 1, 42 meaning units and five themes emerged. Qualitative themes included usability, depth and detail, scholarly communication, community, and course structure (Table 2).

A majority (n=40) of the qualitative responses in Case Study 1 focused on usability. Students focused on the functional aspects of the social media tools for more useful utilization of both Tumblr and Twitter. Suggestions for Tumblr included searching hashtags for content specific information, writing posts and scheduling for a later time, reblogging, adding photos, how to follow people or organizations, and commenting. Recommendations for learning to use Twitter included understanding the limited amount of characters allowed in Tweets and how to use the @ and # symbols in posts.

Students also focused on the amount of depth and detail (n=31) that each platform requires and/or provides. Overall, students explained that Tumblr required far more time

than Twitter to create a quality post, but that the information shared via Twitter was not as rich as that available via Tumblr. One student expressed a viewpoint shared by most other students, “Tumblr was better because I got more info and I learned more by reading and transferring my thoughts into words.”

Additional meaning units focused on the scholarly communication role of Tumblr and Twitter (n=11). Student responses focused on the ability to engage and communicate with people and organizations inside and beyond the classroom. Students appreciated learning new topics, connecting with other accounts related to their field of study, and sharing their own research with the social media world. One student commented, “I definitely now see the value in social media. I had not before.”

Community (n=8) explored the ways in which students built participation with their social media sites. Students discussed the influence of word length on participation, approaches to online community building, and garnering ‘likes’ on posts.

Further responses (n=5) centered on the assignment framework itself. While students commented that they felt well prepared with assignment directions, they suggested that focusing on one social media tool would be better for learning outcomes.

The course instructors and first author met to discuss the results of Case Study 1 and used the information provided by students to influence the development of the assignment for Case Study 2. Student responses from Case Study 1 indicated that Tumblr was more pedagogically promising than Twitter. Tumblr received more favorable reviews and students also appreciated the in-depth research and writing required for the

platform. Tumblr was therefore chosen as the sole platform for the social media assignment framework explored in Case Study 2.

Case Study 2 – Information Literacy. In total, all enrolled students (n=26) completed the Tumblr assignment pre-test and post-test surveys for Case Study 2. See Table 3. Students' comfort level utilizing Tumblr significantly (p=.00) changed. Pre-assignment students disagreed (2.3±1.00) that they were comfortable navigating Tumblr and post-assignment students agreed (3.9±.99) that they were comfortable navigating Tumblr. Data also suggest that there was a significant (p=.02) change in student's opinions about the usefulness of Tumblr for learning course topics, from neutral (3.4±.95) to agree (4.1±1.03). Significant (p=.01) changes were observed in student's pre and post answer to the ability of Tumblr to help apply course materials to larger world issues, from neutral/agree (3.5±.98) to agree (4.3±.94). A large difference was found between Tumblr use in the student's personal life before the assignment versus Tumblr use in the student's personal life post assignment from 4% to 42%.

Table 3. Mean Pre and Post Test Scores for Tumblr assignment from Information Literacy at Montana State University, Spring 2015

Section 1 - Level of Agreement (1 = strongly disagree; 5 = strongly agree) (n=26)		
Question	**Pre-Test Mean±SD***	**Post-Test Mean±SD**
I am comfortable navigating Tumblr	2.3±1.00[a]	3.9±0.99[b]
Tumblr will be/was useful for learning about [course] topics	3.46±0.93[a]	4.12±1.03[b]
I have used social media (e.g., Facebook, Twitter, Tumblr, WordPress) for a course in the past	2.29±1.52[a]	2.13±1.51[a]

Tumblr will help/helped me to apply course material to larger world issues learned in [course]	3.46±0.98[a]	4.25±0.94[b]
Section 2 - Yes or No (n=26)		
Question - Please check the social media you use in your personal life	**% Yes Pre**	**% Yes Post**
Facebook	100%	100%
Twitter	25%	33%
LinkedIn	4%	13%
Tumblr	4%	42%
WordPress, Blogger, etc.	4%	4%
Pinterest	54%	63%
Google+	25%	21%
Instagram	79%	75%
Vine	13%	21%
Flickr	0%	8%
Snapchat	75%	71%
NOTE: *Means with different superscripts across rows are significantly different ($p<0.05$) based on paired t-tests, denoting changes in construct scores.		

Qualitative data helped illuminate student perspectives about the usefulness of Tumblr to accomplish learning objectives. Across qualitative data, 68 meaning units and

five themes emerged. Qualitative themes included usability, interest and motivation, course structure, scholarly communication, and community (Table 4).

Table 4. Qualitative Questions and Thematic Analysis for a Social Media Assignment Used in Information Literacy Undergraduate Course at Montana State University. (n=26)

Qualitative Questions

Question 1 -
Pre - What do you wish you knew about how to use Tumblr (e.g., how can I help you make this assignment easier to navigate)?
Post - What do you (still) wish you knew about how to use Tumblr? Anything particularly confusing or troublesome about using Tumblr for our class?

Question 2 - Pre and Post - What else would you like to add about the Tumblr assignment that I did not ask?

Question 3 - Post - Summarize your experience using Tumblr in this course. If you wish, please provide examples of how Tumblr helped (or did not help) you engage with course topics and classmates.

Thematic Analysis*

Theme	#MU	Example Meaning Unit
Usability	50	It would be nice to have like a categorized group that I could look at visually rather than just using hashtags to communicate to other members of the group.
Interest and Motivation	8	Having to communicate over a blogging site added a fun and different twist on writing, as it created a less stressful atmosphere for writing that is more personal and creative. I really enjoyed it.
Community	5	My experience was positive and it was nice getting feedback from the class and seeing all the different opinions on our topics for the week.

Course Structure	3	Could there possibly be a course calendar with due dates, so I know when to exactly have everything done by?
Scholarly Communication	1	Tumblr is a great way to get your thoughts down in writing. Another way that Tumblr was helpful was through the use of hashtags; clicking on them opened up a portal to a world of that topic!
*Emergent major themes, number of meaning units in which theme was present (#MU), and example meaning units. Each response was counted and categorized as a single meaning unit.		

A majority (n=50) of the qualitative responses in Case Study 2 focused on usability. As in Case Study 1, students in Case Study 2 focused on the functional aspects of the social media tool for more effective utilization of Tumblr. General ease-of-use of Tumblr was an issue for many students, with specific focus on the navigation, commenting, and notification functionality for the platform. One student responded, “Still don't get comment notification like on Facebook and even after I modified my settings, I still found it confusing to find and respond to who had commented.” Likewise, another student commented, “I do not like how cumbersome it is to comment on other people's blog.” The learning curve for Tumblr proved steep for some students. With additional instruction, however, the platform’s idiosyncrasies were overcome, as another student responded, “Once I met with you and it was explained to me Tumblr was easy to use and navigate.” Indeed, with clear—and often repeated and reemphasized—instructions for posting, commenting, and site navigation, Tumblr became an asset for those students who approached it as both a

learning tool (i.e., using a digital technology to facilitate learning) and a learning object (i.e., learning about a digital technology). Another response represented this experience, “I feel like I had a lot of fun using Tumblr and learning how to use it. It made this learning experience a lot of fun for me.”

Students also discussed their own interest and motivation (n=8) with regards to social media. This meaning unit was related closely with usability, as many students experienced increased interest in the platform once its basic functionality was understood. One student responded, “At first, Tumblr was really confusing for me until I figured out how to use it, which just took some time...I think it was a fun way to interact and communicate with our classmates!” An attitude of enjoyment was reflected by others in the class, who noted that “using Tumblr was cool” and that “having to communicate over a blogging site added a fun and different twist on writing, as it created a less stressful atmosphere for writing that is more personal and creative. I really enjoyed it.”

Two further meaning units appeared in students’ qualitative responses, community (n=5) and scholarly communication (n=1). These two related meaning units revealed students’ desire to engage with course topics through peer interaction, thereby effectively accessing and building scholarly communities online. One student noted, “I enjoyed how even though [this class] was an online class I engaged with my classmates a lot.” Another student attributed a positive class experience to “seeing all the different opinions on our topics for the week.” One comment specific to Tumblr showed the learning and community value of the platform’s hashtag functionality, “Another way that Tumblr was

helpful was through the use of hashtags; clicking on them opened up a portal to a world of that topic!"

Concerns about course structure (n=3) were also present in qualitative responses. A few students expressed a desire to have clearly defined due dates and an integrated calendar function that is not currently available through Tumblr. Another student identified a difficulty with assignment management, "I already missed a deadline because I was not understanding everything that was being asked or was unsure when things were due." Whereas the initial social media exercise in Case Study 1 offered a structured walk-through (with relevant screenshots) for opening and utilizing a social media account, the initial social media exercise in Case Study 2 offered comparatively unstructured guidance for opening a social media account and creating posts. Student responses from Case Study 2 indicated that additional structure would have benefited students by providing clearer guidance in platform navigation, posting and commenting procedures, and effective use of hashtags.

