**ABSTRACT**

KRUGER-ROSS, MATTHEW JAMES. Toward a Preliminary Understanding of Educators' Assumptions about Technology: A Case Study. (Under the direction of Lori B. Holcomb).

This qualitative case-based study aimed to identify and uncover in-service teachers' assumptions regarding technologies. Feenberg's (1999) philosophical perspectives of technology served as the theoretical framework and as a data analysis tool to describe how educators' experiences and understandings about technologies affect their teaching. Participants' written philosophies of technology (n=6) as well as in-depth interviews (n=3) were analyzed and demonstrated a primarily instrumentalist philosophy of technology. These findings mirror recent research of political officials thinking about technology (Brooks, 2011) as well as pre-service teachers' perspectives on technology (Chen, 2011). The implications of the results suggest the need for further opportunities for in-service teachers to reflect critically on the intersection of education and technology.

# Toward a Preliminary Understanding of Educators' Assumptions about Technology: A Case Study

by
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## DEDICATION

This thesis is dedicated to my husband Rick, for your love, support, understanding, and pep talks throughout the process.

This document is also dedicated to Pat Dalton, who, in the short time I was able to spend with her at the end of her life, transformed who I was and who I was to become as a teacher, scholar, and person.

Finally, the words that follow are dedicated to all teachers and educators everywhere, for your kindness, caring, and loving commitment to the relationships with your students. You are a blessing.

## BIOGRAPHY

As a young child growing up in Burlington, North Carolina, I explored a variety of vocations before choosing the field of education, ranging widely from serving as the conductor of a major symphony orchestra to exploring the depths of space as an astronaut. However, a chance conversation during the summer break with my advanced math teacher helped me realize my gifts as an educator. More specifically, I discovered empathy within myself that wholeheartedly committed me to meeting the needs of students. My success in teaching math led me to apply and receive the North Carolina Teaching Fellows scholarship at NC State University.

While teaching in a public school would have been the next logical step for me after my undergraduate degree, I inevitably chose a position at Carolina Friends School, an independent school based in the Quaker faith and located in Durham, North Carolina. Teaching in a public school was part of the requirements of the Teaching Fellows scholarship and, if Teaching Fellow scholarship recipients did not teach in a public school, the students would be required to pay back the scholarship. I chose to teach in an alternative environment intentionally because I knew the experience would further my development as a critical educator. The mission and philosophy of Friends School empowered the school community to value the uniqueness of every individual, honor the power of integrity and silence, and encouraged staff to teach the whole child. In addition to my teaching and advising, I was able to advocate for the integration of technologies into the middle school classroom. The culture and climate of the school nurtured my growth as an educator, researcher and individual for over four years.

My research interests lie at the intersection of four strands: philosophy of education, critical theory, transformative learning, and educational technology. As such, I bring a unique, and much needed, balanced perspective to the table. I am at once a digital native (a term used to describe the relationship between the year of my birth and my comfort-level with technology) while also critical of the influence of technology, and I am able to keep one foot firmly planted in each realm. Being able to stand in both of these places creates the opportunity for rich conversations with peers and colleagues and makes me a valuable resource for ongoing professional development. Outside of education, my passions lie in reading, writing, travel, and spirituality.

## ACKNOWLEDGMENTS

I never realized how such a solitary enterprise as composing a thesis would depend so heavily on the gifts, talents, and good will of others. To all listed below, my deepest thanks for your support and assistance.

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Finally, I never could have predicted how heavily I would rely on the NC State Libraries had I not completed this document. I hope all students and faculty at NC State realize what an incredible asset the university Libraries are to the campus. I was never left in need of an article, resource, book, or manuscript. This is phenomenal considering this degree was completed via Distance Education. Therefore, it is with a full heart that I express my deepest thanks to Ann Rothe, the Interlibrary staff, and the entire Library staff for supporting my obsession with collecting resources for my research.

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# CHAPTER 1: INTRODUCTION

This section introduces and contextualizes the study. It begins with the context of the study, followed by the guiding research questions and identifies the significances of the study. The section closes with defining key terms and researcher biases. An overview of relevant research literature follows.

## Context of the Problem

Assumptions are unexamined facts or statements that are taken for granted because they are considered obviously correct. Examining assumptions can be alarming because, as they are identified and questioned, a person's most basic understandings of their experiences are uncovered. Anderson (2009) argues that assumptions are learned generalizations that guide action and support beliefs, values, and expectations. People's assumptions construct the everyday worldviews or mental models that humans use to give meaning to their experiences. Thus, assumptions are critical to understanding how humans make meaning. Philosophical perspectives, theories, and frameworks are grounded in assumptions that help guide how people think, believe, know, and act (Jackson, 2008; Mezirow, 2000). Some scholars utilize the term *habit of mind* to describe what is being defined here as an assumption. Within the context of the present study, habit of mind and assumption are used interchangeably.

Modern societies predominantly assume that technology is a neutral tool, awaiting human action (Brooks, 2011; Feenberg, 2002). Within the context of this study, technology is defined as any form of device that mediates teaching and learning. This group includes physical devices such as computers, laptops, computer projectors, electronic whiteboards,

calculators, cell phones, portable music players, and tablet devices. Nonphysical technologies including the Internet, cloud computing, learning management systems, and software are also included within this definition of technology. While books, pencils, and desks do fulfill the definition of technology suggested for the study, these and other similar items are not the focus of the study.

Instrumentalism is a way of thinking and understanding that considers technology as a tool to be utilized by humans. The assumption of technology as neutral represents an *instrumental theory* perspective (Feenberg, 2002). For example, a laptop computer is understood as a tool in the same way that a hammer or shovel is a tool. The way that the tool is used is up to the user. Therefore, to an instrumentalist, tools are at the disposal and discretion of the user not vice versa. Instrumentalism remains widespread due, in part, to its commonsense quality that make up unspoken assumptions regarding how the world or society works. Underlying instrumentalism is the commonsense view that technology is universal and can be utilized without regard for cultural, political, or social concerns.

Viewing technology as a neutral tool offers only one perspective. For example, Bowers (1988; 2000; 2005) argues that technologies are value-laden and embody the assumptions of their designers and engineers. These assumptions are then unknowingly reproduced in the users of the technologies. The integration of technology into education is built on assumptions that have not been subjected to adequate analysis and critique (Bowers, 2000; 2005).

The instrumentalist philosophy assumes that technology is neutral and can be controlled by humans. For example, an instrumentalist point of view would describe

calculators as simply a tool to help students complete their math quickly and efficiently. Chen (2011) recently conducted a study with pre-service teachers to identify the philosophical perspectives they held toward technology in their teaching. The majority of the pre-service teacher participants held an instrumental perspective. While a majority of society operates from an instrumental worldview (Feenberg, 2002), alternative perspectives for understanding and describing the human-technology relationship exist, each with differing assumptions describing technology and, therefore, ways of experiencing and thinking about technology. These differing perspectives offer insight and possibilities that are not accessible via an instrumentalist philosophy of technology.

Bowers (1988; 2000), for example, argues that educational technologies are situated within particular ideologies and can never be considered neutral. These ideologies, embracing Geertz's (1973) definition, exist as culturally-based interpretive frameworks that shape how we think, speak, see and act in the world. Bowers (1988; 2000) presents a detailed argument from a *substantivist theory* perspective. Feenberg (2002) notes that the substantivist perspective "argues that technology constitutes a new cultural system that restructures the entire social world as an object of control" (pp. 6-7). As such, a substantivist philosophy of technology assumes technology is value-laden rather than a neutral tool. By it's nature, learning management systems not only limit the way instructors can teach online, but also limits how students interact. From an instrumentalist perspective, this is simply the way things are. However, a substantivist perspective would note that learning was being conformed to the technology. Substantivists view technology as beyond the control of humans, arguing that society must conform to the demands of technology. Bowers (2000)

notes that despite the integration of technology into schools, “little attention is given to understanding how technology affects the quality of individual and community life” (p. 15). Concerns about how technology influences human life demonstrate a substantivist perspective.

Instrumentalism and substantivism are two differing perspectives to understanding technology, but are obviously not the only perspectives available. The instrumentalist perspective assumes technology is neutral and can be used as a tool as determined by the user, yet the substantivist perspective rests on the assumption that technology is value-laden and affects the user. Because instrumentalism and substantivism are founded on opposing assumptions, viewing technology from one perspective complicates being able to understand technology from the other perspective. The binary relationship between instrumentalism and substantivism limits what can be known and examined regarding technology. In order to uncover and analyze assumptions that limit human understanding and experience, Mezirow (2000) offers a model of transformative learning.

Mezirow’s transformative learning theory is an adult learning theory that suggests people construct *frames of reference* to facilitate the meaning-making process used to make sense of experiences (2000; 2009). By engaging in transformative learning, adults are encouraged to critically reflect on unexamined frames of reference and assumptions. Within transformative learning, instrumentalism and substantivism can be conceived as two separate frames of reference. Thus, instrumentalism frames how technology is understood in a completely different way than substantivism frames technology. A frame of reference consists of numerous assumptions held about the world, our relationships with others, and

ourselves (Cranton, 2006). The assumptions that make up our frames of reference hide alternative understandings and meanings much like blind spots in a car mirror (Mezirow, 2009). Viewing technology from an instrumentalist or substantivist perspective without reflection or analysis renders alternative perspectives about technology transparent and inaccessible.

Chen's (2011) study into pre-service teachers' views of technology demonstrates this transparency. When participants were asked to reflect on their philosophy of technology it was found that a majority operated from an instrumentalist perspective and also were unaware of any other way of thinking about technology (2011). Educators must be prepared to analyze critically assumptions made about technologies as they are the primary conduit for which students learn to use and understand technologies. Without examining their assumptions about technology, educators risk teaching these assumptions to their students without realizing they are doing so. Bowers (2000; 2005) argues that concerns regarding the environment and culture are specifically connected to uncritically examined assumptions made about technology. Assumptions about the way technologies impact students, curriculum, education, society, and the environment are important concerns for educators (Bowers, 1988; 2000). Kilbourn and Alvarez (2008) suggest that deeper exploration of the effect of technology on teaching and learning are lacking due to the pace of technological development. The lack of research into teachers' fundamental understandings of and assumptions about technology support is evidenced in recent research literature (Chen, 2011). What is known about the intersection of teachers and technology is grounded in existing studies of teacher technology use (MacBride & Luehmann, 2008), beliefs (Ertmer &

Ottenbreit-leftwich, 2010; Webb & Cox, 2004), values (Ottenbreit-Leftwich, Glazewski, Newby, & Ertmer, 2010), attitudes (Holden & Rada, 2011; Zimmerman, 2008), and technology integration (Baek, Jung, & Kim, 2008).

If conversations surrounding educational technologies are framed within the predominant perspective of instrumental theory (Feenberg, 2002), the resulting dialogue is inherently limited and based on uncritically examined assumptions about technologies and education (Bowers, 2000; 2005). Andrew Feenberg, a philosopher of technology, argues that technologies enter society and undergo a stabilization period that allows the social and political influences of the technology to be identified (2009). The Internet, Feenberg notes, has yet to stabilize, yet academics and cultural critics continue to evaluate the social, cultural, and political effects of networking technology (2009). Researchers interested in the social and cultural effects of technology within education have urged caution and greater mindfulness for decades (Bowers, 1988; 2000).

The purpose of the study is to investigate how educators understand technologies and how the assumptions made about technology frames and informs their teaching. The study extends the work conducted by Chen (2011), who explored pre-service teachers, and Brooks (2011), who examined educational technology policy in the Canadian province of Alberta, by providing an opportunity for in-service teachers to reflect clearly and explicitly on their assumptions and ways of thinking about technology. The next section describes the research questions that guide the study.

## Research Questions

The dramatic pace that Web 2.0 and web-based technologies progress has not created adequate opportunity for teachers to reflect on how these technologies are influencing their thinking about their teaching (Kilbourn & Alvarez, 2008). Rather than being able to mindfully integrate technologies into their teaching, educators are constantly attempting keep pace with new technologies. Researchers in academia are also struggling to identify the effect of Internet technologies on global economies, natural environments, and privacy concerns within society (Feenberg, 2009). Recent research has demonstrated Feenberg's (2002) suggestion of the prominence of the instrumental perspective within pre-service teachers (Chen, 2011) and educational policy (Brooks, 2011). Encouraging teachers to reflect on their assumptions about technology through reflective writing and in-depth interviews may help them more effectively and mindfully integrate technologies into their classrooms (Bowers, 2000; Chen, 2011). Research has shown that teachers are not given adequate time to explore, understand, and analyze their views on technology. As a result, teachers can impede student learning or be unaware of the lessons they are teaching about technology (Chen, 2011; Freidhoff, 2008). In order to address teacher assumptions about technology, the study was guided by the following two research questions:

1. What assumptions do educators hold about technology and its use in teaching and learning?

2. How do educators' assumptions about technology influence their teaching practice?

## Significance of the Study

The goal of this study was to describe teachers' assumptions about educational technologies and how these assumptions influenced their teaching practice. Koehler and Mishra (2008) suggest that "technologies are neither neutral nor unbiased; rather, particular technologies have their own propensities, biases, and inherent attributes that make them more suitable for certain tasks than others" (p. 5). However, recent research in educational policy (Brooks, 2011) and with pre-service teachers (Chen, 2011) demonstrates the assumption that technology is a neutral tool. Guided by the research questions above, the proposed study is significant in: (1) addressing an existing gap in educational technology research detailing teacher assumptions about technology, and (2) offering a philosophical analysis of technology from the unique perspective of educators. The significances are discussed and expanded in the following subsections.

### Extends and Enhances Scholarship

The results of the study add to an often-ignored body of work that critically examines technology in education and society (Bowers, 2000; Feenberg, 1991; Ferneding, 2003). Traditionally, philosophical explorations and analyses of technology are conducted within science, technology, and society studies (Chen, 2011) or cultural and media studies (Boler, 2010). By exploring teachers' assumptions about technology, this study fulfills the call for greater philosophical reflection and analysis that is often overlooked at the intersection of education and technology (Kilbourn & Alvarez, 2008). Research into teaching and learning with technology tends to focus on theories and frameworks that do not fully account for the ways humans negotiate assumptions related to technology. Educational technology research

has identified the importance of teacher knowledge, beliefs and attitudes related to technology (see Holden & Rada, 2011; Judson, 2006; Koehler & Mishra, 2008). The current study takes the findings of existing research one step further by examining the assumptions that inform teachers' knowledge and beliefs.

Web 2.0 and web-based technologies have transformed teaching and learning by challenging traditionally understood concepts such as curriculum, facts, knowledge, and authority (Dede, 2008, Kruger-Ross & Holcomb, 2012). The field of educational technology will benefit from encouraging philosophical reflection of teachers' assumptions about technology (Chen, 2011; Pring, 2010) because not only are teachers critical to the success of technology integration but also set the example for students in how to use technologies to support learning. Therefore, the results of the study may help prepare teachers, educational technology professionals, practitioners, and researchers to meet the needs of teachers in effectively and mindfully integrating technology into their classrooms.

**Offering the Philosophical Perspectives of Educators**

Feenberg (1999) argues that Western societies must encourage democratic dialogue about the influences of technology and society rather than continue to accept as given the effects of technologies produced by corporations and endorsed by governments. In particular, these conversations should include the voices of educators and students on their perspectives of technology. Teachers and students:

> … perceive and actualize overlooked potentialities not envisioned in the technical, economic or political rationality already inscribed in the network.

> They give new meaning on the basis of a 'situated knowledge' rooted in their unique relation to technology. (Feenberg & Bakardjieva, 2004, p. 16)

Brooks (2011) notes that it is likely that teachers may offer a more realistic account of the potential of technology within the context of the classroom. The current study showcases the ways of thinking about technology of six educators enrolled in an online graduate course in instructional technology in an effort to provide a voice for their perspectives on technology. Of the six participants, three were able to complete an in-depth interview. The three remaining participants who were unable to participate in an interview are presented to supplement the three Phase Two cases.

Cilesiz (2010) suggests that for greater clarity and deeper understanding there is the need for additional research in educational technology grounded in qualitative methodologies. Research considering teachers' experiences with technology have primarily utilized Likert-based scaling (see Konradt, Filip, & Hoffmann, 2003; Thatcher, Wretschko, Fridjhon, 2008; Weibel, Wissmath, Habegger, Steiner, & Groner, 2008). While worthwhile, these studies are only able to record the responses of questions asked and may not capture the entire experience of the phenomenon. Incorporating more diverse research methods, including an influx of qualitative methods, to study educational technology would provide greater depth and understanding and could be useful in the development of best practices and in policy development (Cilesiz, 2010).

The study is significant for expanding educational technology scholarship and incorporating qualitative methods to describe educators' ways of thinking about technology. By uncovering teachers' assumptions about technology as well as its influence on teaching

and learning, teachers, teacher educators, and professional development practitioners will be able to make more informed decisions about how to integrate and implement educational technologies. There exist multiple perspectives toward technology that are not readily considered in educational technology research (Ferneding, 2003). The results of the study provide an example of the dominance of the instrumental perspective among educators. The study results also point to the need for additional research to examine how teachers' assumptions about technology might be transformed to create new possibilities for understanding of teaching with technology. By extending educational technology research and describing educator perspectives on technology the study offers support to teachers as they integrate technologies into the classroom to support learning and teaching. The limitations and key terms of the study are introduced and discussed in the next sections.

## Limitations

There are four limitations of the study that must be addressed: the use of qualitative case study methods, researcher bias, data collection, and sample size. The first limitation concerns the methods that ground the study with respect to traditional understandings of validity and reliability (Yue, 2009). Brooks (2011) notes that some may regard qualitative case methods as a limitation because they allow for "(1) selective and purposeful data gathering, (2) personal investment of the researcher and a skeptical orientation to inquiry, and (3) interpretative analysis of data to determine underlying meaning and patterns" (p. 27). Therefore, the results of the study do not necessarily meet conditions for predictive and external validity as is common with quantitative methods. However, qualitative researchers suggest that gathering data that cannot be generalized is one of the strengths of qualitative

methods rather than a limitation (Yue, 2009). Analyzing the human phenomenon from a qualitative perspective provides researchers with information that may not be result from quantitative research.

The second limitation includes the researcher's bias in serving as the graduate teaching assistant for the students of the graduate course that served as the participation population for the study. By serving as the graduate assistant in addition to researcher, additional data regarding participants and their assumptions related to technology was readily available. Bracketing was incorporated as a strategy to minimize this limitation.