Tumblr Assignment. When developing assignments involving digital technology such as Tumblr, instructors must balance the various attributes of contemplative technopedagogy in a way that acknowledges students' course topical knowledge, information literacy, and (un)familiarity with specific digital technology. Assignments involving social media such as Tumblr must not be overly prescriptive so as to hamper student creativity. However, such assignments must simultaneously offer sufficient instructional detail in order to guide students through a process of critical engagement with the digital technology. In response to student feedback from Case Study 1 and Case

Study 2, the authors developed a new version of the Tumblr assignment (see Appendix 3). This new iteration of the assignment better addresses students' topical knowledge, information literacy, and (un)familiarity with Tumblr. Depending upon instructional setting (e.g., in-person, online, hybrid), Tumblr and the associated assignment are introduced via instructor walk-through as well as documented instructions. Maintaining the initial step of blog creation and personalization, the assignment was reconfigured to help students more quickly develop familiarity with and confidence using Tumblr. After creating a Tumblr blog, students are asked to (1) publish a first blog post featuring a common course hashtag and (2) write a comment on a colleague's blog. Highly structured and broadly applicable, this revised approach to onboarding helps students gain confidence using social media in higher education while also demonstrating individual student familiarity with the technology and helping cultivate a connected learning community. Lessons learned from this study have produced a new assignment for integrating Tumblr into the higher education teaching-learning environment.

Discussion

This evaluative study demonstrates how contemplative technopedagogical attributes can aid higher education instructors in incorporating social media, such as Tumblr, in ways that facilitate student engagement, community building, and critical thinking. This research utilized a mixed-methods case study approach to explore how contemplative technopedagogy can aid in the development of social media assignments and positively influence student learning. Through two case studies, the authors relied upon attributes of contemplative technopedagogy to develop a Tumblr assignment and

then demonstrated that Tumblr can serve a pedagogical role by facilitating student-led learning when coupled with detailed directive guidance from the instructor and interaction with classmates through the social media platform. The research addressed herein lends to a larger discussion about contemplative technopedagogy and social media use beyond Tumblr and more broadly for research and practice in higher education.

Contemplative Technopedagogy and Social Media in Practice. Tumblr presents opportunities to enhance student interaction and engagement in learning. However, before such change can be realized, "faculty must begin by examining their pedagogical objectives before introducing new elements to the learning equation" (Moore et al., 2008, p. 6). Our research findings support this perspective. An assignment involving social media should include discussion of three key points:

- explicit connections to course learning objectives
- highly detailed and repetitive instruction about platform usability and functionality
- consistent instructor engagement with the platform, functionality, and student-generated content throughout the semester.

As evidenced by themes that emerged through qualitative data analysis, the student experience was highly dependent upon interaction among students and faculty as well as clarity of instruction. The Tumblr assignment changed in response to this finding. For example, students in Case Study 1 requested more detail about hashtags. In response, the first author addressed hashtags specifically with the group and then both authors changed the Tumblr assignment before implementation during Case Study 2.

Incorporating social media as a digital technology in higher education requires careful instructions, assignment testing, and responsiveness to feedback.

Although conducted in distinct instructional settings, similar themes emerged from both case studies. However, some meaning units focused on aspects unique to each instructional setting. For example, although both case studies indicated the significance of community, the emphasis on establishing connections with classmates depended upon whether or not students were meeting in-person and online (Case Study 1) or online only (Case Study 2). Qualitative responses from Case Study 2 were more attentive to the ways in which social media facilitated relationship-building among classmates in an online teaching-learning environment.

A contextual understanding of technology in higher education enables instructors to determine when, how, why, and to what extent social media fit into the teaching-learning environment. Higher education instructors must identify their own assumptions regarding students' familiarity with social media platforms. Students may regularly use social media, however such frequency does not necessarily nor effectively translate to critical engagement with social media in students' academic lives. For example, Case Study 2 overestimated students' familiarity with social media genre conventions and Tumblr functionality, thereby influencing how, when, and why students engaged with Tumblr during early stages of the course. Consequently, incorporating student feedback and authors' reflection regarding experiences from each course, the new version of the assignment focuses on early and in-depth engagement with Tumblr. Similar evidence from both case studies debunks assumptions attributed to the digital native paradigm.

Although generally familiar with social media, many students (92% in Case Study 1 and 96% in Case Study 2) had not used Tumblr prior to the assignment. To realize the potential of Tumblr in higher education, it is necessary to develop assignments and frameworks with contextual awareness. “In line with learner-centered pedagogy, faculty should be encouraged to recognize, respect, and leverage student knowledge and skills in the realm of technology” (Moore et al., 2008, p. 6). To realize course objectives and technological opportunities, it is important not only to teach course content, but also to teach the technology. More importantly, it is necessary to teach in a way that engages students in creative and imaginative exploration – an approach that works well for teaching course content as well as technology.

Future Research. Future work could richly build upon research addressed herein to investigate Tumblr and other social media platforms in diverse educational settings. Methods could be expanded and iterated to include smaller and larger sample sizes, various academic disciplines, as well as in-person versus online classrooms. Other measures should focus on a wider range of variables that impact student learning, including group dynamics, engagement, learning, and critical thinking. The nature of self-reporting is subjective and biased by the participant. A study of social media would benefit from objective observational measures in addition to self-reporting. Our findings lend further credence to the nuanced understanding that students are not always “digital natives.” Future research should explore the extent to which students are in fact often “digital immigrants” with respect to critical technological engagement.

Conclusion

Social media platforms such as Tumblr can be utilized in learning environments to enhance learning by facilitating peer connections and information exchange. In his call for a creativity-enhancing, imagination-broadening higher education, Campbell (2009) emphasizes, "students not only would acquire crucial technical skills for their digital lives but also would engage in work that provides richly teachable moments ranging from multimodal writing to information science, knowledge management, bibliographic instruction, and social networking" (p. 59). Our research findings suggest that Tumblr can help create a learning environment congruent with Campbell's vision of higher education. Incorporating social media into higher education presents opportunities to emphasize the importance of open and imaginative teaching-learning environments.

Our research provides a useful framework developing, testing and revising Tumblr or other social media for use in higher education. Results indicate that Tumblr presents a pedagogical opportunity for building creative, student-led learning communities. However, merely adding social media is insufficient. Echoing McLuhan and Wesch, our findings emphasize the importance of creating social media assignments that are responsive to contextual dynamics that influence modes of learning. Following a contemplative technopedagogy framework, higher education can more effectively use social media to create interactive teaching-learning environments that encourage open and imaginative engagement with content, colleagues, and context.

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Manuscript 4

Teaching Undergraduate Students to Visualize and Communicate Public Health Data with Infographics

Abstract

The purpose of this study was to explore the degree to which an infographic assignment facilitated student learning around health science issues, as well as the ways in which the assignment was an effective teaching tool. The objectives of the assignment were to (1) understand the purposes of and potential uses for infographics, (2) cultivate creative visual communication skills, and (3) disseminate a complex health topic to diverse audiences. The infographic assignment was developed at Montana State University and piloted at Portland State University. Students were assigned to small groups of three or four to create an infographic focused on a health science issue. The assignment was divided into four steps: brainstorming, developing, designing, and finalizing. Focus groups were conducted to assess how learning occurred throughout the assignment and identify any opportunities for modification of the assignment. This study was conducted with freshman students enrolled at Portland State University, a public university located in downtown Portland, OR, USA. Thirty four students completed the assignment and 31 students participated in one of three focus groups. Four themes emerged from focus groups: (1) Communicating Science-Related Topics to Non-experts, (2) Developing Professional Skills, (3) Understanding Health Issues, and (4) Overall Experience. This article outlines the assignment, discusses focus group results, and

presents assignment modifications. It is clear that the infographic assignment facilitated learning about accessing and translating data. This assignment is ideally suited for use with diverse college-age audiences in health education and health promotion fields.

Keywords

infographics, health education, pedagogy, undergraduate education, communicating science

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Background and Rationale: Digital Technology and Higher Education Pedagogy in the Health Sciences

From static chalkboards to collaborative Internet, the contemporary higher education environment contains multitudes of tools to facilitate teaching and learning. Educational technology research shows the changing nature of students' access to information and engagement in deep learning. Research about digital technology in higher education indicates that students today utilize social media to research information that they already perceive as credible (Creighton et al., 2013) and successfully learn course content through social media platforms that extend the classroom (Northey et al., 2015).

Digital technologies undoubtedly influence how learners learn (Wesch, 2013). Digital technologies create opportunities to open new doors to information, facilitate creativity, and inspire deeper learning (Campbell, 2009). With growing popularity of digital technologies in higher education, it is critically important to consider how digital technologies reorient the purpose and practice of teaching. To successfully engage students in this technology-rich learning environment, faculty must carefully construct assignments around each technology and provide ongoing support (A. H. Moore et al., 2008).

In recent years, infographics have become a popular digital technology for sharing information graphically in various sectors, including the news media, business, social media, and research (Smiciklas, 2012). Despite the growing body of research about digital technology use in higher education, there is little scholarship specifically

addressing the pedagogical benefits of infographics, particularly in the health sciences field. This paper seeks to fill that gap by demonstrating how infographics can function as a creative assignment within the health sciences that promotes deep learning, requires critical information analysis, and facilitates collaboration.

Pedagogical Framework and Principles: Infographics for Critical Teaching and Learning

Infographics are graphical depictions of complex information that rely upon visual elements to clearly and concisely communicate data, concepts, and/or ideas to diverse audiences (Lankow, Ritchie, & Crooks, 2012). Infographics use evidence- and practice-based data, compelling statistics, easy-to-read fonts, complimentary color schemes, simple charts, bold graphs, and other graphics to disseminate information in quick and easily digestible format.

Infographics hold potential to serve as a critical teaching and learning tool that effectively combines student technology skills (existing or emergent) and disciplinary domain knowledge. “Similar to a traditional research essay, an infographic assignment challenges students to visually communicate a thesis, supported by citations and statistics sourced from the scholarly literature...” (Matrix & Hodson, 2014). However, infographics are more than a substitute for the traditional research essay. As a teaching tool, infographics also allow students to engage with three transdisciplinary topics important to health sciences education: (1) information literacy, (2) communicating science, and (3) data visualization.

Information Literacy. The health sciences field requires skills to locate and vet data. Infographics are increasingly used to present data that are highly accurate and easily digestible, thereby bolstering the health literacy of end-users (Turck, Silva, Tremblay, & Sachse, 2014). Requiring discovery and appraisal of information available in valid and reliable channels, infographics are an important exercise for the health sciences students.

Communicating Science. After locating and vetting data, students in the health sciences field need to develop the ability to communicate scientific ideas to their peers and the public for use in professional practice. Traditional mediums for communicating scientific information (e.g., manuscripts, books, conferences) are valuable, but often inaccessible to non-scientists. Infographics provide a mode of rapid and concise communication through visuals and have become an increasingly common method for disseminating health research to audiences in need of that health information (Lee & Cavanaugh, 2016; Otten, Cheng, & Drewnowski, 2015).

Data Visualization. In addition to discovery, vetting, and translation of data, infographics also require the developer to think strategically about how data are visualized. Effective visualization of data requires the infographic author to utilize methods that enable the infographic reader to quickly grasp complex concepts (Glenberg & Langston, 1992). Data visualization has become so widely used in the health sciences field that the National Institutes of Health publishes various tools and techniques to visualize data (Federer, n.d.).

Methods

Infographic Assignment. The infographic assignment was developed and pilot tested in summer 2016 by authors JDS and CBS. This paper focuses on further testing of the revised assignment in fall 2016 by authors BI, CS, and AM with technical assistance from authors JDS and CBS.

Students were assigned to small groups of three or four to create an infographic focused on a health issue. The objectives of the assignment were to (1) understand the purposes of and potential uses for infographics, (2) cultivate creative visual communication skills, and (3) disseminate information about a complex health topic to diverse audiences. The assignment was divided into four steps: (1) brainstorming, (2) developing, (3) designing, and (4) finalizing. In the brainstorming step, students familiarized themselves with the infographic genre, selected a topic, used research skills to identify professional sources of information about their topic, and began drawing their infographic. In the developing step, students used Piktochart (or other software) to develop their infographic. In the designing step, they selected fonts and colors for their infographic. As part of the finalizing step, students market tested their infographic with friends, family, peers, and faculty.

Setting and Participants. This study was conducted during fall term 2016 with predominantly freshman students enrolled in one section of Freshman Inquiry (FRINQ) at Portland State University, a public university located in downtown Portland, OR, USA. Portland State University serves a racially and ethnically diverse study body and of the approximately 21,000 undergraduate students enrolled during the 2016–2017 academic

year, 38% were part-time students and more than 70% received financial aid. FRINQ is a year-long, 15 credit, theme-based sequence designed to intro- duce freshman students to Portland State University, general education program. During each 10-week term, FRINQ students meet two times per week in small group sessions led by a trained upper division student (i.e., mentor sessions).

The current study was conducted with FRINQ students enrolled in one section of the FRINQ theme, Health, Happiness, and Human Rights. Students enrolled in this FRINQ section had a diverse set of majors. The most popular major was health- related (e.g., health studies, applied health and fitness; $n = 11$), followed by undeclared ($n = 5$). Other students majored in biology ($n = 3$), psychology ($n = 3$), social work ($n = 3$), business administration ($n = 2$), political science ($n = 1$), art ($n = 1$), communication ($n = 1$), and computer science ($n = 1$).

Students worked in small groups throughout the term to complete the infographic assignment. The infographic assignment had two components: (1) creation of the infographic and (2) 10-min in-class presentation of the infographic. The infographic assignment was worth 40% of the course grade.

Focus Groups. After completion of the infographic assignment, students were recruited to participate in a focus group held during their mentor sessions. Of the 34 students enrolled in the course, 31 participated in one of the three focus groups. The focus groups were facilitated by a researcher AM who was not involved in the class. At the beginning of each focus group, the facilitator described the purpose of the focus group and reminded students that their comments were confidential. Each focus group lasted

approximately 40 min. The focus groups were semi-structured with questions (see Table 1) that focused on the students' experience with the infographic assignment.

Table 5. Semi-Structured Focus Group Questions about Infographic Assignment

1. How would describe your overall experience with this project?
2. What was the easiest part of developing your infographic? What resources, tools, or support were helpful to you in developing your infographic?
3. What was the hardest part of developing the infographic? What challenges did you experience when developing your infographic? How did you group overcome these challenges?
4. Did this project help you increase your understanding of health? [If yes] Which aspects of this project were useful in helping you to better understand course material?
5. Would you recommend this assignment for future students in this course? Why or why not?
6. What advice would you give to future students about developing an infographic for this course?
7. How would you recommend that a group effectively and efficiently accomplishes an infographic assignment together?
8. What else would you like to share about the project or your experience with the project?

The focus groups were audio-recorded and transcribed verbatim by the focus group facilitator. The data were analyzed using applied thematic analysis (Guest, MacQueen, & Namey, 2012). A codebook was created by one of the course instructors with 4 themes and 12 operationally defined codes based on the focus group guide and preliminary review of the transcripts. Two researchers BI and CBS independently coded all three focus group transcripts and compared them for interrater reliability. Coding discrepancies were resolved through discussion until 100% agreement was reached. After all of the focus groups were coded, all authors met to discuss themes and subthemes across the focus groups and to draw and verify conclusions about the data.

The Institutional Review Board at Portland State University approved this study.

Results

Four themes and 12 subthemes emerged from the data (Table 2). Subthemes are organized thematically.

Table 6. Student Focus Group Quotes about Infographic Assignment

Theme	Subtheme	Select Student Quotes
Communicating Science-Related Topics to Non-experts	Translation	"[Infographics] helped show how to put a lot of information into a really short, concise statement, and make it very easy for people who don't necessarily read medical jargon... to understand."
	Visual Representation	"One of the challenges was trying not to add too much information because [the infographic is] mostly visual. So sometimes you're used to explaining things a lot, but on the infographic you can't really do that, it's just the main points."
	Market testing	"[Infographics] helped everyone to look at practicing new skills. For example, the market testing that we did...helped me contact other professors, other people that I don't talk to face to face but through the internet, and try to ask for feedback for the infographic."
Developing Professional Skills	Infographic	"I remember I'd seen infographics before but...there's actually a process to this whole thing, it's not just a bunch or random facts put on a piece of paper."
	Professional Articles	"[Reading professional articles] was cool; you're reading what actual medical professionals read and stuff. It got me, at least, more used to understanding their lingo."
	Resources	"We'd reserve a [study] room that just had a white board so we wrote out planning our presentation, and the last time we met we got a projector room and we were practicing our presentation in there so that was interesting to actually do that. I think that's

		what I took away from [the infographic assignment] the most, actually having to go in and reserve a study room."
	Team Work	"[The infographic assignment] helped me communicate more with my peers as as partners, and helped me manage my time a lot too."
Understanding Health Issues	Understanding	"[The infographic assignment] kind of opens your mind. You're focused this whole time on your specific health disparity, but then you realize there's a lot of other ones out there that we should be concerned about."
	Depth	"I feel like this was an opportunity for us to get a little more in depth and find out about topics that aren't really talked about. "
	Breadth	"There were a lot of interesting health topics covered that every group covered with their infographics, and that was actually pretty interesting. It was pretty interesting to learn what they researched, and it was nice to learn from those students, from their hard work."
Overall Experience	Positive	"I liked how [the infographic assignment] mixes research and artistic stuff and design, and [you] also learn how to put stuff together in a short thing that people can understand. It's a good project, in my opinion."
	Negative	"I kinda want to be thrown into [the infographic assignment' a little more. I mean, I'm lazy, I like to be lazy, but at the same time, this is something cool. This is a cool design project. And I wish instead of being handed something, we were thrown out there a little bit more."

Communicating Science-Related Topics to Non-Experts. Focus group participants discussed that the infographic assignment taught key skills in learning how to communicate science- related topics to non-experts through three subthemes:

Translation, Visual Representation, and Market-testing. Students found that the infographic assignment facilitated practice translating science-related topics to the general public. Students learned how to visually represent science information to non-experts due to the constrained space that forces the author to distil information in an easily digestible format. Market-testing was a requirement of the assignment to understand which pieces of the infographic were effectively or ineffectively communicated. Students noted the importance of the market-testing step in refining their infographic.

Developing Professional Skills. The infographic assignment facilitated development of professional skills through four subthemes: Infographic, Professional Articles, Resources, and Team Work. First, students learned the important skill of creating an infographic. Through the process of creating an infographic, students learned how to access information resources (such as the library's resources) and to identify, read, and summarize professional articles, including development of an annotated bibliography. For some students, accessing information resources and using professional articles were new skills, while others discussed learning these particular skills in high school. Since students completed the assignment in teams, professional skills around team work were discussed in depth. Skills around communication, time management, and meeting deadlines were positive aspects of teamwork. Some participants discussed that it was difficult to find time to meet and to learn about the health topic or assignment in depth because they had delegated a small piece of the assignment to each team member.

Understanding Health Issues. Focus group participants discussed the ways in which the infographic assignment did or did not facilitate learning about health issues through three subthemes: Understanding, Depth, and Breadth. It was clear that the infographic assignment facilitated student learning around health issues. Students discussed that the infographic assignment promoted deep learning about one health topic and that the in-class presentations helped students learn a breadth of health issues. Some students commented that working in a team decreased the amount of information that each individual learns about a health issue because of the shared responsibilities in the assignment.