The data collection process is the third limitation. For example, the prompts required for the philosophy of technology assignment necessarily limited the type and depth of information participants may have shared. The questions developed for the participant interviews and the categories selected for the technology readiness survey limit participant responses. Because the research questions called for educators to reconstruct their understandings and experiences with technologies in their teaching, there also exists the limitation of participants' ability to reconstruct from memory their experiences reflected in the philosophy statements and in-depth interviews.

The final limitation concerned the sample population. Considering potential participants were enrolled in an advanced course focused on education and technology, the level of experience and comfort with technology must be acknowledged. Participants self-selected the graduate course in instructional technology and their inclination toward technologies in education influence the results of the study. Another limitation related to the sample population was the limited number of participants who were able to participate due to

time constraints and course enrollment. In the original conceptualization of the study, there would be four to six participants in Phase Two and between 15 and 17 participants in Phase Two. Phase Two participants would agree to allow specified coursework to be reviewed for the study and participate in a 90-minute in-depth interview. Phase One participants would agree to only allow their coursework to be reviewed and would not participate in an interview. The study presented here consists of six Phase One participants and three Phase Two participants. Therefore, the study should be considered a preliminary inquiry into educator assumptions regarding technologies. Specific recommendations to address this limitation including additional and varied participants and a more flexible population are addressed in the final chapter of the report.

## Key Terms

### Technology

It is critical to define the way that the word *technology* is used within the context of the study given the importance of how language is used to construct and convey meaning and understanding. Technology is defined as any form of device that mediates teaching and learning. This group includes physical (e.g. laptops, cell phones) and nonphysical (e.g. web-based technologies and cloud computing) technologies.

### Educational Technology

Educational technologies, then, are used to describe all technologies that are used to support teaching and learning. Defining educational technology in this way represents a context where learning, teaching, and education intersect with technology, including in and out of formal settings. For example, desktop and laptop computers and laptops within the

classroom are educational technologies. Also, mobile devices such as cell phones and iPods and projection technologies (SmartBoards, VGA projectors) are educational technologies. Twitter, Facebook, Google+, Moodle, and Blackboard are also educational technologies even though they are not necessarily contained within a physical space. The boundary expands to include any and all of these technologies as they may be used outside of traditional educational settings as well.

**Web-based & Web 2.0 technologies**

Web 2.0 is used to describe web-based technologies that are based on shared, user-generated content (O'Reilly, 2005) and includes blogs, social networks such as Facebook and Google+, and wikis. The terms *Web 2.0* and *web-based* will be utilized interchangeably to stress the social and interactive character of these types of technologies. Web 2.0 technologies challenge traditional understandings of time, place, and technology.

**Philosophy of technology**

Mitcham (1994) argues that there are two branches within the philosophy of technology. One branch emerges from an engineering and design point of view while the other considers the philosophical study of technology from a humanities and social science perspective. The humanities approach, including for example, Heidegger and Ellul, means to situate the study of technology as one of many components of human experience (Brooks, 2011). It is the humanities approach that frames and guides the questioning of assumptions and beliefs regarding technology. Therefore, the humanities perspective of the philosophy of technology informs the inquiry.

## Researcher Bias

To aid in transparency, I must acknowledge existing biases that affect the study. First, I served as the teaching assistant for the course identified for study one time prior and have familiarity with course materials, concepts, goals, and objectives. At the same time, I also collaborated on a major course redesign with the course instructor. In addition to serving as graduate student for the course, I am a graduate student in the instructional technology program. This position resulted in teaching and researching my peers in the program.

I became interested in educational technology as a field of study through my interactions with pre- and in-service teachers as they integrated technologies into their teaching. Specifically, my interest in teacher assumptions about technology resulted from reflections on troublesome conversations with educators. Too often, I found teachers speaking about technologies as if the teachers had no say in how the technologies would influence teaching and learning. Therefore, I came to the study expecting to find a variety of assumptions held by teachers. This bias of personal interest in the topic is also influenced by recent scholarship building on the philosophical perspectives first introduced by Feenberg (1999): determinism, instrumentalism, substantivism, and critical theory. A bias exists in selecting these four perspectives to guide data analysis as these categories structured how data was collected, analyzed, and shared in the report. With these biases addressed, I move to the next section to discuss literature relevant to the study.

# CHAPTER 2: REVIEW OF THE LITERATURE

## Introduction

This section provides an overview of the research literature chosen to inform and support the study. First, an overview of educators and technology is offered, embedded in the key findings of prior studies that guided the inquiry. Following, a review of research on assumptions based in transformative learning theory is offered. Finally, Feenberg's philosophy of technology framework is examined. This discussion includes an introduction to four perspectives on the philosophy of technology: determinism, instrumentalism, substantivism, and critical theory.

## The Relationship Between Educators & Technology

The integration of Web 2.0 and web-based technologies into teaching and learning requires opportunities for educators to pause, reflect, and engage in philosophical inquiry on how these technologies are influencing their thinking about their teaching (Kilbourn & Alvarez, 2008). Chen (2011) reports that a majority of his pre-service math teachers understood technology as a neutral tool. The pre-service teachers subscribed to a primarily instrumentalist perspective of technology that does not account for the social and cultural influences of technology. Possessing this perspective, therefore, limited the participants' ability to engage with the social effects of technologies. For example, because the pre-service teachers in Chen's (2011) research viewed technology as neutral tool, they were unable to examine alternative ways of using calculators in the classroom. Concurring with Kilbourn and Alvarez's analysis (2008), Chen (2011) notes that educators have not critically analyzed and reflected on the influences of Web 2.0 and web-based technologies. Fleming (2003)

surveyed almost 600 Canadian teachers' views on technology to discover a predominantly uncritical perspective toward technology. Holding such unexamined views may not help facilitate students' technological literacy skills (2003). Ferneding (2003) noted that upon further reflection, teachers hold multiple and often contradictory beliefs and assumptions about technologies. The current section reviews research pertinent to understanding the intersection of educators and technology.

Rapid development and acceptance of technology within education has resulted in disagreement regarding the actual effects rather than the promises made about its integration. For example, Cuban (1986, 2001) has argued that the promises of each new wave of technology in schools has not resulted in increased educational advancements. Additionally, Bowers (1988, 2000) warns against the dangers of perceiving technology as a neutral phenomenon, or as a tool that can be implemented without reflection. Much of what is known about the intersection of teachers and technology is grounded in existing studies of teacher technology use (MacBride & Luehmann, 2008) and technology integration (Baek, Jung, & Kim, 2008).

Ertmer (2005) suggests that teachers' pedagogical beliefs are the "last frontier" in the quest for technology integration. Recent research exploring how teacher beliefs about technology can be changed suggests this line of inquiry remains critical (Ertmer & Ottenbreit-Leftwich, 2010). Teacher belief systems contain multiple interacting, intersecting, and overlapping beliefs (Pajares, 1992). Hermans, Tondeur, Vanbraak, & Valcke (2008) note that "belief systems consist of an eclectic mix of rules of thumb, generalizations, opinions, values, and expectations grouped in a more or less structured way" (p. 1500). Pajares (1992)

states that these systems of belief are grounded in teachers' backgrounds, assumptions about reality, and, oftentimes, previous teachers.

These belief systems in turn influence how teachers use technology in the classroom (Angers & Machtmes, 2005; Hermans et al., 2008). A report published by Walden University's College of Education (2010) presents and dispels five myths about teachers, students, and 21st century learning. Their key finding was that "teachers' technology habits make a difference in their perceptions of student outcomes" (p. 10). Educators' technology habits are based within beliefs that are substantiated and grounded by assumptions. Brookfield (1995) notes that in order to be a critically reflective practitioner, an educator must examine the assumptions that guide their teaching practice. Ertmer (2005) was quite right in her assessment that teacher beliefs were "the last frontier."

Given the ongoing dialogue regarding teacher beliefs and technology, a coherent literature base examining educators' assumptions about technology does not currently exist (Chen, 2011). Existing research has demonstrated the impact of teacher's knowledge (Khoeler & Mishra, 2008), attitudes (Smarkola, 2008), and beliefs (Ertmer & Ottenbreit-Leftwich, 2010) in integrating technology into their teaching. However, assumptions are different from beliefs or attitudes. Beliefs, attitudes, behavior, and knowledge emerge as a result of assumptions made about the way things are (Clawson & Haskins, 2006; Mezirow, 2000) and therefore are critical to understanding teachers and technology (Bowers, 2000). Four studies approach educators' ways of thinking about technology but do so indirectly (Anderson, 2009; Brooks, 2011; Carroll & Eifler, 2002; Chen, 2011). Carroll and Eifler (2002) explored the metaphors used by educational technology graduate students and

identified six categories based on participant responses. Metaphors, traditionally considered a literary device, offer a way to uncover unspoken assumptions. The graduate students in Carroll and Eifler's study described technology as: (1) an entity with capacities, needs, and appetites, (2) a tease, (3) a specific kind of butler, (4) a tool, (5) a power without form, and (6) some iteration of a demi-techno-god-monster. These categories suggest the need for further questions. What is being assumed about technology when educators experience it as an entity? What is assumed when technology is simply power?

Interestingly, all participants emphasized the power technology had over their lives. In reference to their findings and future recommendations, the authors note:

> It appears unlikely that letting teachers use a new language arts computer program is going to make much difference if they believe that computers are the demi-techno-god-monster. Attention to that belief is going to have to precede the implementation of any technology-based innovation in the classroom. (Carroll & Eifler, 2002, p. 244)

While this study was completed prior to Web 2.0 and web-based technologies, it marks a unique attempt to grasp the ways that educators think about and understand the interaction between technology and society. The study also references teacher beliefs about technology while the present study focused on teacher assumptions about technology.

The second related study examined pre-service math and science teachers' assumptions about technology. Chen (2011) examined his students' written philosophies of technology and conducted interviews with volunteers. In his analysis, Chen found that most participants embraced technology as a neutral tool, or an uncritical, instrumental perspective

of technology. In addition, his students were ambiguous toward deeper analysis of their understandings about the nature of technology. Chen (2011) notes that it is imperative for educational stakeholders to clarify their understandings and assumptions about technology as the decisions regarding the integration of technology into schools continues to be driven by troublesome perceptions of the influences of technology. The current study built on the conceptual framework and methods utilized by Chen (2011) while exploring in-service teachers rather than pre-service teachers. In-service teachers have direct experience from the classroom that pre-service teachers do not. Also, participants in the current study are graduate students in instructional technology and thus have an pronounced interest in integrating technologies into teaching and learning, while the participants in Chen's (2011) study were undergraduate students in math and science education.

The third related study focused on analyzing public and policy discourses surrounding educational technologies in the Canadian province of Alberta (Brooks, 2011). Canada, while approaching educational technology from within a unique culture, is similar to the United States in its push for the integration of technology into schools. Brooks (2011) began her analysis by critically examining public policy documents followed by interviews with a number of school and political officials. The current study draws on Brooks' (2011) theoretical framing of Feenberg's philosophies of technology. Her findings demonstrated Feenberg's (1999) argument that instrumentalism remains the predominant philosophy of technology within society. Brooks (2011) adopts a critical discourse analysis framework in uncovering the assumptions of policy officials and documents in Alberta. She also notes that further research is needed into the ways that educators think about teaching with technology.

Specifically, greater analysis of educator assumptions related to technology is warranted (2011).

The final related study analyzed the assumptions about technology held by a superintendent of a school district (Anderson, 2009). In his analysis, Anderson (2009) reported that the superintendent possessed assumptions about technology that where influential in how he understood concerns of efficiency, sustainability, and the effect on student learning. These assumptions were found to frame and support the superintendent's leadership role in his school district and how initiatives related to technology integration and professional development were conducted. In presenting the assumptions held about technology by an administrator, Anderson (2009) demonstrated the critical influence of assumptions on how technology is understood. The current study answers the calls of Chen (2011) and Brooks (2011) for further research into the ways educators think about technology and education. The next section introduces and provides a background in assumptions grounded in Mezirow's (2000) transformative learning theory.

## The Relationship Between Language & Reality

Geertz (1973) defines an ideology as a cultural phenomenon that structures and frames human experience. Language, the capacity to communicate with shared meaning and understanding, is a cultural and social creation. As Heidegger (1962) notes, "language already hides within itself a developed way of conceiving" (p. 199). Similarly, Barrett (1978) acknowledges that the use of language comes with predetermined ways of thinking and being in the world:

> … for our world – the concrete world in which we live – does not come to us as something independent of language; we do not construct our world independently and then add it on to our experience; our world transpires within language. (Barrett, 1978, p. 76)

While there are real processes and substances in the external and internal world, Fairclough (2003) argues that discourse, a subset of language, has the power to create, frame, mediate, and help us imagine possibilities for the future. Searle (2011) notes that it is via language that corporations are made and marriages are pronounced. Transformative learning theory (Mezirow, 2000) and its treatment of habits of mind and assumptions offers grounding in the importance of language in understanding how humans make sense of and communicate about their experiences. This section provides an overview of transformative learning theory and assumptions.

**Transformative Learning Theory**

Transformative learning theory originally developed from Jack Mezirow's doctoral research (1975). In his study, he uncovered a process whereby women who had returned to continue their college studies shifted their perspectives to support a transformation in their ways of seeing and knowing reality. Within this process, Mezirow's participants were able to name limiting assumptions and, ultimately, were able to redefine their perspectives to support greater self-empowerment. In this way, the women were able to overcome disempowering frames of reference and habits of mind. Mezirow titled this process transformative learning, and it has dominated adult education research and practice for multiple decades (see Boyd & Myers, 1988; Cranton, 1994; Taylor, 2008).

Transformative learning theory is grounded in the distinction made by Jurgen Habermas (1984) between instrumental learning and communicative learning (Mezirow, 2003). “Instrumental learning is about controlling and manipulating the environment, with emphasis on improving prediction and performance” (Mezirow, 2003, p. 59). Communicative learning focuses on how meaning is constructed. Thus, transformative learning suggests that our ability to make meaning must be considered within any educational process.

Transformative learning theory is understood as primarily an adult learning theory that is grounded in the ways adults communicate and interpret meaning (Taylor, 2008). Mezirow (2000) refers to humans’ overarching meaning structures as frames of reference. Frames of reference are best understood as cultural paradigms, large interconnected assumptions that, quite literally, structure how people view and engage with reality. Taylor continues: “Frames of reference are structures of assumptions and expectations that frame an individual’s tacit points of view and influence their thinking, beliefs, and actions” (2008, p. 5.) A frame of reference can be broken down into two components: habits of mind and points of view.

A habit of mind is characterized as the individual assumptions that make up a learner’s frame of reference. Types of assumptions associated with Mezirow’s theory of transformative learning include a learner’s sociolinguistic, moral-ethical, epistemic, philosophical, psychological, and aesthetic perspectives (2000). Habits of mind or assumptions are then experienced in action as a point of view. When a person’s frame of reference or perspective is found to be insufficient and limiting, transformative learning

argues that the perspective can be transformed. The result is "a more fully developed (more functional) frame of reference ... one that is more (a) inclusive, (b) differentiating, (c) permeable, (d) critically reflective, and (e) integrative of experience" (Mezirow, 1996, p. 163). The perspective transformation process can be painful because learners must examine their deepest held assumptions (Taylor, 2008). Additional research into transformative learning utilizing arts-based (O'Sullivan, Morrell, & O'Connor, 2002), spiritual and emotional (Lawrence & Dirkx, 2010; Mamgain, 2011) methodologies are helpful in contextualizing the highly rationally and cognitive-centered transformational learning process. Transformative learning theory has also been criticized for its lack of attention to social transformation (Collard & Law, 1989), but Mezirow has recently revised his theory to include considerations of collective social change (Mezirow & Taylor, 2009).

While the current study was not meant to transform educators frames of reference used to understand and make sense of educational technologies, the study is grounded specifically on the concept of habits of mind, or assumptions, associated with transformative learning theory. The following subsection offers a number of differing interpretations of assumptions including Brookfield, Bowers, and Fairclough. This subsection concludes with an example.

**Assumptions**

Assumptions are generalizations that are taken for granted, unexamined, and unquestioned because they are obviously true. Assumptions guide human thought, action, and experience and frame beliefs, attitudes, and behavior (Anderson, 2009). Categories or domains of human knowledge are framed by philosophical assumptions and justifications or

habits of mind (Jackson, 2008). For example, there exist philosophies of science that are guided by particular assumptions made about reality and the world. Constructivism is founded on the assumption that humans construct their knowledge and understanding of the world. Transformative learning theory is grounded in constructivist assumptions (Cranton, 2006). Positivism is framed by the assumption that there is an objective world that can be known only through empirical methods and numerical analysis. Also, there are philosophies of education that are often referenced to situate research questions or methodologies (e.g. Bruner, 1986; Dewey, 1944; Friere, 1970; Kolb, 1984). Assumptions are often transparent because they are taken for granted yet they structure all human experience (Bowers, 1988; 2000).

There are four approaches to understanding assumptions that guide the current study. The first conceptualization of assumptions is given by transformative learning theory. Within transformative learning theory, assumptions are often referred to as habits of mind. For example, Cranton, an influential scholar and author who researches transformative learning theory, writes in her book *Understanding and Promoting Transformative Learning* (2006) about the interconnection between her own habits of mind and how they influence her frame of reference. Specifically, Cranton (2006) categories the assumptions she holds along the categories suggested by Mezirow (2000):

> My way of seeing myself (psychological habit of mind) is influenced by my cultural background (sociolinguistic habit of mind). By growing up in an isolated and poor community that did not value education (sociolinguistic), I ended up with great gaps in my knowledge (epistemic habit of mind). Moral-

> ethical and aesthetic habits of mind are obviously deeply influenced by sociolinguistic, psychological, and epistemic factors. If, for example, I know little about classical music or art (epistemic perspective), my tastes and standards about beauty (aesthetic perspective) will be very different from those of a person well-informed in the arts. Philosophical habits of mind may provide an umbrella for many other of our perspectives. (Cranton, 2006, p. 28)

Cranton (2006) chooses the term *habit of mind* to describe the assumptions that construct her worldview or frame of reference. These assumptions amplify and diminish the ways that she experiences reality (Mezirow, 2009). For example, Cranton (2006) notes that her assumptions related to education were influenced negatively by growing up poor and in an isolated environment. Cranton's reflection demonstrates ways assumptions frame and contextualize how human's structure and make meaning in everyday life. The next section presents three alternative accounts of assumptions.