Overall Experience. The infographic assignment was received by students as a positive experience. Students recommended the assignment for other courses in the future, with a few adjustments. Students came to the project with differing levels of experience. Students with more advanced skills provided negative feedback that the project was elementary or drawn out over too long a timespan, while other students with less developed skills commented that the assignment matched their abilities. Students were provided with sample infographic software to use, but provided with latitude to research other available software if desired. Most students selected to use the sample infographic software and some commented that it was not user friendly.

Discussion: Recommendations for Assignment Framework

The assignment was honed based upon student feedback and focus group findings. The assignment was reframed in the following ways:

- Develop a baseline skills assessment for students to complete about key skills needed in infographic development, including knowledge of infographics, infographic use, technology use, experience locating and evaluating professional articles, accessing resources that will be useful for infographic development (e.g., library, study rooms), teamwork experiences, presentation skills. This baseline assessment can be used to tailor preliminary classroom activities before students begin the infographic assignment.
- Encourage student to search for and experiment with infographic software at the onset of the assignment. This will empower students to select the software that best suits their technological skills and creative needs.
- Provide guidance on data visualization, potentially with a university librarian or other data visualization expert. A data visualization session should focus specifically on graphic design, choosing images, locating stock images, and providing examples from the health sciences field.
- The infographic assignment can be successfully completed either by a team or an individual. Provide an option, if possible. At the same time, think about the amount of time required for in-class presentations, which can vary greatly depending upon the number of final infographics.
- If teamwork is going to be a requirement for completion of the assignment, the authors recommend teamwork activities that teach about working with various personalities and work styles and build skills for collaboration.

- Researching, evaluating, and translating credible resources is a key component of infographic creation. Many times, students rely more heavily upon Internet search queries rather than library databases (Biddix, Chung, & Park, 2011). As such, it is critical that students have basic research skills and know how to identify professional articles, format references, and understand ethics associated with using other people's work.
- Think carefully about timing of the infographic assignment in the course of a student's education. Freshman may require more guidance with respect to collaboration, critical thinking, and research skills, whereas more advanced students may have developed these skills in earlier stages of their education. Foundational exercises about such topics should be required for the assignment depending upon the level of the student.

The final infographic assignment is available in Appendix 4 as well as at https://scholarworks.montana.edu/xmlui/handle/1/14090.

Future research should explore the infographic assignment at different times during a student's education to parse apart the basic skills (e.g., finding resources, teamwork) that need to be taught at different levels. Likewise, the assignment could occur later in a course, after basic skills are taught. Students are not innately familiar with the intricacies of all digital technologies. Therefore, it is important to understand the degree to which students understand infographic creation and dissemination technologies and not to mistakenly assume student are digital natives (Fisk, 2015; Prensky, 2001b).

Conclusion: Infographics Pedagogy in Practice

The purpose of this study was to explore the degree to which an infographic assignment facilitated student learning around health sciences issues as well as the ways in which the assignment functioned as an effective teaching tool.

Requiring a commitment to be both learner and teacher, the integration of technology creates an educational environment that encourages participants to engage others. If a technology is new to the teacher, it may or may not be new to the student. As such, the infographic assignment for health sciences underwent two major revisions in piloting and then described in the current manuscript based upon a participative process involving teachers and students. Teachers should show students what they already know, share perspectives on the values of a technology and an assignment, and ask students how they might (or already do) use the technology. Teaching is not about supplying answers to students, but about working with students "to create 'active lifelong learners' with 'critical thinking skills' and an ability to 'think outside the box'" to pose, answer, and ask increasingly complex questions (Wesch, 2008).

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Coda:

The Future of Contemplative Technopedagogy in US Higher Education

Digital technology is everywhere; connecting all types of people, places, and ideas. All aspects of contemporary society are affected by digital technology, including the ways in which we think (Gazzaley & Rosen, 2016; Hayles, 2012), communicate (Przybylski & Weinstein, 2012; Turkle, 2011), and learn (Campbell, 2006; Davidson & Goldberg, 2010). Digital technology features prominently in the higher education ecosystem. It can extend and amplify us (as teachers, as learners, as societies, etc.) – open new doors, boost creativity, inspire learning. Digital technology can also amputate and silence us – dull learning experiences, create rout activities, minimize exploration. Given this dual nature, it is important for higher education stakeholders to ask questions about why, when, how, which, and to what extent to integrate digital technology into pedagogical practices.

Digital technology only makes things happen, it does not make one contemplative about pedagogy. Contemplation can facilitate critical engagement with questions about technopedagogy and lead to purposeful utilization of digital technology in US higher education, thereby leveraging amplification and minimizing amputation. Contemplation encourages stakeholders to "stop and think" about the critical questions asked and decisions made in US higher education, thereby increasing intentionality about technopedagogical practices (Buchman, 1989, p. 36).

This dissertation examined fundamental problems stemming from discourses about the well-touted promises of digital technology in US higher education. Through a multi-site analysis of digital technology and pedagogy, this dissertation offered solutions

through practices of contemplation specific to technopedagogy. Twenty-first century higher education requires a dynamic both/and approach to the integration of digital technology into pedagogical practices. It is not a matter of all technology or no technology. It is not a question of independent or collaborative. It is not a decision between all information or no information. The either/or binary is outmoded. Educators, administrators, and other higher education stakeholders must acknowledge and address the pros and cons of technology in tandem. Digital technology holds great promise as catalyst for learning. However, a conceptual and pedagogical shift is required to fully realize this potential.

Higher education is a complex ecosystem. The individuals, institutions, and organizations involved in US higher education need to pay closer attention to the integration of digital technologies into pedagogies. Reshaping practices of teaching with digital technology in US higher education requires involvement of diverse stakeholders. Given the diversity of actors involved in higher education, it is important to interrogate sociocultural conceptions about the purpose digital technology and practice of teaching. To realize a contemplative pedagogy with digital technology, it is necessary to understand discourses at many scales surrounding digital technology and teaching with technology within US higher education. This dissertation combined a critical empirical analysis of the use of digital technology in contemporary US higher education with practical interventions to demonstrate the value of contemplative technopedagogy.

What follows is the conclusion to a multi-site analysis of digital technology and pedagogy that provides a broader vision for technopedagogy in higher education – that

revolutionizing teaching in higher education is hard work, developing a new technopedagogical paradigm requires persistence and creativity, and it is not enough to simply identify the shortcomings of digital technology use and pedagogies in contemporary US higher education – by encapsulating the answers to the research questions explored in each preceding section. The remaining sections of the conclusion accomplish three objectives: (1) briefly recapitulates how the dissertation addressed technopedogoical concerns at three interconnected levels in US higher education; (2) explains what the research results from the four preceding manuscripts offer the larger discourse about technopedagogy in higher education; (3) identifies future research that needs to occur in order to advance contemplative technopedagogical practices in US higher education.

Addressing Technopedagogical Concerns

In effort to improve technopedagogical practices and educational outcomes, this dissertation utilized an interdisciplinary science and technology studies (STS) research toolkit to analyze digital technology as one aspect of a complex higher education ecosystem. To analyze technopedagogy in US higher education at three interconnected levels, the four manuscripts utilized theories and conceptual frameworks from STS (Downey & Dumit, 1997; Downey & Zuiderent-Jerak, 2016; Foucault, 2002; Hughes, 2005; Jensen, 2007; Latour, 2004; Woolgar, 1986; Zuiderent-Jerak & Jensen, 2007), Social Construction of Technology (SCOT) (Bijker, Hughes, & Pinch, 2012), Intellectual History of Technology (Marx, 1997; Schatzberg, 2006; Raymond Williams, 1985; Rosalind Williams, 2002; Winner, 1977), augmentation (Campbell, 2006; Engelbart,

1962) to answer questions about digital technology (McLuhan, 1964; Papert, 1993; Postman, 1993), pedagogy (Illich, 1971; Lusted, 1986; Postman & Weingartner, 1969), technopedagogy (Newson, 1999; Papert, 1997; Wesch, 2013), and contemplation (Buchmann, 1989; Levy, 2006, 2007; Shapiro, Brown, & Astin, 2008; Zajonc, 2013). This robust and interdisciplinary theoretical and conceptual framework is critical for analyzing the complex higher education ecosystem in order to affect change in technopedagogical practice. As Elmborg (2011) emphasized, "Along with technical imperatives have come a series of human questions about the impact of new technologies on our ways of teaching, learning, and thinking" (p. 339).

Acknowledging the interplay of discourses about praxis, digital technology, and pedagogy, the four preceding manuscripts examined three interconnected levels – national, institutional, and experimental teaching-learning environments – to address some of higher education's technopedagogical concerns.

National. Examining the national discourse represented in articles from *The Chronicle of Higher Education* demonstrated that digital technology in teaching-learning environments was frequently adopted and implemented across higher education without critical evaluation. This historical and discursive analysis revealed how technopedagogical practices have or have not been imparted to or employed by educators in US higher education. The inductive approach to data analysis led to the development of the Contemplative Technopedagogy Framework. The Contemplative Technopedagogy Framework offers stakeholders across higher education a structure to simultaneously contemplate the positive and negative aspects of a digital technology

within a particular context. This framework is a place to begin a contemplative approach to shifting national level discourse about augmenting teaching-learning environments with digital technology in higher education.

Institutional. Researching discourse at the institutional level demonstrated how complex economic circumstances, sociopolitical criticism, and institutional decisions shaped the development and dissemination of a technocentric technopedagogical ideology within the Faculty Development Institute (FDI) at Virginia Tech. Research also revealed the absence of a particular pedagogical framework throughout FDI's 20+ year history. Indeed, due to contextual dynamics, pedagogy played an increasingly diminished role as FDI programming evolved. This in-depth case study offers two important lessons for faculty development centers as well as other higher education stakeholders. First, if faculty development centers intend to participate in shaping the digital technology landscape of higher education it is necessary to concurrently develop the conceptual infrastructure (i.e., programming, education) and technology infrastructure (i.e., hardware, software, IT systems). Second, faculty development centers should endeavor to mindfully balance technology and pedagogy when developing and disseminating programming for large-scale, digital technology-oriented faculty development. As faculty development centers across US higher education continue to grapple with the growing prevalence of digital technology in US higher education, a contemplative approach to technopedagogical matters will increase pedagogical resilience by equipping educators with a framework for making informed, engaged, holistic decisions about the possible pedagogical role(s) of digital technology amidst diverse contextual pressures.

Experimental Teaching-Learning Environments. Through experiments conducted in teaching-learning environments, the research accomplished within manuscripts three and four exemplifies how collaboration among stakeholders in US higher education has the power to spark contemplative technopedagogical innovation. Manuscript three applied the Contemplative Technopedagogy Framework to the iterative development of a Tumblr assignment. This mixed-methods research demonstrated how contemplative technopedagogical attributes can be applied during the development and revision of social media assignments to enhance teaching-learning environments in US higher education. Manuscript four was influenced by the Contemplative Technopedagogy Framework to develop an infographic assignment for practitioners across health education disciplines. These experiments demonstrate to a wider audience how philosophies and ideologies from STS, pedagogy, contemplation, and library studies can be translated to engage in "making and doing" collaborations with researchers, educators, and students across higher education (Downey & Zuiderent-Jerak, 2016; Zuiderent-Jerak, 2015). In their application of the Contemplative Technopedagogy Framework, each experiment demonstrated how contemplative collaboration can leverage the interconnected nature of the higher education ecosystem to affect positive pedagogical change. Collaboration is key and autonomy is a myth. Higher education can benefit from a pedagogical framework that contemplatively embraces the technological environment that constantly and infinitely connects individuals with others and information.

Discourse, Conception, and Action to Affect Technopedagogical Change

Discourse shapes conceptions and conceptions shape action (Foucault, 2002; Woolgar, 1986). This dissertation examined discourse, conception, and action related to digital technology and pedagogy at three levels – national, institutional, and experimental teaching-learning environments. The technopedagogical discourses analyzed within this dissertation are interconnected reflections of and responses to the ideologies and actions produced at and disseminated from each research site. Taken together, digital technology is expected to augment pedagogy in US higher education, but too little attention is given to matters of purpose and method. The Contemplative Technopedgagogy Framework offers a valuable tool for increasing contemplation about technopedagogical practices within the various ecosystems and contexts that US higher education exists. This dissertation contributes to the scholarly understanding of and practice of teaching with digital technology in contemporary US higher education.

Research results from this dissertation's analysis of interconnected discourses, conceptions, and actions demonstrate how a contemplative approach to digital technology can more effectively and holistically augment teaching and learning in US higher education. The preceding statement is exemplified in myriad ways throughout this dissertation. The discourse disseminated within *The Chronicle of Higher Education* influenced the technopedagogical ideologies and practices of institutes such as FDI. In turn, the pages of *The Chronicle of Higher Education* contained updates and analyses of the discourses being disseminated from institutes such as FDI. Each of the two translational manuscripts, focused on Tumblr and infographics respectively, is an attempt

to turn interdisciplinary theoretical discourses into actionable technopedagogical frameworks, including sample assignments. These translational manuscripts directly respond to ongoing scholarly and practice-oriented concerns found in research and other discourse regarding the growing uncritical adoption and application of digital technology in contemporary US higher education (Office of Educational Technology, 2017).

Organizations seeking to affect change in US higher education can learn important lessons from the discourses, conceptions, and actions analyzed across this dissertation to apply in praxis. Organizations of and within higher education make decisions amidst various contextual pressures that tend toward or away from integration of digital technology. Utilizing attributes of contemplation described within the Contemplative Technopedagogy Framework provides a structure for organizations to avoid the pedagogical pitfalls resulting from uncritical adoption or rejection of digital technologies in higher education settings. In this way, organizations can purposefully fulfill Engelbart's (1962) visionary aspiration of developing and utilizing computer technology as a powerful and near-natural extension of human cognition. Not in blind pursuit of a particular limited functionality, but pondering the intentions, opportunities, and costs along the way to intellectual augmentation (Naugthon, 2000).

Teaching with digital technology connects all types of people, places, and ideas across the higher education ecosystem. Engaged and purposeful teaching with digital technology requires the application of attributes of contemplation to technopedagogical matters at every level of higher education. Although initially intended to address larger scale sociocultural interactions, Jenkins et al.'s (2009) concept of participatory culture is

a viable model for understanding and contributing technopedagogy in higher education. According to Jenkins et al., participatory culture is an environment with "low barriers to artistic expression and civic engagement, strong support for creating and sharing creations, and some type of informal mentorship whereby experienced participants pass along knowledge to novices...members also believe their contributions matter and feel some degree of social connection with one another" (p. xi). Organizations seeking to affect change in higher education can learn from the in-depth discourse analysis, robust ethnographic case study, and mixed methods translational research provided in this dissertation to cultivate a participatory culture focused on contemplative technopedagogy in contemporary US higher education.

Analyzing how discourse, conceptions, and actions that arose from the pages of *The Chronicle of Higher Education* and within FDI interact and can be applied to experimental teaching-learning environments not only provides a rich understanding of digital technology and teaching, but also grants a solid foundation for building new technopedagogical praxis. Somewhat abstractly, but nonetheless importantly, teachers are (or at least should be) in the business of helping augment students' intellect; not in a physical sense, but with regard to complex and critical thinking. The interconnected analyses within this dissertation led to interventions that applied attributes of contemplation from the Contemplative Technopedagogy Framework to avoid what Papert (1993) refers to as the "remarkably Schoolish mold" (p. 162) where "the prevailing computer culture favored keeping our [students'] focus on the cognitive side of education" (p. 163). The interconnected research and recommendations from this dissertation avoid

the pedagogical shortcomings highlighted in Papert's case – computers or other digital technology in education to achieve discrete functionality with learning conceived as "facts and skills to be acquired" without consideration for the "individual on a level that was not reducible to such specific atoms of learning" (1993, p. 163). Integrating contemplation into US higher education technopedagogy encourages stakeholders to question the meaning of digital technology in higher education ecosystems and wonder how teachers and learners view the role(s) of digital technology as well as their individual and collective relationship with the technology.

Translating and applying these findings across various levels of higher education as a practitioner scholar, I engaged with relevant discursive communities and fostered a new hybrid identity as an STS-informed, library-based practitioner scholar. Like Jenkins (2008), I consider myself a "critical utopian" (p. 273). Among the many utopian options, I focus on practices, philosophies, and other possibilities to realize the best possible paradigm for digital technology and teaching within the US higher education ecosystem. Vast webs of pedagogies, educational policies, technological innovations, cultural practices, and other nodes have shaped (and continue shaping) US higher education. Altering the trajectory of technopedagogy in US higher education requires understanding the ties that bind these various nodes. Each of the four manuscripts that comprise this dissertation was a step closer to such an understanding.

The Future of Contemplative Technopedagogy in US Higher Education

Alas, it is not nearly enough to simply criticize the state of technopedagogy in contemporary US higher education. Reforming higher education is hard work. As Latour

(2004) writes, the critic must become “not the one who debunks, but the one who assembles” (p. 246). Rescued from the deconstructive tendencies of “critical barbarity,” (p. 240) critique offers an apparatus for investigating the entangled relationship between technology, higher education, pedagogy, and society. Now it is necessary to envision a different type of teaching-learning environment; one that is not fettered by deeply ingrained sociocultural assumptions regarding the purpose and practice of technopedagogy in higher education.

Now is the time to build upon the interconnected discourses analyzed throughout this dissertation and disseminate findings in ways that contribute to a participatory culture. Within a participatory educational culture each learner “builds a trail of his interest through the maze of materials available to him” (Bush, 1945). Gender specificity aside, this is a remarkable description of how we might recast higher education. Building new interdisciplinary trails of research that bring together educators, administrators, students, and other stakeholders in specific contexts across higher education will enable a more robust understanding of how the integration of contemplation into technopedagogy influences contemporary US higher education teaching-learning environments. Moreover, additional research is required to understand the paths and destinations of these various trails. In order to demonstrate the full promise of the Contemplative Technopedagogy Framework, it is necessary to test the approach at various levels, using numerous digital technologies, within diverse populations, and different settings throughout the higher education ecosystem. Such rigor will provide opportunities for

iterative revision and demonstrate the value of contemplative technopedagogical practice to contemporary higher education teaching-learning environments.

The Contemplative Technopedagogy Framework – developed from interdisciplinary theory and original research and translated into practice throughout this dissertation – engages with a growing "making and doing" community within STS. This framework is my contribution as a practitioner scholar to cultivating a participatory culture focused on pedagogy (Downey & Dumit, 1997; Downey & Zuiderent-Jerak, 2016; Jensen, 2007; Zuiderent-Jerak & Jensen, 2007). This amalgamation of participatory culture and practitioner scholarship builds upon Downey and Zuiderent-Jerek's (2016) explanation of making and doing as "a mode of scholarship that involves attending not only to what the scholar makes and does but also to how the scholar and the scholarship get made and done in the process" (p. 225).