**Alternative Perspectives of Assumptions: Bowers, Fairclough, and Brookfield**

Three scholars provide alternative understandings of assumptions and the relationship these generalizations have on human experience. An overview of these differing approaches helps to situate the concept of habits of mind within transformative learning theory. Bowers (1986; 2009) provides the first alternative perspective of assumptions. C. A. "Chet" Bowers is currently an adjunct professor of Environmental Studies at University of Oregon. Bowers' scholarship is a result of a lifetime of naming and critiquing cultural assumptions, specifically, cultural assumptions that relate educational technology to ecological crisis (1988; 2000; 2005). Throughout his work he identifies a number of assumptions that, he

argues, are uncritically accepted and detrimental to the natural world. Some of the many assumptions that he critiques include language as a transmission device, technology as neutral and value-free, individualism as preferable to community, and technology as able to save mankind from the same problems it helped to create (2000). Table 2.1 provides a thorough listing of Bowers' cultural assumptions influenced by technologies.

Table 2.1

*Bowers' Cultural Assumptions of Technology*

| |
|---|
| Technology/change progresses in a linearly fashion and is positive |
| Computers as evolutionary |
| Individuals are autonomous and construct knowledge independent of others |
| Data and information are the basis for thinking |
| Human beings are the center of Nature |
| Human solutions are superior to the design processes of Nature |
| Experimental (and scientific) inquiry is the highest expression of intelligence and is worthy of globalization |
| Language is a non-mediating conduit |
| Cultural and social contexts can be ignored |
| Nature is a commodity |
| Solving environmental challenges requires technology |
| Technology can help to preserve the environment |
| Tradition is oppressive |
| Individuals are exempt from cultural traditions |

*Note*. Developed from (Bowers, 2000).

Bowers (1986; 2000) does not categorize or delineate types of assumptions. Rather, he examines the intersection of technology with education to uncover assumptions directly related to ecological and cultural understandings. Bowers (2005) argues that assumptions made about technology in schools and by teachers must be critically analyzed to support a more integrative and realistic understanding of nature and human influence on the environment.

Norman Fairclough, a linguistics researcher and professor, is one of three key individuals associated with critical discourse analysis (CDA) (Rogers, 2011). Along with Gee (2005) and Kress (2010), Fairclough (2003) has developed CDA as an analysis of language and power at the level of meaning. Critical social theory and linguistic theory influences, guides, and frames CDA. There exists disagreement with regard to whether or not CDA is a research method or simply a tool for analysis. CDA is founded on three categories of assumptions (more commonly known as presuppositions within linguistics) that support analysis: (1) existential assumptions - about what exists, (2) propositional assumptions - about what is or can be or will be the case, and (3) value assumptions - about what is good or desirable (Fairclough, 2003). Whereas Mezirow (2000; 2009) suggests assumptions that encompass the range of human experience (e.g. sociolinguistic, moral-ethical, epistemic, philosophical, psychological, and aesthetic), Fairclough (2003) and other CDA scholars (Rogers, 2011) utilize three categories of assumptions to identify and uncover the relationship between power and meaning in language use. Transformative learning theory offers a nuanced understanding of assumptions compared with broad, overarching categories (Fairclough, 2003) and assumptions directly related to education, technology, and culture (Bowers, 2000).

Stephen Brookfield, an adult educator and professor, offers the final perspective towards assumptions. Brookfield has written and researched extensively into the intersection of adult education and critical theory. His work includes a number of texts specifically devoted to assisting adult educators and teacher educators to become more critically reflective by examining assumptions within the context of their practice (Brookfield, 1995;

2005; 2006; 2011). In his text *Becoming a Critically Reflective Teacher*, Brookfield (1995) suggests that there are three types of assumptions that are important to examine in order to be a critically reflective educator:

> (1) Paradigmatic assumptions: Basic axioms that construct our world, paradigmatic assumptions are the most basic scripts we create from the messages we get from significant figures in our lives.
>
> (2) Prescriptive assumptions: Based on and widening paradigmatic assumptions, prescriptive assumptions reflect what we think should happen in a certain situation.
>
> (3) Causal assumptions: Based on the other two assumptions, causal assumptions deal with "If... then" issues. Included in what we think should happen in any situation is our knowledge about what will happen if we take one path or another. (pp. 2-3)

Brookfield (1995) continues to describe four ways that teachers can gain access to these three categories of assumptions. The avenues include self-reflection, student perspectives, peer feedback, and relevant research literature. Interestingly, Brookfield (1995) describes identifying assumptions as hunting to demonstrate how difficult uncovering assumptions can be.

Brookfield (1995) describes three broad categories of assumptions similar to Fairclough's (2003) categories for use in critical discourse analysis. Bowers (1986; 2000) argues for assumptions specific to the intersection of education and technology and the relationship between unexamined assumptions and the environment. Each of the three

alternative perspectives on assumptions give greater context and understanding to the assumptions described by transformative learning research (Cranton, 2006; Mezirow, 2000; 2009; Taylor, 2007). The current study was concerned with exploring educators' assumptions about technology. Therefore, an overview of understandings related to assumptions assisted in framing the study. The next section provides an example of how assumptions structure understanding.

**Assumptions: an example**

Assumptions made about reality are directly informed and created within existing and mostly unexamined worldviews (Jackson, 2008). Worldviews are culturally-situated constructions meant to assist in the social harmony and day-to-day functionality of human life (Jackson, 2008; Mezirow, 2009). Unfortunately, the unexamined status of most worldviews results in conceptualizations, beliefs and assumptions that are inherently limiting.

For example, the belief "Educational technologies can support student learning" is informed by multiple assumptions beginning with understanding the meaning of the words *educational*, *technologies*, *support*, and *student learning*. For instance, *technologies* may be assumed to represent laptops or it might be assumed to mean cell phones and other mobile devices. Depending on the primary assumption, some teachers may need to revise their agreement or disagreement with the stated belief. Another assumption surrounds the use of the word *support* as well as *student learning*. Engaging with these overly vague phrases without context surely results in poor communication.

Mezirow's (2000) transformative learning theory offers two compelling components that inform the current study: frames of reference and habits of mind or assumptions.

Assumptions and frames of references create and simultaneously limit how humans experience and interact in the world. Bowers (1986; 2000), Fairclough (2003), and Brookfield (1995) provide alternative perspectives on categorizing types of assumptions that are influential in accessing educators' assumptions about technology. The final section of the literature review introduces Feenberg's (1999) model of four philosophical perspectives of technology: determinism, instrumentalism, substantivism, and critical theory. Each philosophical perspective frames a specific way of using and thinking about technology that is useful in exploring teacher's assumptions about technologies in teaching and learning and served as the primary framework for the study.

## Philosophies of Technology

The philosophy of technology is a field of scholarship devoted to the study of the nature of technology. The study of technology as a subdomain of philosophy is a recent development. Mitcham (1994) notes that philosophy of technology grew along two separate branches: engineering and humanities. Peters (2006) argues that philosophy of technology "was seen as the handmaiden of science, a kind of applied knowledge that put into practice the pure theory of science" (p.97). For this reason, the field of study known as philosophy of technology emerged later rather than sooner. Emerging from science, critical examinations of technology did not develop until the 20th century (Brooks, 2011).

The engineering perspective of philosophy of technology aims to examine human experiences through technological or technical terms. The humanities approach situates the study of technology as one of many components of human experience (Brooks, 2011). The humanities approach frames and guides the questioning of assumptions and beliefs regarding

technology. Therefore, the humanities perspective informs the current inquiry. Feenberg (1999) offers a philosophical framework that rests on the assumptions of the humanities approach to technology. This section introduces Feenberg's (1999) framework and discusses the implications for the study.

Feenberg (1999; 2002) provides a critical approach to the philosophy of technology and serves as the overarching theoretical framework for the study. Feenberg classifies four philosophical perspectives pertaining to the study and analysis of technology: determinism, instrumentalism, substantivism, and critical theory (1999). Table 2.2 summarizes the key features of each perspective.

Table 2.2

*Feenberg's (1999, p. 9) Four Perspectives of Technology*

| **Technology is...** | **Autonomous** | **Humanly Controlled** |
|---|---|---|
| **Neutral** | Determinism | Instrumentalism |
| **Value-laden** | Substantivism | Critical Theory |

Table 2.2 summarizes and categorizes Feenberg's approach to examining assumptions about technology through the questions of control and value (1999). Analyzing technology through the lenses of technology as neutral or value-laden on the vertical axis and technology as autonomous or driven by human intent on the horizontal axis provides a useful framework to consider alternative perspectives on technology. By considering opposing ends of the spectrum for the questions of value and control, we arrive at four possible positions represented in the table above. In the top-left quadrant, determinists claim that technology is neutral and autonomous while in the top-right, instrumentalists agree in the neutrality of

technology but differ from determinists in their understanding of technology as a function of human agency. Like determinists, in the bottom-left, substantivists argue that technology is autonomous but differ in their views on technology as value-laden. Finally, critical theory in the bottom-right views technology as value-laden and humanly controlled.

In the sections that follow, each of the philosophical perspectives are described and expanded. Instrumentalism and substantivism, two perspectives on technology that were described in Chapter 1, are revisited below with the additional perspectives of determinism and critical theory. Determinism is presented first followed by instrumentalism, substantivism, and critical theory. The summaries of the perspectives also include authors and scholars associated with that perspective.

**Determinism**

Technological determinism casts humans in the role of spectators. Technology is an autonomous entity that evolves naturally through progress. At the same time, technology is simply a tool that is not influenced by cultural or social factors. Brooks (2011) identifies the two underlying assumptions associated with determinism: "(1) technology develops according to a fixed, direct and inevitable course; and (2) society must respond and be organized around technological developments" (p. 39).

Darwin (1958) is often classified as a determinist due to his beliefs in the progressive development of technology via natural laws. Developments in technology are tools that extend and enhance our abilities to engage with the environment. Technology also helps us increase our knowledge and understanding of the natural world. Both nature and technology, for Darwin, abide by the laws of evolution and progress.

Feenberg (1999) also places Marx (1906) within determinism, while acknowledging that identifying Marx as pro- or anti-technology is not necessarily as clear. Brooks (2011) draws on the work of Winner (1986) to demonstrate an anti-technology determinist perspective: "(T)echnologies are not merely aids to human activity, but also powerful forces acting to reshape that activity and its meaning" (1986, p. 6). Winner (1986) also notes that technology often comes with unforeseen consequences that are powerful influences in political life.

**Instrumentalism**

Feenberg (1999) argues that instrumentalism is the "standard modern view" inherited from the 18th Century Enlightenment (p. 6). The instrumental perspective maintains that technology is neutral. Humans are separate from the tools they use, and the tools have no influence on human nature or value considerations. Pacey (1983) provides an applied example of the instrumental theory by explaining that negative implications of a particular technology will be blamed on the social actors (e.g., politicians, businesses) rather than the technology. Instrumentalism can be interpreted as the legacy of Aristotle (Christians, 1997) who believed that "technological products have no meanings in themselves and that technology receives its justification from serving human life" (Chen, 2011, p. 58).

Chen (2011) summarizes the instrumental perspective: "people subscribing to [this theory] separate themselves from the tools they are using. Technology has no bearing on human nature; it does not have any ethical meaning in itself" (p. 57). Within education, an example of positive instrumentalism is given in the work of Seymour Papert (1980). By

using computers and technology, Papert argues, children are able to reach new levels of thinking and understanding that would not have been possible without the computer.

Two assumptions provide the foundation for instrumentalism: "(1) technology is non-mediating; and (2) humans control ends" (Brooks, 2011, p. 37). The value-neutral instrumentalist perspective has dominated Western understandings of technology with a liberal faith in progress (Feenberg, 2003). Instrumentalism is also the commonly held perspective of natural scientists and positivist researchers. Within this framework, technology seems to operate by the same principles and virtues as scientific rationality (Feenberg 2005). Bowers (1988; 2000) problematizes the instrumentalist perspective and argues that its effects on language and technology have disastrous consequences for the natural world.

While differing in the question of technology and control, the determinist and instrumentalist philosophies are fairly straightforward. The following accounts of substantivism and critical theory are significantly more complex.

**Substantivism**

Substantivism frames technology as value-laden because it redefines culture and society into objects of control. The substantivist argues that "technology and society are dialectically intertwined; technology [is] an environment and a way of life." (Chen, 2011, p. 58). The good and bad qualities of technology are overshadowed by rationality and efficiency. This theoretical perspective is supported by German sociologist and political economist Max Weber (1958), French sociologist Jacques Ellul (1964), and German philosopher Martin Heidegger (1977). Substantivism is grounded in two assumptions: "(1)

technology shapes society more than society shapes it; and (2) technology holds some inherent values" (Brooks, 2011, p. 46).

Weber's theory of rationality (1958) provides the grounding for substanstivism (Brooks, 2011). In *The Protestant Ethic and the Spirit of Capitalism* (1958), Weber argues that the demise of modern society comes as a consequence of the increased technical control through bureaucracy. "For Weber, technology secured rational order thereby enlisting human beings as cogs in the bureaucratic machine or objects similar to raw materials and the natural environment" (Brooks, 2011, p. 42). Weber's ideas influenced many other scholars including Ellul, Heidegger, and Habermas (Brooks, 2011).

Chen (2011) notes that Ellul and Heidegger:

> share the notion that human civilization is becoming more and more aligned with a standard of efficiency intrinsic to modernity and, in this regard, becomes alien to the tradition of social humanism. Technology has been transforming our society to a more technically oriented system where values and questions are re-defined and solutions are directed to technical ones. (p. 58)

Substantive theory assumes that technology has, will, and can never be a neutral phenomenon.

Ellul (1964) describes a technological society by way of *technique*:

> The term *technique*, as I use it, does not mean machines, technology, or this or that procedure for attaining an end. In our technological society, *technique*

> *is the totality of methods rationally arrived at and having absolute efficiency* (for a given stage of development) in *every* field of human activity. (p. xxv)

Ellul continues to explore how this technique exists in all areas of society from politics to education. The substantivist view argues that society is positioned towards efficiency, no matter what the cost. Technique "integrates the machine into society. It constructs the kind of world the machine needs and … clarifies, arranges, and rationalizes … it is efficient and brings efficiency to everything" (Ellul, 1964, p. 5). Franklin continues: "Today the values of technology have so permeated the public mind that all too frequently what is efficient is seen as the right thing to do" (Franklin, 1999, p. 124).

Feenberg (2003) notes that Martin Heidegger is considered the most prominent, anti-technology substantivist (Brooks, 2011). According to Heidegger (1977), the modern society encourages humans to view the natural world as raw materials under their command. "Thus, in the technology-saturated society, a fixation on progress and the endless pursuit of efficiency motivates all aspects of human endeavour" (Brooks, 2011, p. 44)

Feenberg continues to suggest that the substantivist view is best considered and approached as a way of life or even a religion due to the technology possessing the value rather than a human agent (2003).

> When you choose to use technology you do not simply render your existing way of life more efficient, you choose a different way of life. Technology is thus not simply instrumental to whatever values you hold. It carries with it certain values that have the same exclusive character as religious belief. But technology is even more persuasive than religion since it requires no belief to

> recognize its existence and to follow its commands. Once a society goes down the path of technological development it will be inexorably transformed into a technological society, a specific type of society dedicated to values such as efficiency and power. Traditional values cannot survive the challenge of technology. (Feenberg, 2003, para. 28)

**Critical theory**

Feenberg (1999) introduces the technological perspectives of determinism, instrumentalism, and substantivism prior to situating his own version, a critical philosophy of technology. "Technology is not a thing in the ordinary sense of the term, but an ambivalent process of development suspended between different possibilities" (Feenberg, 1991, p. 14). Feenberg argues that any understanding of technology must begin with the social world. "Technological design has historically proven to be political as design choices often reflect the control of privileged actors and not an essential essence of technology." (Brooks, 2011, p. 49). Thus, whereas substantivism frames technology as inevitable, critical theory leaves open the possibility for human agency. For the purposes of this study, three assumptions underlying Feenberg's critical theory of technology (2003) are referenced:

> (1) Values embodied in technology are socially specific and not narrowly limited to efficiency or control technology, (2) Technologies offer frameworks for ways of life, and (3) The design and configuration of technology does not only meet our ends; it also organizes society and subordinates members into a technocratic order. (Brooks, 2011, p. 50)

A history of the critical theory philosophy of technology begins with Marcuse and Foucault's concern with "emancipation from instrumental rationality as an ideology" and continued to Feenberg's interest in "problems of technoscience not separate from, but as part of social life" (Hickman, 2006, p. 72)". Feenberg was a student of Marcuse and builds his theory on the foundational work completed by his mentor. Marcuse's earlier work, however, shows a strong connection to substantivism: "It is (the world) a rational apparatus, combining utmost expedience with utmost convenience, saving time and energy, removing waste, adapting all means to the end, anticipating consequences, sustaining calculability and security" (Marcuse, 1941, p. 419). Technology, grounded in the social context, has successfully limited our lives to one dimension (Brooks, 2011). Marcuse does leave some space for the possibility of human agency provided humans engage deeply to understand technology (Brooks, 2011; Marcuse, 1972).

The influence of Foucault (1980) on Feenberg's perspective is evident in Feenberg's analysis of technologies within the realm of power and oppression (e.g. technology as a form of power and used to oppress). Foucault's work uncovers the political nature of technology by showing how the "masters of technical systems, corporate and military leaders, physicians and engineers, have far more control over (the organization of society) than all the electoral institutions of our society put together" (Feenberg, 1999, p. 131).