In the same vein, and anticipating what Jenkins et al. (2009) were yet to utter, McLuhan (1960) issued an important call for further cultivating participatory culture in my own and others' scholarly work, "Education has become everybody's business in our society. The globe has become a community of learning." Leveraging the collective intelligence of the global community is key. Since "[n]one of us can know everything; each of us knows something; and we can put pieces together if we pool our resources and combine our skills," (Henry Jenkins, 2008, p. 4) and collaborate around common goals. Reshaping practices of teaching with digital technology in US higher education is complex and requires input, testing, implementation, and approval from diverse stakeholders. Cultivating a participatory culture focused on technopedagogy creates space for diverse

actors and broad interests to coalesce and produce new scholarly understandings of digital technology and teaching that can also be translated into improved technopedagogical practices and educational outcomes.

To that end, the inductively generated Contemplative Technopedagogy Framework can and should be applied within various other sites at each of the three levels identified within this dissertation – national, institutional, and experimental teaching-learning environments. For example, a qualitative Delphi technique could be applied to the Contemplative Technopedagogical Framework at various sites and levels (Murry & Hammons, 1995). Applying the Delphi technique to the Contemplative Technopedagogy Framework would engage a panel of thematically pertinent experts in examining the framework to determine its widespread applicability. The panel would thereafter iteratively modify the structure of the Contemplative Technopedagogy Framework until arriving at consensus regarding the framework's applicability across various levels and sites within the higher education ecosystem. In addition to the Delphi technique, the Contemplative Technopedagogy Framework will benefit from the development of more precise pedagogical frameworks for each of the attributes of contemplation. Development of this additional pedagogical layer would involve participation of pertinent experts and testing by educators and other higher education stakeholders.

Digging deeper reveals how participatory culture provides a useful framework for re-envisioning technopedagogy in contemporary US higher education. In many ways, contemporary higher education works from the assumption "that learning remains in a 'centered' activity with large numbers of students routinely focused on the teacher as well

as a limited selection of carefully selected repositories of knowledge such as textbooks" (Raschke, 2003, p. 4). Future research could measure metacognition gains of students and faculty after using the Contemplative Technopedagogy Framework and purposefully integrate of specific digital technology into a teaching-learning environment.

While "[t]he myth of the teacher as 'Hal the computer' dies hard," (Raschke, 2003, p. 57) it is just that, a myth. Investing (both conceptually and financially) upon a technological fix within higher education without first critically contemplating and evaluating matters of purpose and method has significant implications for pedagogy. The contemporary technosocial environment has exponentially increased opportunities for idea expression and circulation to an ever-expanding public. Such an environment holds potential to cultivate a widespread and bottom-up participatory culture to re-envision technopedagogy across all levels of contemporary US higher education. This dissertation provided to two applications of the Contemplative Technopedagogy Framework within experimental teaching-learning environments. Therefore, to test the validity of the framework and realize its potential for altering the trajectory of technopedagogy, the idea needs to be shared more widely. The Contemplative Technopedagogy Framework needs to be applied and measured within sites beyond teaching-learning environments. The framework should be tested within organizations, institutions, and centers (e.g., faculty development centers, digital scholarship labs, media outlets, professional conferences) that are beyond, but certainly influence the teaching-learning environment. Additionally, the Contemplative Technopedagogy Framework will benefit from testing within diverse

disciplines by diverse participants (within and beyond US higher education), using a wide range of digital technologies, and utilizing control and comparative groups.

I offer the Contemplative Technopedagogy Framework as a solution to what ails teaching within contemporary US higher education. The framework developed out of this dissertation's novel and rigorous multi-site analysis of digital technology and pedagogy in contemporary US higher education. In its nascent form, the Contemplative Technopedagogy Framework is now beginning to engage with relevant discursive communities. In order to mature, the Contemplative Technopedagogy Framework must participate in a multi-pronged discourse among interdisciplinary scholars and practitioner communities. As a self-reflexive STS practitioner scholar, I intended to facilitate this discourse in order to identify what needs further explanation, what needs defending, and what needs revision. The ultimate aim is to integrate contemplative technopedagogy into US higher education in order to creatively revolutionize teaching with digital technology. After all, the digital technology is not the thing, it is the thing that gets us to the thing…teaching and learning.

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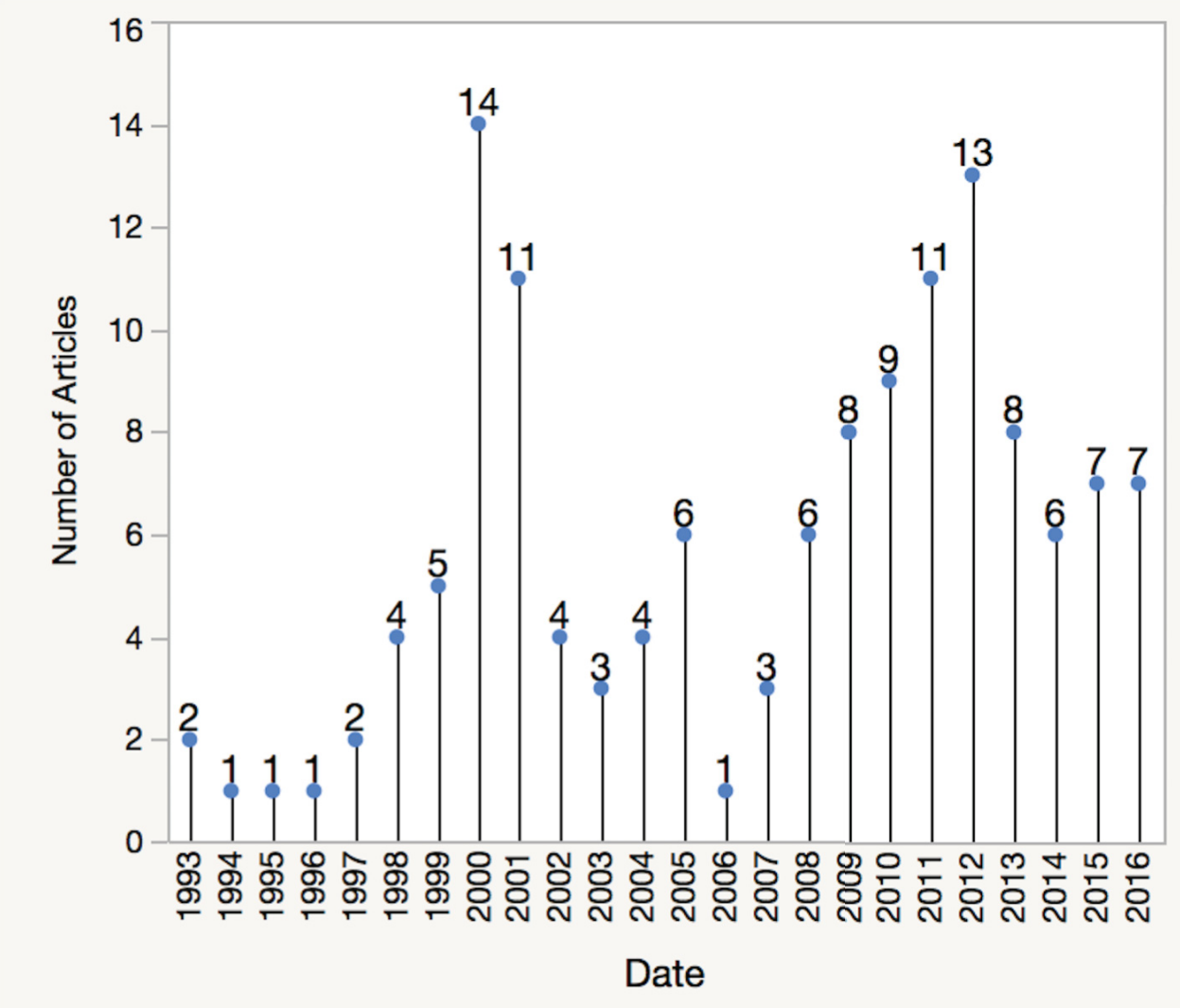
Appendix 1

Distribution of Authors Yielded from *The Chronicle of Higher Education* Search String "teaching" + "technology", 1993 – 2006

Appendix 2

Distribution of Articles by Year from *The Chronicle of Higher Education* Search String "teaching" + "technology", 1993 – 2006



Note: 10% of articles per year were randomly selected from a list of 1,345 total articles. The 1,345 total articles were yielded by using the search string *teaching* + *technology* in the publication, *The Chronicle of Higher Education.* Rounding occurred, yielding 137 total articles.

Appendix 3

Sample Tumblr Assignment

[course number: course title]
[date]

Due Dates

- [date]: Tumblr proposal
- [date]: Tumblr set up
- [date]: Tumblr post 1
- [date}: Tumblr post 2, etc., etc.
- [date]: Tumblr reflection
- [date]: # comments due on classmate's Tumblr, although you should be providing these comments throughout the semester

Total Points: [#] points

Getting Started with Tumblr

In short, Tumblr (and other social media) provides opportunities to more thoroughly explore [insert key course themes such as research, politics, culture, geography, etc.] Tumblr is the social media tool that will assist you in exploring the intricacies of [insert overarching course topic]. Your Tumblr account will become a space for information dissemination, professional networking, and intellectual meandering, centered around the themes and concepts of [insert course number]. Ultimately, Tumblr, a form of social media, will help to bolster your academic and professional careers.

Below are a few steps to get you up and running with Tumblr. Of course, if you have any questions, comments, or concerns, please do not hesitate to contact me [insert e-mail].