A critical philosophy of technology, Feenberg argues, is one that supports and encourages democratic discussions and deliberations about technology and its integration into social life. In this way, Feenberg "reflects Habermas' notion of a democratic speech community but includes technological design and development to promote the need for a

‘democratic rationality’ (Brooks, 2011, p. 48). Feenberg (1999) states that technology is ambivalent as it embraces two differing principles: 1. Conservation of hierarchy: social hierarchy can generally be preserved and reproduced as new technology is introduced. 2. Democratic rationalization: new technology can also be used to undermine the existing social hierarchy or to force it to meet needs it has ignored (p. 76). Brooks summarizes:

> As one of these two principles is enacted, technology frames a way of life or predisposes us to a particular way of being and interacting. Feenberg sees the critical theory of technology as a political project intersecting the functional and the social dimensions of technology. (2011, p. 49)

Where substantivism leaves humans destined to whims of technological development, Feenberg’s critical theory asserts that social constructivism gives human agency the final say in the way technologies are adopted and practiced. Technology is not determined to evolve in a particular direction; “the illusion of neutrality and autonomy of the technical professions arises from the way in which they construct their history” (Brooks, 2011, p. 50; Feenberg, 1996). Feenberg’s philosophy suggests that as members of a democratic society it is our duty to engage with technological understanding and the social world.

> We need to understand ourselves today in the midst of technology and technical knowledge itself cannot help us. Philosophy of technology belongs to the self-awareness of a society like ours. It teaches us to reflect on what we take for granted, specifically, rational modernity. The importance of this perspective cannot be over-estimated. (Feenberg, 2003, para. 4)

Technology in education, in this view, needs to be examined not as purely instrumental, neutral or natural but rather as a part of the framework for a way of life in our schools (Brooks, 2011; Feenberg, 2003). Table 2.3 below combines and summarizes Feenberg's (1999) four perspectives with Brooks' (2011) analysis of key authors and assumptions associated with each perspective.

## Conclusion

The current study is framed and informed by research literature on educators and technology, transformative learning theory, assumptions, and Feenberg's philosophical perspectives of technology. Specifically, Feenberg's philosophical perspectives ground the data analysis and discussion of the study because of the focus on assumptions directly related to technology. Existing research at the intersection of teachers and technology has consisted of examinations of teacher beliefs and attitudes. However, transformative learning theory suggests that a person's habits of mind or assumptions create frames of reference that then support beliefs and attitudes. In particular, in viewing teaching and learning with technology through one frame of reference necessarily limits other ways of thinking. Feenberg's perspectives on technology demonstrate four frames of reference for approaching technology, each perspective building on its own assumptions (see Table 2.3 above). If educators are to mindfully integrate technologies into their teaching, examining the assumptions that teachers have about technology is important.

Bowers (1986; 2000) argues that teachers must critique and evaluate assumptions about educational technologies. By not subjecting assumptions to analysis, educators may perpetuate existing ways of thinking and understanding technology that do not account for all

available perspectives (Feenberg, 2003; Ferneding, 2003). Examining how assumptions limit human experience and possibility is at the core of transformative learning theory (Cranton, 2006). Uncovering limiting assumptions about technology held by teachers is driven by the transformative education scholarship. Feenberg's (1999) philosophical framework provides the analytical lens incorporated to assist in uncovering educators' assumptions about technology. The next section details the methodology of the study informed by the research questions and literature.

Table 2.3

*Feenberg's (1999, p. 9) Four Perspectives of Technology with Key Authors and Brooks' (2011) Assumptions*

| **Technology is...** | **Autonomous** | **Humanly Controlled** |
|---|---|---|
| **Neutral** | Determinism<br><br>Authors: Darwin, Marx<br><br>1) technology develops according to a fixed, direct and inevitable course<br>2) society must respond and be organized around technological developments | Instrumentalism<br><br>Authors: Papert, Negroponte, Noble<br><br>1) technology is non-mediating<br>2) humans control ends |
| **Value-laden** | Substantivism<br><br>Authors: Weber, Heidegger, Ellul, Habermas<br><br>1) technology shapes society more than society shapes it<br>2) technology holds some inherent values | Critical Theory<br><br>Authors: Feenberg, Marcuse, Foucault<br><br>1) values embodied in technology are socially specific and not narrowly limited to efficiency or control technology<br>2) technologies offer frameworks for ways of life<br>3) the design and configuration of technology does not only meet our ends; it also organizes society and subordinates members into a technocratic order |

# CHAPTER 3: METHODOLGY

## Introduction

The relationship between humans and technology is increasingly complicated by new, emerging, and increasingly mobile technologies (Turkle, 2011). The purpose of the study was to explore educators' ways of thinking and assumptions about technology. Additional research is needed to fully grasp teacher's understandings about technology (Chen, 2011; Kilbourn & Alvarez, 2008). Further, teacher beliefs and assumptions regarding technologies are critical to technology integration because educators are the primary models for how to interact with and think about technology in teaching and learning (Ertmer & Ottenbreit-Leftwich, 2010). Educators' assumptions about educational technologies are also projected and reflected in the ways their students see and engage with technologies (Bowers, 1988; 2000).

This chapter describes the methods that guided the study. Qualitative research methods were utilized to complete the research since the study was aimed at describing the deep experiences of human subjects. The following sections present the guiding research questions, design of study, sample population, and data collection and analysis procedures. Finally, data validity and reliability are addressed.

## Research Questions

In order to explore the ways educators think about technology in education, the study was guided by two research questions:

1. What assumptions do educators hold about technology and its use in teaching and learning?

2. How do educators' assumptions about technology influence their teaching practice?

The following section details the how the research questions were addressed by the study design.

## Design of Study

This study was guided by qualitative and case study methodologies based on Merriam's explanation that "a qualitative case study is an ideal design for understanding and interpreting observations of educational phenomena" (Merriam, 1998 p. 2). Qualitative research methods are interpretive and focused on meaning-making and building conceptualizations. Specifically, the study was conducted as an illustrative or descriptive multiple-case study (Yin, 2009). Descriptive case studies are meant to provide readers with a common language to demonstrate and explore a phenomenon deeply. Thomas (2011) defines case studies as:

> … Analyses of persons, events, decisions, periods, projects, policies, institutions, or other systems that are studied holistically by one or more methods. The case that is the subject of the inquiry will be an instance of a class of phenomena that provides an analytical frame—an object—within which the study is conducted and which the case illuminates and explicates. (p. 513)

The aim of the current study was to explore educators' assumptions about technology. For this study, a case was defined as an educator who met two requirements: (1) being an experienced educator, defined as having more than three years experience, and (2) being

currently enrolled in an advanced online graduate course in education and web-based technologies. The methods used to study each case included a technology readiness survey, a philosophy of technology written statement, and a 90-minute, in-depth interview. The three Phase Two cases (participants) were supplemented with three Phase One participants whose technology readiness survey and philosophy of technology written statements were reviewed and analyzed. As the study was a preliminary exploration of educators' assumptions about technology, observations of the cases were not necessary. A future trajectory of the study will include multiple interviews as well as scheduled observations.

Stake (1995) describes qualitative research as holistic, empirical, interpretive, and empathetic. Qualitative research is useful in answering the question "how." Within qualitative research methods, the researcher is the primary instrument for data collection and analysis (Miles & Huberman, 1994). Qualitative research is inductive (Stake, 1995), grounded in the intuition of the researcher (Miles & Huberman, 1994), and focuses on description and natural language (Creswell, 2003). Thus, data analysis in qualitative research contains a series of fluctuations, constantly pushing and pulling the research questions and guiding theoretical framework(s) (Creswell, 2003).

While there is no single set of methods for case study research (Merriam, 1998), the specific methods used for the present study were interviews and document analysis. Glesne and Peshkin (2010) note that qualitative study requires the researcher to utilize multiple methods to make sense of, understand, and describe the research. They continue to describe the openness of qualitative inquiry to encompass the complexity of participants' experiences (2010). Case studies are useful when research questions are phrased with "how" or "why"

and control over human behavior is not a concern (Yin, 2009). The second research question of the current study focused on describing *how* educator assumptions about technology influence their teaching practice and therefore case study methods were appropriate. Data triangulation is one way case study researchers can ensure adequate representation of the phenomenon under study. "[T]riangulation is a strategy that allows [researchers] to identify, explore, and understand different dimensions of the units of study, thereby strengthening their findings and enriching their interpretations" (Rothbauer, 2008, para. 3). In the current study, the use of multiple data sets enabled data triangulation (Rothbauer, 2008; Wolfram Cox & Hassard, 2009).

More specifically, students enrolled in an online instructional technology graduate course were approached about participation in the study. Of the fifteen students enrolled in the course, six in-service educators volunteered to participate in the study. Research considering the appropriate number of cases remains inconclusive due to the flexibility and varying types of case study research (Fletcher & Plakoyiannaki, 2009). The current inquiry was designed as a multiple-case study. Bleijenbergh (2009) states that a multiple-case study design includes between two and ten individual cases that are selected to represent a social phenomenon. Of the six participants who agreed to participate in Phase One of the study, three participants agreed to participate in Phase Two. Table 3.1 below summarizes the expectations for participants in Phase One and Phase Two.

Table 3.1

*Description of Data Sources and Study Phases*

| Data Sources | Technology Readiness Survey | Philosophy statement | In-depth, semi-structured interview |
|---|---|---|---|
| Phase One (n=6) | X | X | |
| Phase Two (n=3) | X | X | X |

Phase One participants provided consent to utilize their responses from a pre-course technology survey on their knowledge and comfort with technology (see Appendix A for survey description). Phase One participants also allowed their written philosophies of technology assignments from the course to be considered for analysis (see Appendix B for assignment description). Finally, Phase Two participants agreed to participate in a 90 minute, semi-structured interview to explore and describe their experiences of technology in teaching in learning. Of the six participants who participated in Phase One of the study, three agreed to participate in Phase Two. The three participants in Phase One who did not continue to participate in Phase Two had expressed initial interest but despite multiple efforts made by the researcher, they were not able to complete an interview. Thus, the Phase One participants only gave consent to utilize their technology readiness survey and written philosophy of technology statement as data sources.

In order to be considered for inclusion in the study, participants were required to be enrolled in the online graduate course in instructional technology and have at least three years classroom teaching experience. Of the fifteen students enrolled in the course, 9 met the criteria for participation. Participation in the study was fully voluntary, and there was no

benefit afforded for participating or risk involved by participating. The next section offers a more thorough treatment of participants followed by a discussion of the data sources and analysis.

## Sample

This qualitative case study explored educators' assumptions and ways of thinking about technology. The participant pool of the study was convenience-based. Convenience or non-probability sampling is appropriate for research for the current study given the research questions into teachers' conceptualizations of technology. The participants included educators enrolled in an online instructional technology graduate course in the spring semester at a large, public land-grant university in the southeastern United States. There were two phases of participation: Phase One (n=6) and Phase Two (n=3). The expectations associated with each phase are noted in Table 3.1 above. The goals and objectives of the graduate course included introducing educators to design a web site utilizing web-based and emerging technologies. Therefore, it must be acknowledged that participants were likely biased towards an interest in educational technologies. The online graduate course was offered within the universities' Instructional Technology graduate program and had recently been revised to include the integration of numerous web-based technologies including the blogging platform Wordpress and web development sites such as Weebly. Beginning with foundational concepts regarding the historical significance of the Internet, copyright, and usability concerns, students were guided through the process of developing their own web site through the use of Web 2.0 and web-based tools. The course overall was structured into cohorts that were assigned in the first week of the course according to students' comfort and

ability levels as determined by the Technology Readiness Survey. These groups were sustained throughout the course as a source of reflection and feedback for students.

## Data Collection

In the third week of the course, all students enrolled were approached via email and provided with an introduction to the research study. A copy of the email was also made available within the course learning management system site (Moodle) as a forum post. A link to the informed consent and instructions on how to complete the form were included within the email. The email also included a description of the ways participation in the study would include pieces of their required coursework including their responses from the pre-course survey and their philosophy of technology statements. Participants were also reminded that they were not required to participate in the study as a part of the graduate course.

Six graduate students responded and completed the informed consent for Phase One of the study. Following their consent, each of the six received an email to request their participation in an in-depth interview. At this point, the researcher assigned participants an appropriate pseudonym to ensure anonymity. Of the six original participants in Phase One, three agreed and signed the informed consent for the second phase of the study that included an in-depth interview. The researcher and the three Phase Two participants exchanged emails in order to identify a time and medium to complete the interview. Prior to completing the interviews, the researcher began reviewing and analyzing the first two datasets: pre-course technology survey and the philosophy of technology statements of the six Phase One participants. The three interviews were recorded and transcribed and coded along with the

first two data sets. Throughout the project, the researcher kept a research journal that included reflections regarding the process, research questions, literature reviewed, and participant data. No personally identifiable information was included in the researcher's journal, and only pseudonyms were used to refer to individual participants.

## Data Storage

All data were collected and stored on the researcher's laptop, which is password-protected and only accessible to the researcher. Additionally, backups of all files were made regularly and saved on a backup hard drive that is password-protected and only accessible to the researcher. Participant names and associated data (philosophy statements, interview transcriptions) were assigned an appropriate pseudonym and coded to protect participants' identities. At the conclusion of the study all original data and analysis documentation will be erased and destroyed.

## Data Analysis

There were four data sources in the study: participants' pre-course technology survey (see Appendix A), participants' philosophy of technology statements (see Appendix B), interview transcriptions, and researcher memos. The following subsections describe how each source was analyzed separately and then simultaneously in an effort to answer the guiding research questions regarding in-service educators' ways of thinking and assumptions about technology.

### Pre-Course Technology Survey

Phase One participants were required to complete an online survey (see Appendix A) to collect basic data on their level of comfort and knowledge of educational technologies.

The survey was a requirement of the graduate course and included 65 items grouped into topics including basic knowledge of computing processes such as searching the Internet, building a web site, identifying copyright appropriate media, and teaching online. Fifty-one items considered students' level of comfort with technologies using Not Competent, Somewhat Competent, Competent, and Very Competent scale. The remaining survey items requested student input on distance education experiences and online learning preferences and were not considered within the data analysis of the current study. The critical limitation of the technology readiness survey was the reliability of students' subjective and self-reported responses. However, the current study was aimed at participants' understandings and assumptions about technologies from their lived experiences, and therefore this limitation was actually key to the study.

**Philosophy of Technology Statements**

The second data source included participants' philosophy of technology statements. All students enrolled in the graduate course were required to complete a non-graded written assignment that included guided questions meant to support reflection about students' views on technology. A copy of the Philosophy of Technology assignment is provided in Appendix B. The researcher reviewed the philosophy statements from Phase One participants in order to gain a background understanding of each participant's perspectives toward technology. In the first reading, the researcher began coding and categorizing the participants' philosophy statements. Assumptions were identified within participants' philosophy statements by key words, terms, and phrases. Identifying words and phrases were developed from 1) research literature (Brooks, 2011; Chen, 2011; Feenberg, 1991; Ferneding, 2003), 2) participant

philosophy statements and interview transcripts, and 3) the professional experiences of the researcher. A selection of the key terms is provided in Table 3.2.

Table 3.2

*Selection of Key Words to Identify Assumptions*

| | | | |
|---|---|---|---|
| 21st century | Advance | Apply | Consequences |
| Cost | Critical thinking | Development | Engage |
| Enhance | Evaluate | Evolve | Facilitate |
| Global | Implications | Independent | Information literacy |
| Model | Negative | Positive | Possibility |
| Problem Solving | Reliable | Responsibility | Skills |
| Solve | Tool | Traditional | |

Key words and phrases representative of the four perspectives toward technology as described by Feenberg (1999) were identified within the research literature. For example, the use of the word *evolve* to describe technology is an indicator of a determinist or substantivist perspective. The phrase neutral tool is most commonly used from within an instrumentalist view. As a database of key words and phrases was developed, data from participants were consulted to integrate additional layperson terminology to supplement theoretical and philosophical terms. Phase One participants' philosophy statements and Phase Two participants' interview transcriptions assisted in this process. Finally, the researcher's professional experiences as an educator, administrator, and professional development leader aided in finalizing the key terms associated with each philosophical approach.

Assumptions embedded within Phase One participants' philosophy statements were identified and marked within a standard word processing program informed by Feenberg's (1999) four perspectives of philosophy of technology and the assumptions associated with each perspective developed by Brooks (2011). Specifically, key words and phrases were utilized to identify participant assumptions. At the completion of this phase of analysis, the researcher completed a memo recording observations and insights gained from the key terms identified in the philosophy of technology statements. Data pertaining to the philosophy statements were coded and categorized throughout the study in Microsoft Excel. Codes and categories assigned to the philosophy statements served to structure the analysis of interview transcripts.

**In-depth Interview Transcriptions**

The six students who expressed interest in participating in the study were categorized into two levels based on their agreement to participate. All six participants were approached individually through email to request their participation in an in-depth, 90-minute interview to discuss their philosophy statements and perspectives on technology. Of the six interested participants in Phase One, four responded within 24 hours to schedule a time for an interview and agreed to serve as Phase Two participants. Three of the four participants who responded were able to schedule an interview within two weeks. The fourth participant did not respond to a multiple emails requesting a time to schedule an interview. The three Phase Two participants were given the option of either a face-to-face, audio-only, or videoconference interview. The Phase Two participants selected the audio-only or videoconference interview format due to their location and time constraints of participants' schedules. One interview

was completed via videoconference, and two were completed through audio-only Internet phone. Each of the participants was informed that the interview was being audio recorded and agreed to participate.

Interviews were guided by a set of semi-structured questions (see Appendix D) as well as the key terms and assumptions identified from the participants' philosophy statements and research literature (see Table 3.2). Prior to conducting interviews with the three Phase Two participants, their respective philosophy statements were reviewed again by the researcher to identify specific terms and clarifying questions best answered in the interview. The researcher transcribed each of the interview recordings before analysis began. Data analysis began by applying to the participants' interview transcriptions the key terms and assumptions identified in their respective philosophy statements for similarities and contradictions. Additionally, the researcher identified and marked assumptions and phrases not referenced in the participant's philosophy statement.

Following a review of each individual's philosophy statement and interview transcription, a memo reflecting on this step of the analysis (see next section) was completed. Finally, the researcher analyzed and compared the data collected and analyzed from the three Phase Two participants for commonalities and differences. Phase Two philosophy statements and interview transcriptions were coded by the assumptions associated with Brooks' (2011) interpretation of Feenberg's four philosophical perspectives toward technology (see Table 2.3). After coding by assumptions, Phase Two participants' reflections on their teaching with technology were compared and integrated with the philosophical perspectives toward technology findings. This final step was summarized in a researcher memo that offered a

comparison and synthesis of the Phase Two participants' philosophy statements and interview transcriptions but also the philosophy statements of the three participants who only participated in Phase One.