1. Open your preferred internet browser and go to tumblr.com
2. Complete the "Sign up" section
3. Tips When Creating a Password
    a. Use a combination of akLafJHBj, 8597143, and #&)!#$* (i.e. letters, numbers, and symbols).
    b. Switch up your chaR@ctEr5
    c. Don't make it easily guessable
    d. Use a password management tool (e.g. iCloud Keychain, Chrome, 1Password, Last Pass, Keeper, etc.)
4. Tips When Creating a Username
    a. Before determining your username, it is wise to pause for a moment…Think about the significance (and signification) of potential usernames — both to you and to all your readers (those who we intend to read your posts and those who may stumble upon your Tumblr feed). Aside from acting as your

login credential, the “username” is also how readers will identify you as an author of Tumblr content and associated content.

b. Think for a few moments about how you wish to portray yourself in the digital arena. Keep in mind that any future posts, reblogs, favorites, lists, and associated content will associate with this “username.” Therefore, you may want to create a “username” that is significant, identifiable, memorable, thematically relevant, but still somewhat universal. In other words, a username similar to [insert course number and semester], although very significant, may not have the universality that one could use when using Tumblr beyond this semester. Just some food for thought, ultimately the decision is yours.[15]

5. Click “Sign up”
6. Complete the age verification section
    a. Fairly straightforward, but it is always a good idea to review the “Terms of Service”
    b. Click “Next”
7. Complete the CAPTCHA (Completely Automated Public Turing test to tell Computers and Humans Apart) section
8. Click “Almost Done!”
9. Complete the “Make a Blog” section
    a. Title – Create a title that is significant, identifiable, memorable, and thematically relevant.
    b. Description – Write a short description or biography of yourself. Again, think in terms of significance, identifiability, memorability, and thematic relevance. Give current and potential followers a sense of who you are and what you’ll be (re)blogging about. Don’t forget to mention that you are a burgeoning expert on matters of [insert course themes or topics].
    c. Icon – Upload a professionally-oriented image that will function as your Tumblr icon. Since icons appear quite small on mobile devices, don’t use anything too complex. Just as with the username, I encourage you to select an image that is significant, identifiable, memorable, and thematically relevant.
    d. Header – Make sure the header is professionally-oriented, significant, identifiable, memorable, and thematically-relevant.
10. Click “Make it”
11. Find blogs to follow
    a. Select from Tumblr-generated “Trending Blogs” lists
    b. Search by keyword or blog title.
    c. Click “+” to follow a blog

[15] Please note that Tumblr usernames can be changed (via the main section of “Settings”). That said, for the sake of continuity, identifiability, and memorability, you are encouraged to maintain a consistent Tumblr username. If you have other Tumblr-able content (i.e. materials that fall beyond the purview of [insert course number] or your professional audience, you may wish to create an alternate Tumblr account. Feel free to contact me with questions.).

    d. After following at least 3 bogs, click “Next step”
12. Email confirmation
    a. Before you can start posting, you’ll need to confirm your email address
    b. Don’t worry it’s simple — Tumblr sent an email to the email address you used to create an account. Click the confirmation link provided in the email.
    c. You may now head back to your Tumblr account, adjust settings, and begin creating audio/visual/textual content
13. Send your Tumblr URL to [insert email of instructor or teaching assistant] by [insert date].
    a. Each student will develop and disseminate your own Tumblr content (e.g. posts, reblogs, favorites). Your unique and independent Tumblr feeds will then be aggregated using the hashtag [insert course number]. This will enable authorial autonomy while still maintaining the important collaborative features of social media.
14. We’ll talk more about Tumblr, social media, digital professionalism, etc. as questions arise. In the meantime, please begin exploring your amazing new Tumblr account. You may want to modify the theme, create tweets, adjust settings, or any number of other things. For more information about Tumblr, social media, digital professionalism, etc. please visit:
    a. For Tumblr help, click on the question mark icon at the top of the screen.
15. Go forth and Tumble!
    a. To help organize things, be sure to categorize your posts using # [insert course number]. Anytime you write a post relevant/tangential to [insert course number: course title], just add # [insert course number]. Using this method will allow create a hashtag (that’s this symbol #) feed that contains all posts using # [insert course number]. If you have questions/concerns about posting and/or hashtag categorization, don’t hesitate to e-mail your instructor.
    b. To better acquaint yourself with Tumblr, feel free to introduce yourself, add some information about your goals and interests for your internship, or any other thoughts tangential to [insert course number], [insert course theme], [insert course topic].

Tumblr Proposal

For this assignment, **create a document and include the following**:

1. Proposed Tumblr title
2. Proposed topic
3. Expected audience
4. Reason you want to create a Tumblr about this topic
5. Two potential valid and reliable resources that you can cite in your Tumblr

Tumblr Posting

During the semester, each student will be responsible for **at least t# Tumblr blog posts**. Students are also expected to engage with colleagues’ social media activity by providing

 # comments on different blogs each week. Tumblr comments will be graded at the end of the semester – each student should have commented # times spread evenly throughout the semester.

1. Log into your Tumblr site.
2. To create a blog posting with # words, click 'Aa Text' at the top of the page. Add a Title to the blog post. Begin typing your blog posting content in the box. You can format text, add a photo, or add a hyperlink by using the tool bar above the content box.
3. You are also encouraged to test and regularly use the functions to the right of the 'Aa Text' icon. These include just posting a picture, quote, hyperlink, chatting with another Tumblr account, or posting audio or video files. All of these functions should be related to research topic or food systems in some way.
4. To post your blog or other media to the public, click 'Post'. Make sure that you proofread before posting!
5. For more Tumblr assistance, see the great tips and tricks provided in the Help Center: https://www.tumblr.com/help.
6. Blog posts should focus on communicating current about the topic you selected and was approved in your blog proposal. Use correct grammar that demonstrates a mature writing style and professional presentation. Each blog should be # words (and should incorporate at least one picture or diagram/figure).
7. Your job is to provide a thoughtful critique of the material and communicate the facts to the public. To do this, thoroughly read and examine the content – determine if it is factual and take notes about your own opinion(s) about the information as it relates to your topic.
8. To write your blog, first include what the most interesting points of the information are, then summarize the rest (for example, if it is a peer-reviewed journal article, write about the surprising findings and then write about how the authors conducted the study, etc). This is where the art of blog writing occurs – only write about what is relevant; don't include details or jargon that are not applicable to your non-expert audience. Next, make sure to weave in your opinion in a professional manner – Is the information valid? How does it apply to your topic of interest? Be sure to include a visual in your posting and make sure that you explain or refer to it in text. Lastly, include a reference (any citation style is acceptable, just be consistent) to all of the places that you gather information.

Commenting on Tumblr

Each student should participate with other student's Tumblr accounts. To generate interaction and thoughtful reflection, I will post all student Tumblr links in a document located at [insert location]. To follow an account:

1. Enter the URL from student Tumblr links document posted on D2L into your search box.
2. When the site loads, click 'Follow.'
3. You are also encouraged to follow other non-class Tumblr accounts that are related to your approved proposal topic.

4. To comment, go to a fellow student's Tumblr that you have followed by finding through the list of who you are following located on the right side or your home page or going directly to the link.
5. 'Like' the post by clicking the heart in the bottom right corner of the Tumblr post.
6. Click the double arrow that is located in the bottom right corner of the Tumblr (left of the heart).
7. Add your comment directly above or below the reblog.
8. Your comments should be professional! Make sure your comment is respectful of other people's opinions, adds value to the conversation, and is meaningful. A Tumblr comment should include the following: Write at least # words. Share your opinion and thoughts about the post in a respectful manner. Do this by providing new or different information, a link to another piece of information, experiences or observations you have had related to the topic, or a new question related to the topic. Comments that are not respectful will be given a 0 and will be deleted.
9. Add [#class name] in the tags section (at the bottom of the reblog). This is how your instructor will read your comments.
10. Click the reblog button in the bottom left corner.

Tumblr Reflection

For the first three questions, please rate on a scale of 1 to 5: 5 = strongly agree; 4 = agree somewhat; 3 = neutral; 2 = disagree somewhat; 1 = disagree strongly. Please respond to questions 4 and 5 using as much text as you deem sufficient.

1. Tumblr was useful for learning about topics in [insert course]	5	4	3	2	1
2. Tumblr helped me to learn from colleagues about [insert course]	5	4	3	2	1
3. Tumblr helped me to apply course material to larger world issues in [insert course]	5	4	3	2	1

4. What do you now know that you wish you knew when you started using Tumblr?
5. This assignment is meant to take you through a journey back to the beginning of the semester and reflect on what you will take from the [insert course] Tumblr experience into your professional and personal life. Be creative and reflective! Summarize what you learned from participating in the [insert course] Tumblr assignment. In at least 3 paragraphs, discuss what you learned about professionally using social media and how you will apply it in the future. Discuss the opportunities and challenges for using social media in professional settings.