**Researcher Memos**

The researcher's memos provided a timeline of the data collection and analysis as well as an additional lens for interpretation. Memos were written at key steps including: delivery of the pre-course technology readiness survey, analyzing technology readiness survey data from participants, conversations with the course instructor at the beginning of the course, delivery of the request for participation to students, following emails from students confirming interest in participation, after reviewing and analyses of philosophy statements, prior to Phase Two participant interviews, reflecting after interviews, throughout transcribing, and preliminary drafts of the research report. Other memos composed regarding ongoing summaries of relevant literature and a final summary analyzing the Phase One and Phase Two participants' assumptions were included as researcher memos as well. The memos were not coded by key terms and assumptions as the philosophy statements or interview transcriptions per se and were completed on Microsoft Word and saved on the researcher's laptop. The memos were used to frame the study and serve as an ongoing reflective narrative containing the researchers impressions and thoughts regarding the participants, research questions, themes, assumptions and terms. Overall, the memos provide a map of the researcher's analysis throughout the study and are critical to the final report.

## Validity & Reliability

Questions and tests of validity in case study research are complex and critical throughout the research process (Yue, 2009). Yin (2008) identifies four categories of validity relevant to social science research: construct validity, internal validity, external validity, and reliability. Construct validity includes selecting appropriate methods for the phenomenon under study. Internal validity is useful for explanatory or causal studies where the goal is to explore causal relationships. External validity refers to the generalizability of study results. Reliability is the likelihood of obtaining similar results upon replication of the study. Yin (2008) suggests a number of ways for case study research to address each of the four categories of validity. The tactics for addressing validity in case study research are summarized in Table 3.3 below.

Table 3.3

*Yin's (2009) Tests of Validity Mapped to Case Study Tactics*

| Tests | Case Study Tactic |
|---|---|
| Construct validity | Use multiple sources of evidence<br>Establish chain of evidence<br>Have key informants review draft case study report |
| Internal Validity | Do pattern matching<br>Do explanation building<br>Address rival explanations<br>Use logic models |
| External validity | Use theory in single-case studies<br>Use replication logic in multiple-case studies |
| Reliability | Use case study protocol<br>Develop case study database |

Yin's (2009) categories of validity for case study research mirror the quantitative conceptualizations of validity and reliability. In an effort to acknowledge the important of

meaning-making in human experience, qualitative researchers have offered parallel notions of validity that include trustworthiness, credibility, authenticity, transferability, and plausibility (Lincoln & Guba, 1985). Miller (2008) notes that within qualitative understanding of validity, trustworthiness, credibility, authenticity, transferability, and plausibility can be increased at any time throughout a study by strategies such as peer debriefing, self-reflection, audit trails, and continual verification of findings. The study is analyzed via Yin's (2009) tests of validity first followed by the qualitative notions of validity.

The phenomena under inquiry in the present study were educators' assumptions about technology. In order to address construct validity, two types of triangulation were integrated into the study: data triangulation and methodological triangulation. Data triangulation includes the use of multiple data sources to examine a phenomenon. Methodological triangulation describes the use of differing methods to collect data. Three data sources provided the ability for triangulation: Phase One participants' philosophy of technology statements, Phase Two participants' interview transcriptions, and researcher memos. Methodological triangulation was addressed by incorporating three methods of data collection including written responses from Phase One and Phase Two participants, interviews conducted with Phase Two participants, and the researcher's reflective writing. The philosophy statements completed by Phase One participants were utilized to determine the spread of educators' individual assumptions about technology. The three Phase Two participants' interviews were used provide a check on data gathered from the philosophy statements as well as gain access to deeper and more specific descriptions of technology.

Participant demographics data served to ground and provide context for analysis. Finally, the researcher's written reflections offered additional insight into the philosophies of technology held by the educators.

The current study is a descriptive case study and, therefore, does not need to meet conditions for internal validity (Yin, 2009). External validity is concerned with the generalization of results. The analytical generalization of case study results must not be confused with statistical generalization. In analytical generalization, the investigator is striving to generalize a particular set of results to some broader theory (Yin, 2009) rather than a population. Within the context of the current study, the generalizations made regarding results are framed within a theoretical understanding rather than as a description for the larger participant population. External validity and therefore generalization of the results were addressed by the incorporation of replication logic. Replication, or duplication, describes the use of multiple cases to confirm the reproduction of similar results whether within an existing study or previous research. The three Phase Two participants serve as individual cases and were analyzed using replication logic to address generalizability.

Reliability was addressed by developing a case study database, case study protocol, and triangulation of data sources and data collection. Ward and Street (2009) note that there are three ways to address reliability in case study research: triangulation, interrater reliability, and audit trail. The current study addressed concerns of reliability through triangulation of data sources and by documenting the research process. Future research would benefit from incorporating an external reviewer to address the possibility of bias researcher.

Lincoln & Guba (1985) offer trustworthiness, credibility, authenticity, transferability, and plausibility as constructs to evaluate the validity of qualitative research. The present study incorporated a number of strategies to increase the five constructs including continual verification of findings, member checks, self-reflection, theoretical thinking, and audit trails. Researcher memos served to verify findings and as a venue for self-reflection, theoretical thinking, and audit trails. Member checks were conducted in the collection of multiple methods of data collection including Phase Two participant philosophy statements and interviews. For example, Phase Two participants were asked to clarify and expand on ideas presenting in their philosophy statements. Also, at the completion of each interview, the researcher presented a summary of the interview and requested agreement and feedback form the Phase Two participants. Miller (2008) notes that regardless of paradigm, validity is focused on research transparency and convincing research results.

# CHAPTER 4: FINDINGS & DISCUSSION

## Introduction

In order to answer the research questions of the study regarding the assumptions teachers make about technologies, volunteer participants were requested from a graduate course in Instructional Technology at a large, public land grant university in the southeastern United States. Six students volunteered from a class of 15 and agreed to participate in Phase One of the study. Phase One participants allowed their course materials to be integrated into the study. Three of the six students served as Phase Two participants by allowing review of their course materials in addition to participating in a 90-minute interview to discuss their understandings and experiences with technology.

This chapter begins with an overview of the three data sources: technology readiness surveys, philosophy of technology statements, and in-depth interviews. Following, the Phase Two participants are introduced and situated through their contributions. Following, an in-depth analysis of each of the Phase Two participants who volunteered to participate in an interview is presented.

## Technology Readiness Survey Results

The first dataset for the study included the results of participants' information collected through a pre-course technology skills survey. The survey was administered via an online form and completed by all students enrolled in the graduate course. Students were encouraged to reflect on their level of competency with computer and Internet skills ranging from databases to uploading videos to YouTube on the following scale: Not Competent = 1,

Somewhat Competent = 2, Competent = 3, Very Competent = 4. Table 4.1 below presents the technology readiness survey responses of Phase One participants.

Table 4.1

*Technology Readiness Survey Results*

| Skill Group | Barbara[a] | Christine[a] | Grace | Julie | Penny | Sheryl[a] |
|---|---|---|---|---|---|---|
| Basic Computer Operations Skills | 4 | 4 | 4 | 4 | 4 | 4 |
| Setup, Maintenance, and Troubleshooting of Equipment | 3 | 2 | 2 | 3 | 3 | 4 |
| Word Processing | 4 | 4 | 4 | 4 | 4 | 4 |
| Spreadsheets | 3 | 4 | 4 | 3 | 3 | 4 |
| Databases | 3 | 3 | 2 | 3 | 3 | 3 |
| Networking | 3 | 3 | 2 | 3 | 3 | 4 |
| Web-based technologies | 3 | 3 | 3 | 3 | 3 | 4 |
| Teaching with technology | 2 | 3 | 2 | 2 | 3 | 3 |
| Social, Legal, and Ethical Issues | 3 | 3 | 3 | 3 | 3 | 4 |

*Note*. Scale: Not Competent = 1, Somewhat Competent = 2, Competent = 3, Very Competent = 4.
[a] Phase Two participant.

The participant's self-reported responses to the technology readiness survey showed that basic computer and word processing skills were the skill areas in which participants were most competent. Within these subheadings, all of the participants recorded that they were Very Competent in each of the described skills. (A detailed list of the skill areas is included in Appendix A). The remaining skill groups were reported within the range Somewhat Competent to Competent: troubleshooting, spreadsheets, databases, networking, web-based

technologies, teaching with technology, and social, legal, and ethical issues. No participant reported an evaluation of Not Competent for any grouping of skills.

**Analysis**

The pre-course technology survey established a baseline level of comfort, competence, and ability to differentiate instruction throughout the course. Students were also grouped based on their survey results in order to ensure mixed-ability groupings. To be categorized as an advanced user, students had to record a majority of *Very Competent* within each skill group. Of the six Phase One participants, only one, Sheryl, was identified as a very advanced user while the remaining five were categorized as mid-level or intermediate technology users.

Given the call for greater attention paid to teacher technology assumptions (Bowers, 2000; Brooks, 2011; Chen, 2011), how teachers perceive their technological abilities becomes increasingly important. A basic, and somewhat advanced, understanding of key technology skill groups was determined from the technology survey. While the survey data do not directly correspond to the perspectives described by Feenberg (1999), they are helpful in demonstrating how the participants view their personal understandings and knowledge about technologies. For example, a student who self-identifies as *competent* or *very competent* at web-based technologies and social, legal and ethical concerns related to teaching with technology could be expected to engage in active reflection of their understandings at a level that might not be accessible for a participant who perceives themselves as predominantly *not competent* in the same areas. One participant, Sheryl, was identified as an advanced user while the remaining five participants were identified as

intermediate users of technology. The findings resulting from the technology readiness survey were therefore influential in determining how the researcher approached the analysis of participant philosophy statements and participant interviews.

## Philosophy of Technology Statements

Phase One participants' philosophy of technology statements were analyzed simultaneously. Analysis began with highlighting and marking key terms and phrases to identify assumptions based on Feenberg's (1999) four philosophical perspectives on technology. Six predominant assumptions were identified from the philosophy statements and are summarized with supporting data below.

### Assumption: Technology is a neutral tool

The term most often used to describe technology, consistently and across the six participants' philosophy of technology statements, was "tool." Barbara offers her understanding:

> For me, technology encompasses the ability to use a tool to solve a problem. I define it this way due to technology's inability to create anything without proper direction and guidance. Technology is like a hammer: without the nail or the human operating it; it is worthless.

In this way and in her own words, Barbara speaks from within an instrumentalist perspective that assumes technology as humanly controlled but value-neutral. Penny, after framing the relationship between society and technology as "like a family with an expected amount of dysfunction," summarizes her point of view: "The most important consideration in educating children in a technology and media laden society is to help them understand that technology is a tool and a means to an end." Penny's choice of words in describing technology as a

"means to an end" suggests a substantivist point of view that assumes the dominance of technology over society and the technology as embedded with values. However, on closer examination and given the context of her statement, Penny continues to hold that human agency is key to educating children. Additionally, technology is a tool and value-neutral for Penny. Therefore, Penny's assumptions align with instrumentalism.

Other participants also assume technology is a tool when they refer to specific devices such as computers, cell phones, digital cameras, and iPads. The devices are autonomous and independent of humans and do not mediate experience. Information, facts, data, and knowledge are all available via technology and while each participant hints at issues concerning credibility and truth, no participant actually addresses this concern at the level of technological assumption. Put simply, that technology is assumed to be a neutral, non-mediating device is not considered in concerns related to credibility of information available in digital formats. The emphasis here is on how the people select to use the information or, more commonly, a person is at fault when claims of credibility are raised rather than exploring the way technology may have mediated the experience.

The assumption of technology as a tool is represented in Julie's argument that there are specific skills that must be learned to use technology including "how to work with and use technologies." Similarly, Sheryl speaks of a technology skill set that her students must master to be successful in acquiring a 21st century job. These skills include how to properly use Microsoft Office applications. Sheryl continues later to note that her ultimate goal is to sponsor critical thinking in her students, but technology remains a tool that is secondary to critical thinking processes.

**Assumption: Technology evolves**

Participants frequently demonstrated the assumption of technology as evolving. Two of Feenberg's positions on technology are grounded in the assumption that technology is neutral: determinism and instrumentalism. The primary difference between the two positions is whether technology can be directed or controlled by humans. Thus, determinism applies Darwin's evolutionary theory to technology in claiming that technology is value-neutral and evolves according to the laws of nature (Brooks, 2011; Feenberg, 1999). All of the participants elected to use the term *evolve* to describe technology specifically. Each participant framed technology as moving along a determined path of development and progression. Some participants addressed this directly: "The relationship between society and technology is long-standing, dynamic and co-evolving" and "Society has greatly evolved due to improvements in technology." Other participants approached the evolving nature of technology indirectly: "One of the biggest technological problems we have is keeping up with new technology." While no participant expanded specifically on where the path led, it was implied that the path was inevitable.

**Assumption: Technology sponsors efficiency and enjoyment**

Technology was also referenced by its ability to make learning more efficient and enjoyable, in addition to its ability to increase student motivation. Efficiency is a highly contested feature of technology that is best demonstrated by the opposing substantivist and instrumentalist perspectives. Because both positions are grounded in differing assumptions, they clash specifically on whether the advances of technical efficiency outweigh the costs. Instrumentalists would argue that it is the person using the technology that is ultimately

responsible for the technical efficiency since technology is simply a neutral tool. A substantivist would reject this and argue that the technology may include the capability for greater efficiency, but whether or not this is positive or negative for a person is debatable. For example, online gradebooks are presented as solutions to administrators and educators as a tool to save time and help facilitate the assessment process. However, one participant found her online gradebook to take more time than traditional, paper-based methods. She now completes her grading in her traditional way, posting grades to the online gradebook only when required by administration. Does technology sponsor efficiency? Most of the participants assume it does and Christine acknowledges that she is the one that has the final say in its efficiency:

> I find technology fun. My students find it fun. As long as I am teaching material to the same level, or maybe even a better level, I will use technology. I have worked very hard to use it in a way that will engage my students and still achieve the same end result.

**Assumption: Technology is a threat**

Participants also reflected on the negative qualities attributed to technology as well. For example, two participants saw technology as a threat. For these participants, the threat of technology was embodied by online predators and concern for children's safety. Other participants were concerned about the negative influences of a media- and information-saturated modern society as well as the challenge of financing technology in education. Interestingly, while participants predominantly held assumptions about technology that included technology as value-free, participants simultaneously held assumptions regarding technology as a threat.

**Assumption: Technology is mostly promising**

Even while simultaneously holding assumptions about technology as a threat and as a neutral tool, the participants' reflections on the promises of technology within education read like an infomercial for educational technology:

> Penny: I think certain technology is favorable for integrating in classroom instruction. Computers and peripheral devices like webcams and microphones can help to enhance the learning experience and prepares children for society. The advantage is that they can provide access to resources and practice beyond textbooks and what's taught in the classroom … An overwhelming benefit of technology is that it has brought people and communities closer together in a virtual sense.
>
> Barbara: My role as a teacher is not replaced by technology, however it may be enhanced by it. Currently, I teach adults, so I become more a facilitator and guider of the educational process, rather than the sole source of the educational process. Technology, when used with this mindset, helps me as a tool to enhance the educational process. I use multimedia to illustrate points, and use web based tools to help learners apply knowledge gained within the classroom.
>
> Grace: Technology has helped to change the role of teachers in several ways. Even without technology, teaching has evolved over the years. Teachers no longer lecture to passive students. Today's learning is accomplished through cooperative group work and active learning. The role of teachers today is more of a facilitator of learning. It is their job to guide students through the learning process. Because of the nature of new technologies, the teachers also have to act as safety monitors and provide a good model of ethical computer use.

Penny's reflections adopt a determinist stance based in assumptions that society must accommodate technology. Such a position also assumes a neutral view of technology. Technology enhances the learning process, helps prepare children, and brings people together. Similarly, Barbara and Grace reflect that technology has changed the role of teacher in such a way that ultimately enhances learning. While Grace continues to distinguish

teaching from technology, the notion that teaching evolves as an entity reflects a determinist position. The statements represent the conflicting assumptions held by participants. While leading to mostly positive conclusions about technology, the assumption of technology as promising limits the social and cultural influences of technology that are represented by substantivist and critical perspectives of technology.

**Assumption: Technology is complicated**

None of the six participants' philosophies of technology statements could be classified as representing a critical analysis of technology. A critical approach to technology considers the values associated with the technology and the ability of humans to control technology. More specifically, Brooks (2011) describes three assumptions associated with the critical approach:

> (1) Values embodied in technology are socially specific and not narrowly limited to efficiency or control technology, (2) Technologies offer frameworks for ways of life, and (3) The design and configuration of technology does not only meet our ends; it also organizes society and subordinates members into a technocratic order.

Participants came closest to a critical approach to technology when reflecting on the negative qualities or results (e.g. inappropriate images and content, media saturation of students) but there was little evidence in the philosophy statements that offer a truly critical stance. There are conjectures made (e.g. flipped classroom, the availability of inappropriate images and information online, etc.) that, while compelling reflections, are rendered transparent by the participants' assumptions about technology.

Numerous references to a binary or dichotomous representation of good and evil are inherent to technology: the double-edged sword, positives and negatives, the privileged and disadvantaged, affordances and risks/consequences; yet not a single participant pushes the boundaries of these binaries to acknowledge any gray area.

Julie notes:

> As adults, we have a responsibility to model healthy behaviors for our children, at home and in the classroom. Yet, even we have difficulty unplugging ourselves from our media outlets. We are so accustomed these days to using technology in just about every area of our lives, that we have to take a step back to realize the implications of our own physical and psychological dependence on our digital devices. (At least I do!)

Julie's words offer an example that characterizes the complexity of the participants' assumptions about technology. In this one section she notes that humans are responsible for modeling healthy behaviors (instrumentalist), yet technology is everywhere and hard to unplug from (substantivist/determinist), and still we must step back to realize the implications of our actions (substantivist/critical). The conflicting assumptions held are hidden from view and therefore occurs as complexity.

## Case Interviews

Phase Two participants agreed to participate in a 90-minute interview to discuss their philosophy of technology statements and their ways of thinking about technology and education. A summary and description of each is offered below. Barbara and Christine's interviews were conducted through an audio-only Skype call, and Sheryl's interview was completed using the Apple videoconferencing software FaceTime.

**Case 1 – Barbara**

**Background.** Barbara teaches courses in kinesiology at a mid-sized public university in the southeastern United States. In addition to her teaching duties, Barbara also maintains an active professional career as a kinesiologist. Ever since she was a child, Barbara knew she wanted to work in rehabilitation. When she was twelve she knew what she was going to do with her life and set out to make a plan to ensure that it would happen. Barbara acknowledges that she is a go-getter type of person and has been her whole life. After working successfully as a rehabilitation specialist for many years, Barbara was asked to lead professional development sessions for new and existing practitioners. Her proven expertise and teaching methods led her to become a successful trainer and eventually led her to her current position in university teaching.

Barbara's interests lie where education, technology, and rehabilitation meet. Her questions regarding how her students relate and interact with mediated and simulated patients led her to pursue an academic degree to find appropriate solutions. (Barbara already possesses a professional/clinical doctorate in her field.) Her teaching methods currently include the integration of simulation technology - a simulated patient that is activated and embodied via a computer program - into her classroom. The simulations are increasingly a part of the curriculum at her current university and while it is generally accepted that the simulations represent a positive direction in pedagogy among her peers, Barbara is still uncertain and would like to do more research into the simulations to determine just what the effects are.

Rather than attempting to poll or survey students who have utilized simulation technology as part of their training, Barbara is more interested in how her students create meaning, knowledge and understanding of disease and ailments mediated by the simulation. This led her to ask such questions as: Are the students really learning? Are the simulations helpful? What does the use of the simulated patient do to student's understandings of ethical practice? Barbara, through an extensive literature search and conversations with colleagues, has discovered that there is a severely limited amount of research into this area. Further exploration is critical, Barbara notes, considering the future direction of simulation technologies into rehabilitation training including the increased number and acceptance of the methodology as an appropriate pedagogical solution.

Barbara loves her technology and loves being connected, she reflects as she rattles off the number of Apple products she owns. But in the same breath Barbara describes her attitude towards technology as critical. This stems from her experience in the classroom and in interacting with colleagues who, she notes, are quick to integrate technologies without much thought to the pedagogical implications. The effects of technology on teaching and learning are uncertain as far as Barbara is concerned. To note, Barbara is active in her professional field through conference presentations and published manuscripts on simulation technology and rehabilitation.

**Analysis.** Of all participants, Barbara demonstrates the most critical perspective toward technology. A compelling feature of Barbara's case is the difference in the tone of her philosophy statement and the point of view she shared during her interview. While her philosophy statement is forceful in referencing technology as a tool multiple times, when

speaking about technology in her interview Barbara has many more questions than the answers offered in her statement. She asks:

> Does a simulation represent good pedagogy? Is it worth the money? Does it matter who uses it in their teaching? Why isn't anyone asking these questions? There are not many people out there looking at this. I know – I've been looking.

Brooks describes the assumptions made by the critical approach to technology as acknowledging the ways technology can frame human thinking and understanding as well as the ability for humans to make alternative choices regarding the ways technology is used. Barbara takes a critical perspective by asking the question "Does a simulation represent good pedagogy?" Throughout her interview she maintained a healthy skepticism that did not surface as clearly in her philosophy statement. This skepticism toward technology and education is not reflected in her personal experiences with technology. She is obsessed with anything Apple and laughs when she talks about having so much technology.

For Barbara, technologies do possess values and part of what she is interested in researching are exactly how these values influence her students' moral and ethical understandings about interacting with future patients. While she could easily slip into the negative concerns associated with substantivists such as Bowers (2000) and Heidegger (1977), Barbara speaks with passion about her responsibility as a teacher to demonstrate what technologies can and cannot do, what they make available and what they diminish. Technology is assumed to be a matter of what she says about it and it is this sentiment that places Barbara within the critical tradition.

**Case 2 – Christine**

**Background.** Christine exemplifies the modern educator: she teaches Algebra online for a virtual public school and also teaches an undergraduate face-to-face course in school and society at a large, public, land grant university in the southeastern United States. She is also an online graduate student, enrolled in a program at the same university where she teaches, hoping to learn more about how to use technology effectively in her teaching.

Christine has always wanted to be a teacher and has looked forward to the day she would have her own classroom from a young age. She began her teaching career right out of her undergraduate degree teaching high school math for five years at a large, public suburban high school. In reflecting on her relationship with technology and her teaching, Christine draws on each of her three teaching experiences: face-to-face high school math, her online Algebra course, and face-to-face undergraduate class in Schools and Society.

Her interest in technology and education first came when she was trying to convey abstract mathematical concepts to her face-to-face high school students. She was aware of a number of online "applets" that demonstrated foundational concepts and formulated a number of lessons within her teaching units that utilized these modules. Christine reflects quite fondly on these memories of technology integration because she felt her students really seemed to "get it" for the first time. When asked to recall a time when a lesson worked particularly well when technology was integrated, these face-to-face lessons were specifically referenced.

Christine's personal relationship with technology is increasingly integrated. In completing her philosophy of technology statement she realized just how ubiquitous

technology has become: “What did we do 10 years ago? How did we live without these things [technologies]?” Having just recently purchased her first smart phone, Christine notes that she thinks phones have become somewhat of a status symbol. She saw this play out in her face-to-face high school classroom. Christine reflects on the cell phone and how it evolved from simply making phone calls to sending text messages, taking photos and recording video. Technology is always moving forward, getting better, more convenient, and more efficient.

What is most present for her now is her face-to-face undergraduate course where she utilizes PowerPoint slides to guide and frame the structure of each class session. Christine has purposefully attempted to include specific Web 2.0 technologies into this course since she thinks it is important for her students to know more about educational technologies. She has had her students utilize mobile polling, a laptop cart for 1:1 computing, and a number of web-based applications. Her students utilize a university provided laptop cart most recently in their assignment related to collecting information about school improvement plans at schools within the area.

Her online Algebra course teaching methods consist of creating announcement posts within Blackboard, recording screencasts, and sharing web-based tools with her students. The curriculum and tests are already produced so there is not much for Christine to do with developing content. She struggles with helping her students feel connected to her and the course online, though, and she attributes this to a lack of balance in her students’ world between technology and face-to-face communication. Christine is also unsure of whether or not online learning is the best solution for students taking courses for remediation (the

Algebra course that she teaches is co-taught with a face-to-face teacher in a blended learning format). Still, technology can be exciting and engaging for students, she reflects.

Christine loves and is fascinated with new technologies. As a teacher, however, she does not feel that the various organizations that employ her have prepared her adequately to use technology in her teaching. Christine refers to this as a theme with teachers and professional development. She relates a story from her face-to-face high school teaching where she volunteered to help teach an after-school program to at-risk students on using a new version of a calculator. The after-school workshops were funded in part by a grant, and teachers were urged to help the at-risk students approach abstract mathematical concepts and objectives with the technology. Christine, exasperated, reported that she and her co-teachers received no training on how to use the calculators and had to spend time outside of the workshops and apart from their other responsibilities to try and learn how to use the new calculators. What's more, the calculators that the students used after-school were "just different enough" from the ones they were expected to use during the normal school day such that they became confused and the entire process left a bad taste in her mouth.

Educators need education or training in technology, Christine argues. The calculator workshops were increasingly frustrating for her and her peers as there were high hopes and expectations included in the use of the grant monies for the calculators to affect students' understanding and achievement. Christine thinks that this has become what teachers expect from professional development and training. On the training she received before teaching online, Christine reflects that while she did shadow an online teacher and complete some training modules on teaching online, she feels that the amount of education offered to her

was inadequate. Most of what she's learned about teaching with technology she has done on her own.

**Analysis.** Christine's assumptions about technology most align with the determinist and instrumentalist perspectives. What is of interest is that she can recognize others' assumptions about technologies that are not as easily accessible to see in herself. For example, she acknowledges that teachers need more professional development in teaching with technology and even cites a story about an experience she had where the technology failed because she and her peer teachers did not receive adequate education and training. The fault is not the technology but rather with how others (administrators, other officials) thought that technology could be applied without regard for training or context. Throughout the interview, Christine reflected on how she used technologies in her teaching (mostly from an instrumentalist, technology as tool perspective) but only in the final moments of the interview mentioned using PowerPoint to structure her undergraduate face-to-face course. When asked why she did not think of PowerPoint earlier in the interview when asked to speak about the ways she used technologies in her teaching, she replied that it had become so much a part of her life and her teaching that it did not seem like a technology.

One of the results of an instrumentalist perspective is the rendering of technologies as transparent (Bowers, 1988; 2000). As a result, educators who hold instrumental views of technology are often unable to critically examine the technology because their point of view places the technology in a blind spot. For Christine, technology is assumed to be a neutral tool.

**Case 3 – Sheryl**

**Background.** Sheryl teaches business education and basic technology courses at a public high school in a rural area of the southeastern United States, in the same school that she attended for high school. Sheryl began her professional career as a tax accountant and while she and her husband enjoyed the financial stability provided by her work, she felt the urge for greater purpose and meaning in her work life and left over ten years ago to become a teacher. She reflects that she has always wanted to be a teacher and that she used to "play school" as a young child. Sheryl loves her job and her students.

Sheryl is most concerned with ensuring that her students leave her classes with an understanding of what they will need to know to be useful and successful in their lives. She is active in multiple communities within her school. Not only is Sheryl an active participant in her school community via assisting other teachers but also through volunteering for other roles and responsibilities as well. Sheryl is proud of her membership in her subject-specific community (career and technical education) and is well aware of current trends, initiatives, key stakeholders, and the overall context of her subject area.

Technological development shares a common history with her own life story. Sheryl teaches in a computer lab, the same room where she took keyboarding as a student in the mid 1970s. Her past and present relationships with technology become intertwined as she reflects on her career. For Sheryl, technology means primarily computers and the Internet. In her first career as a tax accountant, her first on-the-job training was a full week of computer training, completing computer-learning modules to prepare her for the software she would need to use. Ever since then, she has been fascinated with computers and what they can do.

Access to technology at Sheryl's school is high given the location of her classroom. Part of her course-load is regularly teaching Microsoft Office for certification, a skill-set that she acknowledges has high value in today's economy. Technology makes things so easy for students, she reflects, and she often wishes she could convey to students how easy it is to use the "strip of buttons" within Microsoft Word to format footnotes and endnotes. In the very room she teaches she struggled to learn to create footnotes on a typewriter three decades ago. Sheryl has tried to explain this phenomenon to students but does not think they really understand.

Still, Sheryl views technology and its trajectory positively and wishes that students would use it to explore more on their own. Recently, she has noticed a shift in her students when they have free time. Sheryl's students used to tend towards playing games on the computer or Googling information; but now, given the choice, they often select to talk to one another. Sheryl notes that it is very important for students to learn 21st Century Skills as well as those soft skills like face-to-face communication.

**Analysis.** While Sheryl does see technology headed in a positive direction, her philosophy statement frames technology as a mixture of good and bad. According to Feenberg's (1999) positions, Sheryl assumes a determinist/substantivist perspective. From these perspectives, Sheryl assumes that technology evolves and advances just as her own life does. She uses technology in her classroom as a tool to keep up with new technology trends to ensure her business students have the skills they need for the future. But at the same time, Sheryl is able to articulate a number of concerns that mirror the concerns of substantivists: "I'm worried that students aren't able to really think critically anymore with all of the

information out there… Are they getting those soft skills? Those face-to-face communication skills? I don't know." At the same time Sheryl describes a different relationship students must consider with technology:

> I think that kids need to be taught to respect it [...] I'm trying to expand their minds to get them to look past their first hit they get on Google or Bing because they're not always what they need to know. Does that make sense? There's more to the story than the first two hits on a page.

In this scenario, students must adapt to the technology and be respectful of it. Sheryl assumes technology as entity and that students should be wary of it and question their trust or faith in it. While her comments may sound deterministic, Sheryl actively reflects on how she thinks and uses technology throughout the interview. She noted at the beginning of the interview that she was grateful for the opportunity to talk about her thinking because she did not feel she was able to adequately express herself in her philosophy statement. Sheryl continued to grasp at her words while she was talking and often interspersed "I don't know" or "I'm not sure, does that make sense?" within her dialogue.

However, despite her grappling with technology, for practical concerns she clearly elucidated the instrumentalist perspective:

> But [students] need to be taught: It's a tool and they need to understand how to use it and use it effectively, to make it work. Just like with anything - a shovel... not doing anything except sitting in your driveway or your house.

## Discussion

The assumptions that the participants held about technology were complex, overlapping, and, more often than not, contradictory. This section names and describes the assumptions about technology held by the Phase One and Phase Two participants. In

addition, connections are made to Feenberg's (1999) philosophical perspectives towards technology to address the second research question regarding the influence of teacher assumptions about technology on their teaching practice. Six primary assumptions about technology were identified from participants' philosophy statements. These assumptions included: technology is a neutral tool, technology evolves, technology sponsors efficiency and enjoyment, technology is a threat, technology is mostly promising, and technology is complicated. Similar assumptions were categorized and subsumed within the six primary assumptions.

The three Phase Two participant cases (Sheryl, Christine, and Barbara) demonstrated each of the six predominant assumptions identified from the philosophy statements. However, specific assumptions were shared more often and more cogently within each case. Barbara begins her analysis of technology by assuming it is complicated. Her concerns regarding her students' understandings of the social and moral influences of technology assumes that technology can be a threat. Christine and Sheryl share key assumptions about technology including technology is a neutral tool and evolves. The way Sheryl and Christine spoke about the promises of technology (technology as mostly promising) evokes a sense of wonder and awe. At the same time, Barbara, Christine, and Sheryl each share experiences that they claim demonstrates the ability of technology to facilitate joy and efficiency. A paradox exists between the assumption of technology sponsoring efficiency and technology as a threat or as complicated. The challenges of technology shared by the Phase Two participants do not seem to match the assumptions they hold about technologies, regardless

of the complexity of their assumptions. This complexity may be why assuming technology as a tool is the default perspective.

Bowers (1988; 2000) argues that the dominance of instrumentalism is due to its ability to render other perspectives transparent. Likewise, Mezirow's transformative learning theory (2000) states that habitual ways of thinking are based on unexamined assumptions that hide alternative approaches and experiences of reality. More specifically, Bowers (2000) notes that the way we speak and the language we use to talk about technology renders the cultural and social assumptions made about the technology transparent. At the conclusion of the three case interviews, the Phase Two participants were given the opportunity to ask questions of the researcher regarding the study. Each participant requested more information on the researcher's point of view on the topics of education and technology as well as the goals and intent of the research study. Each conversation demonstrated the phenomenon described and detailed by Bowers (2000) and Mezirow (2000) – i.e., how to talk about concepts and understandings that are unseen and unknown for others.

Participants found it easy to reference how technology has influenced their teaching, resting on the assumption that technology was simply a tool. All participants assumed efficiency as a factor of technology integration. The ability for technology to motivate students was shared by half of the participants including one Phase One participant and two Phase One participants. Generally, technology is assumed to bring about immense opportunities (assumption: technology is mostly promising) including the ability to connect students with others from across the globe, decrease time spent engaged in administrative tasks, and provide access to an immense amount of information. Yet each of these advances

takes as fact that technology is a neutral tool. Whether adopting a determinist or instrumentalist point of view, technology does not, for the participants, mediate experience.

> Sheryl: It's a tool and [students] need to understand how to use it and use it effectively.
>
> Barbara: Technology, when used with this mindset, helps me as a tool to enhance the educational process … The most important consideration in educating children in a technology and media laden society is to help them understand that technology is a tool and a means to an end."
>
> Julie: We must be capable of critically evaluating the tools at our disposal.
>
> Grace: Since most students are comfortable with technology, it makes sense that technology can be used as a tool to help these students learn … Teachers have to beware of falling into the entertainment trap by finding tools that support the curriculum rather than tools that keep the students entertained.

Assuming that technology is neutral is beyond traditional understandings of right and wrong, positive and negative, or good and bad. In assuming that technology is a tool other ways of thinking about technology become invisible. For the participants in this study, technologies are transparent tools that they choose to employ whenever they see it fit. For Christine, Microsoft PowerPoint has become a natural part of her teaching and is no longer understood as a technology. Sheryl teaches in a classroom full of computers and her focus is on teaching students how to use the computers and the required software as tools. What would happen if Christine operated from the assumption that information presented digitally on a PowerPoint is fundamentally different from content shared orally? How might the shift away from the assumption of PowerPoint as neutral change her teaching practice? If it were assumed that software programs such as Microsoft Office were embedded and transmitted with the cultural assumptions of designers, would that change the way Sheryl approaches

teaching her students to use the software? These types of questions made available by alternative perspectives toward technology are almost unthinkable from an instrumentalist perspective (Bowers, 2000).

Brooks (2011) speaks of the "blind faith" espoused by politicians and political documents in her research into the political dialogue surrounding educational technology in the Canadian province of Alberta. This blind faith is showcased in Christine's calculator experience and Barbara's colleagues with simulation technologies. But as Barbara found in her review of the research literature, there do not seem to be conversations that exist surrounding critical questions of technology. She points out that her profession does not understand the effects of mediated simulations on students' ability to experience empathy or how the technology will truly affect patient care. These concerns deal with ethical and moral issues that instrumentalist points of view make unavailable. The virtual school Christine teaches for (and the participant population!) relies on the assumption that technology is neutral and does not mediate or influence interaction or experience.

The blind faith concept is also demonstrated in a number of reflections from participants about the assumed promises of technology:

> Grace: Teachers no longer lecture to passive students. Today's learning is accomplished through cooperative group work and active learning. …The role of teachers today is more of a facilitator of learning. It is their job to guide students through the learning process. Because of the nature of new technologies, the teachers also have to act as safety monitors and provide a good model of ethical computer use.
>
> Barbara: My role as a teacher is not replaced by technology, however it may be enhanced by it. Currently, I teach adults, so I become more a facilitator and guider of the educational process, rather than the sole source of the educational process. Technology, when used with this mindset, helps me as a

> tool to enhance the educational process. I use multimedia to illustrate points, and use web based tools to help learners apply knowledge gained within the classroom.
>
> Christine: I believe that technology can reach students with disabilities, provide flexibility for completing work, engage and motivate students, and simplify tasks for teachers. However, technology will not be beneficial when it is just placed in a classroom and teachers are not provided with proper training for how to use it. Technology should enhance the learning that is already occurring in the classroom.