Tumblr Posts and Comments Rubric

Category for Assessment	**Accomplished Level 5**	**Developing Level 3.75**	**Incomplete Level 2.5**	**Insufficient Level 1.25**

Reflection	Succinctly describes and connects several key concepts from current research. It is clear that the writer read and reflected upon material as evidenced by maturity of and synthesis of posting.	Describes and connects few concepts from current research. It seems that the writer very quickly read or did not reflect upon material as evidenced by a posting that lacks full development.	Lacks coverage of key concepts from current research topic. It seems that the writer did not read and did not reflect upon material as evidenced by a posting that has very little development or synthesis.	Very limited coverage of topic.
Writing, Grammar, Syntax, and Word Count	Uses correct grammar, syntax, and word count (#) with a mature writing style, appropriate for educating the public.	Lacks one of the following elements: correct grammar, syntax, word count, but has a mature writing style.	Lacks one or more of the following elements: correct grammar, syntax, word count and does not have a mature writing style.	Attention to correct grammar, syntax, word count, a mature writing style was not conveyed.
Presentation	Overall, the Tumblr post is presented in a professional manner – easy to navigate and read because of organization. One or a few pictures are present to interest the reader.	The Tumblr post lacks one of the following elements: easy to navigate, easy to read, organized, graphics.	The Tumblr post lacks more than one of the following elements: easy to navigate, easy to read, organized, graphics.	The presentation of the Tumblr post Tweet is unprofessional.
Total Points Possible Per Tumblr Post #				
Commenting	The student comments, hearts,	The comments connect a few concepts, but it	Lack of coverage of key concepts	Very limited or no coverage of key concepts

	reblogs, and provides a significant point on two Tumblr accounts.	seems that the comment did not reflect on material fully on two Tumblr accounts.	in comments on two Tumblr accounts.	in comments on two Tumblr accounts.
Total Points Possible Per Comment #				

Appendix 4

INFOGRAPHIC ASSIGNMENT FOR THE HEALTH SCIENCES

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OBJECTIVES // This assignment will help you to:

1. *Understand* the purposes of and potential uses for infographics
2. *Cultivate* creative visual communication skills
3. *Disseminate* a complex health topic to diverse audiences

DUE DATE // [date]

OVERVIEW // Infographics are graphic depictions of complex information (e.g., knowledge, data, concepts, ideas, etc.). This medium relies upon visual elements to clearly and concisely communicate complex information to diverse audiences. Infographics use evidence and practice-based data, compelling statistics, easy-to-read fonts, complimentary color schemes, simple charts, bold graphs, and other graphics to disseminate information in quick and easily digestible format. For this project, you will work [independently or in small groups].

ASSIGNMENT // As a group, decide on one health topic as the foundation for creating an infographic. For example, you could focus on [fill in examples. For example, sleep disordered breathing among adolescents, mental health and mental disorders in early life, or vision loss among older adults]. Upon selecting a topic, your group will develop an infographic to disseminate the topic in a way that effectively communicates with diverse audiences (i.e., media, scientists, non-scientists, non-disciplinary experts, disciplinary experts, policymakers, voters, etc.).

BRAINSTORMING

1. ***SCOPING //*** Familiarize yourself with the infographics genre. What makes one infographic more effective or engaging than another? **Explore other infographics** related to topics we've discussed in class to better understand which elements, layouts, etc. are important for creating a visually appealing, concise, and clear message. Use examples for inspiration when designing your infographic. Be sure not to copy any content for your infographic – this is a creative endeavor. Here are some examples to kick start your investigation:
    a. How parents can help their child maintain a healthy weight
        i. https://www.niddk.nih.gov/health-information/health-topics/weight-control/childhood-obesity/Documents/Childhood_Obesity.pdf
    b. Comparison of health care coverage and access between men and women
        i. http://jamanetwork.com/data/Journals/JAMA/934167/jig150001fa.png
    c. Relationship between hunger and malnutrition
        i. www.fao.org/resources/infographics/infographics-details/en/c/238873/

2. ***SELECT //*** You've investigated the infographic genre and better understand its elements, layouts, and conventions. Now, it is time to **choose a topic**. Remember, infographics should tell a story, identify causes and issues that are supported by evidence and practice-based data, and should have sustainable solutions. A phrase (or short sentence) is all that should be required to concisely communicate the idea, story, or concept of your infographic. For example, an infographic might:
    a. Provide recommendations to parents to help their child maintain a healthy weight
    b. Present differences in health care coverage and access between men and women
    c. Present the relationship between hunger and malnutrition

    Be sure to test your topic with a few peers and ask for feedback regarding clarity and edit as necessary. Your group must submit your topic to [instructor] for approval via email by [date]. If you are working in groups, one person should send the email to [instructor] on behalf of the group with cc: to other group members. Please send your email to [e-mail address].

3. ***RESEARCH //*** Use skills developed in class (e.g., finding, assessing, and using credible articles) to find evidence and data from your course readings, peer-reviewed journal articles, and other quality professional sources about your topic of choice. Remember, a quality resource should be current, provide authoritative information, be reliable, and have a transparent purpose. You must use at least 5

quality professional sources for your infographic. You will need to cite your sources using [format type]. After your readers are captivated by the infographic, citations provide them with additional resources for further reading.

You will document your credible research with an annotated bibliography. Your annotated bibliography should include a short summary (5 to 7 sentences) of each source with description of how the source will be useful for your infographic. Please follow guidelines for summarizing and assessing sources for an annotated bibliography at [website for reference formatting]. Submit annotated bibliography to [submission site or e-mail of instructor] by [date]. [The instructor] will provide you with feedback on your annotated bibliography. Please be aware that [you or your group] may be asked to conduct additional research in order to meet the minimum research requirement for your infographic.

4. ***WRITE //*** What essential information about the topic do you want your readers to understand? What are the most compelling pieces of knowledge about your topic? Write down the key concepts and compelling information about your selected topic. Your infographic will include visual elements to clearly, concisely, and captivatingly communicate key concepts, essential information, and compelling knowledge to diverse audiences (i.e., media, scientists, non-scientists, non-disciplinary experts, disciplinary experts, policymakers, voters, etc.) – make sure that the information you identify is the most important and most compelling.

5. ***SKETCH //*** Before you begin creating your infographic within the infographic software of your choice, it is a useful conceptual exercise to sketch your infographic. What is the story you are going to tell? Grab a pen, pencil, crayons, or other writing implements and visually organize your key concepts on paper. Draw a flowchart that shows what order the data should be presented. To be most effective:

    a. begin with a compelling title that tells your story or conveys your message
    b. identify the cause or issue
    c. present facts and figures that are quality and persuasive
    d. discuss strategies to address the topic

DEVELOPING

1. Explore various infographic software available for your use. Examples are PiktoChart, Visually, Visme, and many more. Practice making your infographic in each software.
2. Choose one infographic software based upon its usability, compatibility with your infographic sketch, and cost of development (we suggest that you choose free).

3. Sign up for a free account and select a free template.
4. Find the infographic software's help center for specific directions about how to incorporate the following elements:
    - Modify an existing template or begin with a blank canvas.
    - Keep in mind that your aim is to build a visually appealing infographic that clearly and concisely communicates complex information to diverse audiences.
    - Edit the template by double-clicking and replacing default text with information (e.g., facts, statistics, words, etc.) pertinent to your topic.
    - Search for new graphical elements to include (e.g., charts, maps, icons, pictures, tables).
    - Change colors of background or fonts.

DESIGNING

1. ***FONT //*** For graphical cohesion, use no more than two different fonts. Remember, any font you use should be very readable.

2. ***COLOR //*** Choose one or two main colors for the background and one or two main colors for fonts throughout. Shades of your color selections are acceptable to use. Too many colors make the infographic difficult to read. Use colors that are complimentary own another and (if possible) related to your topic. For example, if you're displaying concepts about rhubarb's place in the diet, choose pinks and greens.

3. ***BLANK SPACE //*** Don't be tempted to clutter your infographic. Provide plenty of blank spaces to split up your concepts, differentiate ideas, and increase readability.

FINALIZING

1. ***PREVIEWING //*** Periodically, it is useful to zoom out to see what your infographic looks like as a whole. Make sure to frequently and automatically save your progress while you preview your work.

2. ***DOWNLOADING //*** Download your infographic as a [PNG, JPEG, PDF]. Submit the first iteration of your infographic to [submission process] by [date].

3. ***MARKET TESTING //*** When you feel your infographic is visually appealing, clear, and concise, show it someone you know. Ask them what they learned from your infographic. Did they find anything confusing? Are there areas that could be modified to improve visual appeal? Any suggestions to increase clarity? Is the infographic too

wordy – how can it be made more concise? [You or your group] should complete this step by [date].

4. ***REVISING //*** Consider the feedback provided by your first reader. Implement suggestions to help increase the appeal and readability of your infographic. Are there other changes you think might be useful? Be sure to take notes on how market testing affected your final product so that you can include this information in your presentation. After you are satisfied with the new draft, download a new PNG, JPEG, or PDF file. Save your infographic as **groupname_infographic.** Submit your final infographic to [where to submit] by [date and time]. The infographic is worth [point value].

INFOGRAPHIC REFLECTION // After you are done creating, testing, and revising your infographic, each group member will write a brief (i.e., 1-page or less) MS Word document that addresses:

1. What message are you communicating within your infographic?
2. Why did you choose this topic?
3. What did you like about creating an infographic?
4. What was challenging about creating an infographic?
5. What did you learn while creating an infographic?
6. How can you use infographics in the future?

Save the MS Word document as **lastname_infographicreflection.docx.** Submit your infographic reflection to [where to submit] by [date and time]. The infographic is worth [point value].

PRESENTATION // On [date] [you or your group] will share its infographic with the class in a **PowerPoint presentation**. In addition to presenting the infographic, [you or your group] will also discuss the process of creating the infographic, including why [you or your group] chose the topic, what sources were used to develop the infographic, and lessons learned about creating infographics. The presentation is worth 15 points.

SELF- AND PEER-EVALUATION // After your presentation, you will complete a self-evaluation [and a peer-evaluation for each member of your group]. **Note for groups:** Students who do not demonstrate sustained and substantive contributions to their group will receive zero points for their group project. The self- and peer-evaluation is worth [points].

ASSESSMENT // Please see the grading rubric for this project. Your infographic will be graded based on content, graphics, design and layout, and mechanics.

IMPORTANT DATES

[Date]

- Submit infographic topic

[Date]

- Submit annotated bibliography

[Date]

- Submit first iteration of infographic

[Date]

- Submit final infographic
- Submit infographic reflection essay

[Date]

- Present infographic to class
- Submit hard copies of evaluations