The guiding assumption within these responses is of a positive, natural, and direct relationship between technology and teaching and learning. Barbara and Grace especially reflect the assumption that technology transforms teaching: "Teachers no longer lecture," and "I have become a facilitator." Research has challenged the so-called positive influences of technology on pedagogical decisions arguing that even with the influx of technologies teachers' teaching practices did not change (Ertmer & Ottenbreit-Leftwich, 2010; Lawrence & Beltran, 2010).

Specifically addressing the second research question regarding how teacher assumptions influence their teaching practice, the assumptions made about technology as a neutral tool characterized how participants used technologies in their classrooms: to enhance instruction, explain concepts, connect with others, access information, and facilitate administrative tasks. Technology was also referenced as a way to present and access a wealth of data for students. It is imperative that educators, teacher educators, professional development practitioners, state officials, and administrators understand that by adopting any of the philosophical perspectives results in certain realities made possible and others rendered

impossible. What might be gained from offering pre-service teachers the opportunity to examine how they choose to view technologies in their teaching?

What is lost in operating from only one perspective, especially considering the enormous influence and impact technologies seem to have on and over our everyday lives? This understanding of differing perspectives could open new inquiries into the development of existing teachers who are often seen as being unwilling or even afraid to consider using technologies in their teaching. What might they be concerned about, beneath that concern? What assumptions are being made about technology? What insight might tech-wary educators be able to offer the tech-savvy teacher? By identifying the assumptions educators are making about technology, we can analyze and reflect on the ways they experience and think about technology.

The current study focused on identifying and describing educators' assumptions about technology and the impact on their teaching. Participants' philosophy of technology statements and interviews revealed a number of assumptions held by educators. From the philosophy statements, six key assumptions about technology were analyzed: technology is a neutral tool, technology evolves, technology sponsors efficiency and enjoyment, technology is a threat, technology is mostly promising, and technology is complicated. The Phase Two participant interviews assisted in clarifying the assumptions held about technology, including the paradoxical quality of Phase One participants' assumptions. Considering the philosophy statements and case interviews as a whole, the participants primarily operated from a frame of reference that framed technology within an instrumental perspective. Instrumentalism therefore framed and influenced participant's teaching practice. Specifically, technology can

help: enhance instruction, explain concepts, connect with others, access information, facilitate administrative tasks, present and access data for students, motivate students, generate interest, and transform the role of the educator. While these statements seem promising, they are founded on unexamined, instrumental assumptions about technology. The current study results, which align with existing studies (Brooks, 2011; Chen, 2011), have implications for future research and practice. Additional research is needed to further explore how educators' assumptions frame and diminish their experiences with technology.

# CHAPTER 5: IMPLICATIONS, FUTURE RESEARCH & CONCLUSION

## Introduction

In this final chapter, an overview of the study and its methodology is provided. Research findings are summarized followed by an acknowledgment of the limitations of the study. The chapter concludes with recommendations for future research, implications for practice, and final thoughts.

## Methodology

This study focused on understanding and describing educators' assumptions about technology and how the assumptions influenced their teaching practices. Two questions guided the study:

1. What assumptions do educators hold about technology and its use in teaching and learning?

2. How do educators' assumptions about technology influence their teaching practice?

The study was completed as a qualitative case-based study. Merriam states: "A qualitative case study is an ideal design for understanding and interpreting observations of educational phenomena" (Merriam, 1998 p. 2). Glesne and Peshkin (2010) describe qualitative study as requiring the researcher to utilize multiple methods to make meaning/sense of, understand and describe the research. Four data sets were used for the current study: technology readiness survey results, Phase One and Phase Two participants' philosophy of technology statements, Phase Two participants' interview transcriptions, and researcher memos. The use of multiple data sets enabled data triangulation (Rothbauer, 2008;

Wolfram Cox & Hassard, 2009) that encouraged reliability of the study (Ward & Street, 2009). Participant data including philosophy statements and interview transcriptions were analyzed using Feenberg's (1999) perspectives on technology and the assumptions aligned with each position suggested by Brooks (2011). Data analysis was mapped by researcher memos, and assumptions were identified through key words and phrases as determined by the research literature, data sources, and professional experience of the researcher.

## Research Findings

The results of the study enhance and expand on previous research in educational research and philosophy of technology by incorporating additional perspectives on technology. Additionally, the results build on Chen's (2011) work with pre-service teachers, Brooks' (2011) research into public official and policy documents, and Anderson's (2009) case study on a school superintendent's assumptions about technology. Participants of the current study held assumptions about technology that are associated with Feenberg's (1999) determinist and instrumentalist perspectives. In the determinist point of view, technology is seen as neutral and evolves without influence to human agency. The assumptions underlying this philosophy include technology develops on an inevitable course and society must organize around technological advances. The instrumental position allows for human control, but still assumes technology as value-free. Both determinism and instrumentalism hold that technology is a neutral tool that does not possess any value-direction.

Chen (2011) examined only two perspectives of the philosophy of technology, instrumentalism and substantivism, and reported that his pre-service math teachers held instrumentalist points of view. Similarly, Brooks (2011) examined public policy documents

and interview transcriptions with educational administrators and officials and reported that the predominant discourse related to technology in teaching aligned with instrumentalism as well. The current study utilized Feenberg's four perspectives to examine the assumptions of technology of made by six in-service educators to find that participants most often assumed a determinist or instrumentalist perspective towards technology. In addition to embracing these two perspectives, six key assumptions were identified from Phase One and Phase Two participants' philosophy of technology statements and confirmed in the Phase Two participant interviews. The six assumptions include: technology is a neutral tool, technology evolves, technology sponsors efficiency and enjoyment, technology is a threat, technology is mostly promising, and technology is complicated. In making these assumptions about technology, the participants' ways of using technology aligned accordingly. For example, technology can help: enhance instruction, explain concepts, connect with others, access information, facilitate administrative tasks, present and access data for students, motivate students, generate interest, and transform the role of the educator. Specifically, most had uncritically adopted a technology-as-tool position towards technology.

## Limitations

There are four limitations of the study: the use of qualitative case study methods, researcher bias, data collection, and sample size. The first limitation was the use of qualitative and case study methods. The results from qualitative and case study research are challenged by concerns of validity and reliability. This limitation was addressed through the incorporation of multiple strategies including self-reflection and data and methodological triangulation. The aim of this descriptive study was to identify educators' assumptions about

technology by providing a case analysis of in-service educators enrolled in an online graduate course in instructional technology. Therefore, the results of the study are not meant to be a generalization for all educators. Researcher bias was addressed through bracketing to minimize this limitation. The data collection process is the third limitation. The questions developed for the participant interviews and the categories selected for the technology readiness survey limit participant responses. Because the research questions called for educators to reconstruct their understandings and experiences with technologies in their teaching, there also exists the limitation of participants' ability to reconstruct from memory their experiences reflected in the philosophy statements and in-depth interviews. The final limitation concerned the sample population. Considering potential participants were enrolled in an advanced course focused on education and technology the level of experience and comfort with technology must be acknowledged. The results of this study may vary considerably with a different sample of graduate students that lack an interest in educational technologies. Rather than originally conceived, this study consists of six Phase One participants and three Phase Two participants. Therefore, the study should be considered a preliminary inquiry into educator assumptions regarding technologies. The four limitations of the study could be resolved through further research.

## Recommendations for Future Research

There is a need for continued research and exploration into the ways that educators think, conceptualize and understand how technology intersects with their practice (Chen, 2011). Future research can build on Chen's (2011) work with pre-service teachers, Brooks' (2011) analysis of the assumptions made within policy dialogue in the Canadian province of

Alberta, and Anderson's (2009) case study of a superintendent's assumptions about technology. Specifically, future research should further expand the preliminary work of the present study to include additional interviews spanning a longer period of time. The inclusion of multiple participant observations of teachers' classroom practices would greatly supplement the reflective written statements and semi-structured interviews.

Additional inquiry could also assist understanding by framing and situating educators' assumptions about technology within the larger cultural and social context. This could include policy statements and documents, student input and reflections, parental feedback, administration officials, district and state boards of education, and existing curricular materials. Analyzing teacher educators' assumptions about technology would be another fruitful trajectory for future given their responsibility for preparing teachers to enter the classroom and effectively integrate technologies. By adopting alternative methodologies including action research and postmodern/poststructuralist research approaches, transformative learning theory could be used to explore ways to assist educators in transforming the assumptions made about technology. As a result, educators would be empowered to have a greater say in the ways technology is or is not utilized in the classroom.

## Implications for Practice

Despite increased professional development and greater integration of learning technologies into teacher preparation programs, teachers are not effectively integrating technologies into their classrooms to support student development and learning (Kilbourn & Alvarez, 2008). Pre- and in-service teachers are regularly pressured to unquestioningly embrace and accept new technologies. Educators need to be engaged in conversations that

encourage critical reflection on technology and its integration into education (Feenberg, 2002; Ferneding, 2003). While an instrumentalist or deterministic philosophical perspective may support technology use (Brooks, 2011), approaches that assume technology is a neutral tool do not necessarily promote effective use in classrooms (Somekh, 2000, Watson, 2006, & Cox & Marshall, 2007). Understanding this perspective is critical for teacher educators and providers of professional development to address with pre- and in-service teachers.

Efforts to support and instruct existing and future teachers in effectively integrating technologies into the classroom do not regularly examine the assumptions teachers hold about technology. Rather, these efforts focus on procedures, skills, teacher beliefs, and comfort level. Addressing and critiquing teacher assumptions about technology support educators' critically reflective practice and can empower rather than disempower teachers as they interact with technologies. However, Chen (2011) notes that there is little room within the undergraduate college curriculum for the types of philosophical reflection needed to support educators in critically analyzing the social and cultural implications of technology. Yet, engaging in critical reflection is key to being an effective teacher (Brookfield, 1995). Bowers (1988; 2000; 2005) argues that teachers must examine the assumptions that are the foundation for educational technologies to ensure a more harmonious relationship between humans and the natural environment. Given the power that assumptions have on educator beliefs, values, and expectations, there is a need for additional explorations with teachers to identify other ways this type of reflection could support teachers' reflective practice.

## Concluding Thoughts

As is demonstrated in multiple ways throughout this document, instrumentalist and determinist philosophies dominate educators' experience and understanding related to technology. Bowers (1988; 2000) demonstrates the ways that language has been influenced by instrumentalism. I was shocked after each interview to realize that in the process of completing the research study, I too had fallen into the traps of instrumentalism as I approached interacting with participants. Specifically, this shift in perspective occurred before and sometimes during interviews. I assumed that the questions I had developed, discussed with my graduate advisor, consulted on with my thesis committee, and were approved through the institutional review board were accessible and clearly worded for my interviewees. What I did not anticipate was what happened within each interview.

The interviews were meant to be semi-structured, so there was room for variability to match the conversational character of the interaction, but I found myself moved and connected with interviewees on a level my instrumentalist point of view had not prepared me for. My own background is in teaching and the words of the educators were touching, real, infused with emotion and counter to everything that is portrayed via mass media about teachers. At the conclusion of each interview - each interview - I reflected on what amazingly wonderful, committed, brilliant people teachers are. They love their students and their subjects. They are invested in their communities and the well-being of multiple stakeholders (parents, administration, etc.). They are doing their absolute best considering the many challenges and impediments that exist in their work.

Technology, and more specifically ways of thinking and assumptions about technologies, need not stand in the way of teachers. Technology does not direct the learning, does not set the boundaries. Teachers do. Instrumentalism holds educators back, disempowers them.

Most dedications are made at the beginning of documents like these. However, it has taken until the end for me to realize that the dedication of this document is to all teachers and educators, everywhere, for creating new possibilities in their students.

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# APPENDIX

## Appendix A: Technology Readiness Survey

Technology Readiness Survey

Please fill out this form to the best of your ability. It will help us best fit the course to your needs.

Items 1-56
Scale: Not Competent / Somewhat Competent / Competent / Very Competent

Basic Computer Operations Skills
1. Store files in a folder or subdirectory.
2. Access information on CD-ROM, hard drives, and other external storage devices (USB drives, etc.)
3. Create and delete folders or subdirectories.
4. Overall rating of basic computer operation skills.
5. Create, edit, and print various types of documents.

Setup, Maintenance, and Troubleshooting of Equipment
6. Virus protection
7. Connecting peripheral devices
8. Managing memory
9. Overall rating of ability to setup, maintain, and troubleshoot equipment

Word Processing
10. Set margins
11. Change font size and type
12. Cut, copy, and paste in and between documents
13. Insert files, graphics, and tables in a document
14. Overall rating of word processing ability

Spreadsheets
15. Enter data in cells
16. Move data within spreadsheet
17. Use formulas
18. Create charts
19. Overall rating of spreadsheet management ability

Databases
20. Enter data in a database
21. Sort and search in a database
22. Produce a report in a database
23. Queries using AND and OR

24. Overall rating of competencies using a database

Networking
25. Logging on a network
26. Working in a network environment
27. Electronic file sharing
28. Knowledge of advantages of a server
29. Overall rating of networking skills

Web-based technologies
30. Send and receive email
31. Navigate webpages and websites
32. Subscribe to a listserv
33. Develop programs or applets using an authoring system or language
34. Develop a slideshow presentation
35. Develop a presentation using graphics and sound
36. Using a blog
37. Using a wiki
38. Using RSS or a feed reader
39. Photo-sharing applications (Picasa, Flickr, etc.)
40. Video-sharing applications (YouTube, Vimeo)
41. Develop a website/webpage

Teaching with technology
42. Integrating "Web 1.0" technologies
43. Integrating Web 2.0 technologies
44. Integrating social media
45. Identify new web-based tools and how they can be integrated into the classroom
46. Evaluate the effectiveness of a web-based learning tool
47. Use technology to support instruction
48. Use technology to support connections with peers
49. Use technology to support connections with parents/other stakeholders
50. Use technology to support connections with administrators
51. Use technology to support connections with the greater community

Social, Legal, and Ethical Issues
52. Knowledge of copyright issues
53. Knowledge concerning shareware
54. Knowledge of software piracy
55. Knowledge of intellectual property rights
56. Overall rating of social, legal, and ethical issues

The following items refer to your satisfaction with distance education.
Scale: Strongly Disagree / Disagree / Neither Disagree nor Agree / Agree / Strongly Agree

57. Distance education is stimulating.
58. I prefer distance education.

You as a student
Scale: Never / Seldom / Sometimes / Often / Always

59. I work well with others.
60. I relate my work to other's work.
61. I discuss my ideas with other students.
62. I collaborate with other students in class.
63. I enjoy group work and find it beneficial to my learning.
64. I am able to set and meet my own deadlines.
65. I am able to meet instructor set deadlines.

## Appendix B: Philosophy of Technology Statement Assignment

Philosophy of Technology Statement Assignment

Your first assignment for ECI 719 will be to compose a Philosophy Statement on Technology. The following describes how you will complete this assignment.

First, skim the articles listed below so that you are familiar with them.

> Oppenheimer, T. (1997, July). The computer delusion. *Atlantic Monthly*, archived at http://www.theatlantic.com/issues/97jul/computer.htm.
>
> Subrahmanyam, K. Krut, R. Greenfield, P. & Gross, E. (2000). The impact of home computer use on children's activities and development. In *The Future of Children: Children and Computer Technology, 10*(2), (p. 123-144). Los Altos, CA: The David & Lucile Packard Foundation. [ link ]
>
> Montgomery, K. C. (2000). Children's media culture in the new millennium: Mapping the digital landscape. In *The Future of Children: Children and Computer Technology, 10*(2), (p. 145-167). Los Altos, CA: The David & Lucile Packard Foundation. [ link ]

Then, begin to draft your statement. Your Philosophy Statement on Technology should be no more than 1,000 words. It is important that you engage the required readings in your Statement and address each of the questions listed below. You can also include other sources if you wish. You must include a bibliography in your paper and notate sources/citations in the body of the text in APA 6th format.

1. Reflect on the relationship between society and technology – how would you define it? Why do you have this particular definition?

2. How does the relationship between society and technology involve the role of media in our society and the socialization of children? Why is this important to educators?

3. What do you think about the use of technologies in classroom instruction in terms of its effectiveness as an instructional tool? Please provide both advantages and disadvantages.

4. Explain how the use of technologies may/not change your role as a teacher. What are your feelings about this factor?

5. What do you think is most essential to consider about educating children within an information economy and media saturated cultural sphere?

This first assignment is due by Sunday, January 15 and should be submitted on your Working Portfolio Shared Google Doc. It should also be noted that this assignment is not graded, but rather recorded as Completed/Not Completed.

Adapted from (Chen, 2011):
http://www.ed.uiuc.edu/courses/ci235/grading/philosophy_assignment_sp04.html

## Appendix C: Emails to Participants

Emails to Participants

*Study Announcement Post & Email Approaching Potential Participants*

Hello! I hope this note/email finds you well!

I am beginning a research project on how graduate students in instructional technology understand and conceptualize educational technologies. Specifically, I'm interested in studying how in-service teachers experience technologies inside and outside of the classroom setting. Given your choice to enroll in ECI 719, I think your perspective will add a lot of value and insight to my research.

By agreeing to participate in the study, you are allowing me to utilize your (1) Technology Readiness Survey and (2) your Philosophy of Technology Statement as sources of data for the study. You will be assigned an appropriate pseudonym to ensure confidentiality. Other than reviewing and electronically signing a consent form, there are no other expectations for participation.

There is a second phase to my study that will include a 90-minute interview. Interested participants can volunteer for an interview to discuss their Philosophy of Technology Statements and their personal experiences with educational technologies. An additional email and Forum Announcement will be sent regarding participation in this phase.

If you have any questions, are interested in learning more about the project, or even if you are unable to participate, please let me know.

Click Here to View and Sign the Electronic Consent Form

Have a great day/evening! –matthew

*Phase Two Announcement Post & Email Approaching Potential Participants for Interviews*

Hello! I hope this note/email finds you well!

Thank you for agreeing to participate in the study. I am now beginning the second phase of the project: participant interviews.

By agreeing to participate in this second phase, you are allowing me to utilize your (1) Technology Readiness Survey and (2) your Philosophy of Technology Statement as sources of data for the study. Also, you will be asked to hold a 90-minute interview with the researcher to discuss your Philosophy of Technology Statements and personal experiences

with educational technologies. As with Phase One of the study, every effort will be made to ensure your anonymity.

If you have any questions, are interested in learning more about the project, or even if you are unable to participate, please let me know.

Click Here to View and Sign the Electronic Consent Form for the Second Phase of the Study

Have a great day/evening! –matthew

*Email to Determine Meeting Time/Medium*

Hey! Thanks for your email!

This is wonderful news – thank you so much for agreeing to let me interview you.

All we need to do is set up a time that is good for you to talk and figure out the best way to do so (e.g. Skype, Google+, phone call, face-to-face).

Let me know and thanks again! –matthew

## Appendix D: Interview Protocol

INTERVIEW PROTOCOL

General Technology
1. Describe your relationship to technology.
2. What kinds of technology do you use regularly in your day-to-day life? How do you use these technologies?
3. How have your understandings of technology represented in your Philosophy of Technology Statement and Technology Readiness Survey?

Teaching
1. Where (geographically) and what (subject/age) do you teach? For how long?
2. Why did you become a teacher?
3. Describe a lesson or unit that went really well. What specifically helped the lesson be so successful?
4. What kind of support do you receive within your school for professional development?
5. Describe your ideal lesson.
6. Describe your ideal student.
7. Describe your experience as a student. How would others describe you as a student?

Teaching & Technology
1. What technologies do you use in your classroom?
2. Do you receive any kind of support for teaching with technology?
3. Tell me about a time you used a technology in a lesson. What worked and what didn't work?
4. Talk to me about an upcoming lesson that you are thinking about incorporating technology into. How will the technology be used?
5. What do you want/wish students to learn/knew about technology?

## Appendix E: Informed Consent (Phase One)

**North Carolina State University**
**INFORMED CONSENT FORM for RESEARCH (Phase One)**

Title of Study: In-Service Teachers' Philosophies of Technology
Principal Investigator: Matthew Kruger-Ross
Faculty Sponsors: Lori B Holcomb-McClaren, PhD

**What are some general things you should know about research studies?**
You are being asked to take part in a research study. Your participation in this study is voluntary. You have the right to be a part of this study, to choose not to participate or to stop participating at any time without penalty. The purpose of research studies is to gain a better understanding of a certain topic or issue. You are not guaranteed any personal benefits from being in a study. Research studies also may pose risks to those who participate. In this consent form you will find specific details about the research in which you are being asked to participate. If you do not understand something in this form it is your right to ask the researcher for clarification or more information. A copy of this consent form will be provided to you. If at any time you have questions about your participation, do not hesitate to contact the researcher named above.

**What is the purpose of this study?**
Educators are often expected to integrate educational technologies into their teaching. While there is existing research on teacher knowledge, beliefs, and attitudes at the intersection of teacher education and technology, teacher philosophies of technology have rarely been explored. This study aims to explore in-service teachers' philosophies of technology as it relates to their teaching practice. Results will offer greater clarity for teacher educators, professional development coordinators, and supports and encourages participants' reflective practice.

**What will happen if you take part in the study?**
If you agree to participate in the Phase One of the study, you will be asked to allow the researcher to use your Technology Readiness Survey and Philosophy of Technology Statements as data sources. Every effort will be made to ensure your anonymity by assigning an appropriate pseudonym to any and all data. There are no other active requirements for participation in Phase One. As the researcher works and sorts through all data sources to produce the research report (thesis), the researcher may approach participants to seek further clarity and feedback on data included within the framework of the study. This communication will occur via email and the results will be incorporated into the secured data set.

**Risks**
The risks associated with participating in this project are minimal.

**Benefits**
Although you may not benefit directly from participation in this study, your participation will help to build the foundation of an area of research and study that is not well understood by researchers – teacher beliefs and assumptions about technology and teaching. A more direct benefit will include the opportunity to reflect on the use of educational technologies in your own classroom.

**Confidentiality**
The information in the study records will be kept confidential. Your identity and all data associated with your participation will be coded with a pseudonym to ensure greater confidentiality. Although the researcher is providing you with a pseudonym in the reports, there is a possibility that your identification may be determined due to the limited sample size and criteria used in this study. Data will be stored securely on the researcher's computer that is password-protected and in a secure location at all times. No reference will be made in oral or written reports that could link you to the study. If quotations from your interview are included in the final study report, they will be identified only by pseudonym and will not be linked to your identity. At the completion of the study, all data will be destroyed.

**Compensation**
For participating in this study you will receive no compensation.

**What if you are an NCSU student?**
Participation in this study is voluntary and not an official course requirement and your participation or lack thereof will not affect your class standing or grades at NC State. Participation is not required for any course.

**What if you have questions about this study?**
If you have questions at any time about the study or the procedures, you may contact the researcher, Matthew Kruger-Ross, at matthew_ross@ncsu.edu.

**What if you have questions about your rights as a research participant?**
If you feel you have not been treated according to the descriptions in this form, or your rights as a participant in research have been violated during the course of this project, you may contact Deb Paxton, Regulatory Compliance Administrator, Box 7514, NCSU Campus (919/515-4514).

**Consent To Participate**
"I have read and understand the above information. I have received a copy of this form. I agree to participate in this study with the understanding that I may choose not to participate or to stop participating at any time without penalty or loss of benefits to which I am otherwise entitled. I confirm that I am at least 18 years of age."

**Subject's signature_____ Date _____**
**Investigator's signature_____ Date _____**

## Appendix F: Informed Consent (Phase Two)

**North Carolina State University**
**INFORMED CONSENT FORM for RESEARCH (Phase Two)**

Title of Study: In-Service Teachers' Philosophies of Technology
Principal Investigator: Matthew Kruger-Ross
Faculty Sponsors: Lori B Holcomb-McClaren, PhD

**What are some general things you should know about research studies?**
You are being asked to take part in a research study. Your participation in this study is voluntary. You have the right to be a part of this study, to choose not to participate or to stop participating at any time without penalty. The purpose of research studies is to gain a better understanding of a certain topic or issue. You are not guaranteed any personal benefits from being in a study. Research studies also may pose risks to those who participate. In this consent form you will find specific details about the research in which you are being asked to participate. If you do not understand something in this form it is your right to ask the researcher for clarification or more information. A copy of this consent form will be provided to you. If at any time you have questions about your participation, do not hesitate to contact the researcher named above.

**What is the purpose of this study?**
Educators are often expected to integrate educational technologies into their teaching. While there is existing research on teacher knowledge, beliefs, and attitudes at the intersection of teacher education and technology, teacher philosophies of technology have rarely been explored. This study aims to explore in-service teachers' philosophies of technology as it relates to their teaching practice. Results will offer greater clarity for teacher educators, professional development coordinators, and supports and encourages participants' reflective practice.

**What will happen if you take part in the study?**
To participate, you must be (1) enrolled in ECI 719 and (2) an in-service teacher who has taught for more than three years. If you agree to participate in the Phase Two of the study, you will be asked to participate in one interview via a medium of your choice (face-to-face, online chat, email, video-conference, etc.). In the interview, which will last 90 minutes, you will be asked a series of questions meant to stimulate a reflective dialogue about your understandings and experiences regarding teaching and technology. The interview will be held in a private place, away from the work-place, and where you will not be overheard. Should the interview be recorded, the researcher will approach you and ask your permission before beginning to record the interview. As a final component of your participation in the study, you will be asked to review the researcher's summary and analysis of your interview for accuracy. Due to the limited population size, the number of participants in the second phase of the study and participating in the interviews will be no more than 5 individuals. This

increases the risk that you may be identifiable by other participants. As the researcher works and sorts through all data sources to produce the research report (thesis), the researcher may approach participants to seek further clarity and feedback on data included within the framework of the study. This communication will occur via email and the results will be incorporated into the secured data set.

**Risks**
The risks associated with participating in this project are minimal and would accompany an interview where mild emotional discomfort might be felt when asked to reflect on your beliefs and values.

**Benefits**
Although you may not benefit directly from participation in this study, your participation will help to build the foundation of an area of research and study that is not well understood by researchers – teacher beliefs and assumptions about technology and teaching. A more direct benefit will include the opportunity to reflect on the use of educational technologies in your own classroom.

**Confidentiality**
The information in the study records will be kept confidential. Your identity and all data associated with your participation will be coded with a pseudonym to ensure greater confidentiality. Although the researcher is providing you with a pseudonym in the reports, there is a possibility that your identification may be determined due to the limited sample size and criteria used in this study. Data will be stored securely on the researcher's computer that is password-protected and in a secure location at all times. No reference will be made in oral or written reports that could link you to the study. If quotations from your interview are included in the final study report, they will be identified only by pseudonym and will not be linked to your identity. At the completion of the study, all data will be destroyed.

**Compensation**
For participating in this study you will receive no compensation.

**What if you are an NCSU student?**
Participation in this study is voluntary and not an official course requirement and your participation or lack thereof will not affect your class standing or grades at NC State. Participation is not required for any course.

**What if you have questions about this study?**
If you have questions at any time about the study or the procedures, you may contact the researcher, Matthew Kruger-Ross, at matthew_ross@ncsu.edu.

**What if you have questions about your rights as a research participant?**
If you feel you have not been treated according to the descriptions in this form, or your rights as a participant in research have been violated during the course of this project, you may contact Deb Paxton, Regulatory Compliance Administrator, Box 7514, NCSU Campus (919/515-4514).

**Consent To Participate**
"I have read and understand the above information. I have received a copy of this form. I agree to participate in this study with the understanding that I may choose not to participate or to stop participating at any time without penalty or loss of benefits to which I am otherwise entitled. I confirm that I am at least 18 years of age."

**Subject's signature_____ Date _____**
**Investigator's signature_____ Date _____**

## Appendix G: IRB Exemption Request

### Institutional Review Board for the Use of Human Subjects in Research
### REQUEST FOR EXEMPTION (Administrative Review)

## GENERAL INFORMATION

| |
|---|
| 1. **Date Submitted:** *1/4/2012* |
| 2. **Title of Project:** *In-Service Teachers' Philosophies of Technology* |
| 3. **Principal Investigator:** *Matthew J. Kruger-Ross* |
| 4. **Department:** *Curriculum, Instruction & Counselor Education* |
| 5. **Campus Box Number:** *7801* |
| 6. **Email:** *matthew_ross@ncsu.edu* |
| 7. **Phone Number:** *XXX-XXX-XXXX* |
| 8. **Fax Number:** *n/a* |
| 9. **Faculty Sponsor Name and Email Address if Student Submission:** *Lori Holcomb McClaren / lori_holcomb@ncsu.edu* |
| 10. **Source of Funding? (required information):** *n/a* |
| 11. **Is this research receiving federal funding?** *n/a* |
| 12. **If Externally funded, include sponsor name and university account number:** *n/a* |
| 13. **RANK:**<br>Faculty: ☐<br>Student: ☐Undergraduate;☒ Masters;<br>or ☐ PhD<br>Other (specify): ☐ |

*As the principal investigator, my signature testifies that I have read and understood the University Policy and Procedures for the Use of Human Subjects in Research. I assure the Committee that all procedures performed under this project will be conducted exactly as outlined in the Proposal Narrative and that any modification to this protocol will be submitted to the Committee in the form of an amendment for its approval prior to implementation.*

**Principal Investigator:**

*Matthew J. Kruger-Ross*
(typed/printed name)

*As the faculty sponsor, my signature testifies that I have reviewed this application thoroughly and will oversee the research in its entirety. I hereby acknowledge my role as the* ***principal investigator of record****.*

**Faculty Sponsor:**

*Lori Holcomb McClaren*
(typed/printed name)
***Electronic submissions to the IRB are considered signed via an electronic signature**

*PLEASE COMPLETE AND DELIVER TO:*

**(carol_mickelson@ncsu.edu) or Institutional Review Board, Box 7514, NCSU Campus (Administrative Services III, Room 245)**

**********

For SPARCS office use only
Regulatory Compliance Office Disposition

☐ Exemption Granted ☐ Not Exempt, Submit a full protocol
Exempt Under: ☐ b.1 ☐ b.2 ☐ b.3 ☐ b.4 ☐ b.6

_____ _____
IRB Office Representative

**Project Description:** *Describe your project by providing a summary and answering the requests for information below.*

1. Project Summary. Please make sure to include the purpose and rationale for your study as well as a brief overview of your study.

*Educators are often expected to integrate educational technologies into their teaching. While there is existing research on teacher knowledge, beliefs, and attitudes at the intersection of teacher education and technology, teacher philosophies of technology have rarely been explored. This study aims to explore in-service teachers' philosophies of technology as it relates to their teaching practice. Results will offer greater clarity for teacher educators, professional development coordinators, and supports and encourages participants' reflective practice.*

2. Description of participant population, including age range, inclusion/exclusion criteria, and any vulnerable populations that will be targeted for enrollment.

*The population that I want to study is in-service teachers who are also enrolled in ECI 719: Integrating and Evaluating Web-based tools in Education. "In-service" is defined as having been in the classroom for more than three years. Projected participants will be 21 years old and greater. Other than attempting to reach a gender-balance and ensuring that participants are in-service teachers, there will be no other inclusion/exclusion criteria.*

3. Description of how potential participants will be approached about the research and how informed consent will be obtained. Alternatively, provide an explanation of why informed consent will not be obtained. Include a copy of recruitment materials, such as, scripts, letters of introduction, emails, etc. with your submission.

*Potential participants will be approached and introduced to the research project through the course learning management system, Moodle, that is sponsored by the university. The researcher will provide a written introduction (included with this submission) that will be shared within the Announcements Forum of Moodle. Even though students are automatically subscribed to the Forum (and therefore receive an email notice), the researcher will also send an introductory email to students that will contain the same text that is posted within the Announcements Forum.*

*The identical introductory Forum posting and email will include a link to an online consent form that is authenticated by the university-sponsored unity id system that requires a username and password. The students will select a checkbox marking whether they consent or do not consent and the online form will record each student's submission, username, and time of submission.*

4. Description of how identifying information will be recorded and associated with data (e.g. code numbers used that are linked via a master list to subjects' names). Alternatively, provide details on how study data will be collected and stored anonymously ("anonymously" means that there is no link whatsoever between participant identities and data). Describe management of data: security, storage, access, and final disposition.

*There are four sources of data: (1) demographics and survey responses, (2) written philosophy of technology statements, (3) recordings/transcriptions of recordings of participant interviews, and (4) researcher written reflections.*

*Beginning with the demographics and survey responses, the data will be coded as follows. Each participant will be assigned a pseudonym that will be recorded with every piece of data collected and will be sorted as such. The master list will be kept in a locked file on the researcher's computer and will only be accessible to the researcher. All data will be collected and stored on the researcher's laptop that is password-protected and stored in a secure location at all times. All data will also be backed up in an online storage folder that is password protected and accessible only to the researcher. At the completion of the study all associated data files will be destroyed (deleted) from all locations including the online storage folder and researcher's laptop.*

5. Provide a detailed (step-by-step) description of all study procedures, including descriptions of what the participants will experience. Include topics, materials, procedures, for use of assessments (interviews, surveys, questionnaires, testing methods, observations, etc.).

    1. *The first contact that potential participants will have is through a Welcome email sent by the course professor, Lori Holcomb McClaren, in early January 2012. In addition to provided information about the upcoming semester, the Welcome email will include a link to a demographics and technology knowledge-base survey which is required for all students enrolled in the course. Students will be asked to complete this survey, located online and accessible through the university-sponsored authentication process, before the first day of classes. The survey is utilized to better meet the needs of the students enrolled in the course and therefore no mention of the proposed research project will be mentioned in the Welcome email. (A copy of the Welcome email and Survey are included with this submission.)*
    2. *The researcher (who is also the course teaching assistant) will approach the students before the first day of classes (Spring 2012, Monday, January 9) by email to assign the Philosophy of Technology statement assignment. Students will be required to complete the assignment by the end of the first week of classes. No mention of the research project will be provided for students at this time. (Assignment description included in this submission.)*
    3. *During the first week of classes the researcher will send an introduction to the research project memo via email as well as a copy within the course Moodle site as a forum post. (See Question 3 above.) Within the email/forum post there will be a link to the informed consent and instructions on how to complete the form. Clarity will be provided for students at this juncture informing them that while their responses to the Demographics and Technology Survey and Philosophy of Technology assignment are required assignments for the course (non-graded, pass-fail), they are not required to be a participant in the study and are also not required to allow their information to be included in the study. (See Introduction email included in this submission.) The informed consent will also include an explanation of the possibility of a voluntary interview that participants may agree to complete with the researcher regarding their Philosophy of Technology Statements. Emails will be sent to both non-participants and participants thanking them for their consideration and/or participation as informed consent is completed.*
    4. *Once participants have had ample time to review the informed consent and ask any needed questions for clarification, the researcher will begin assigning participants an appropriate pseudonym for those students who have agreed to participate. After completing the master coding*

*list of pseudonyms, the researcher will return to the Demographics and Technology Survey data and the Philosophy of Technology statements assignments and begin to correlate, sort, code, interpret and analyze the data using Microsoft Word and Excel – both local to the researcher's laptop. All identifiable information will be removed and destroyed.*

5. *At the beginning of the third week of the course the researcher will email the participants who (1) have provided consent and (2) are in-service teachers requesting volunteers to participate in a 90-minute interview to discuss their survey responses, Philosophy statements, and overall relationship with technology. At least five volunteer participants will be selected based on (1) incorporating a distributed level of experience in the classroom and (2) equal representation of gender. These selected participants will then be asked to sign an additional informed consent including specifications of the interview. Selected volunteers will be sent a follow-up email to schedule a time and format acceptable and appropriate for the participant. Telephone, videoconference and face-to-face options will be suggested as possible formats. Participants will be asked to reflect on their experiences with technology and their philosophy statements. Mild emotional discomfort may occur but nothing beyond a typical conversation is expected.*
6. *The interviews will be recorded and transcribed by the researcher. If a paid service is utilized due to time constraints, no audio will be provided to the transcription service that would allow the participant to be identified in any way. The interview transcriptions will be correlated and coded as the Survey and Philosophy statements, and stored in a secure location.*
7. *Throughout the project, the researcher will keep a research journal that will include reflections of regarding the process, research questions, literature reviewed, and participant data. No personally identifiable information will be included in the researcher's journal and only pseudonyms will be used to refer to individual participants.*
8. *As the researcher works and sorts through all data sources to produce the research report (thesis), the researcher may approach participants to seek further clarity and feedback on data included within the framework of the study. This communication will occur via email and the results will be incorporated into the secured data set. All emails will be archived and are password-protected within the university-supported email program.*

6. Will minors (participants under the age of 18) be recruited for this study:

   *No.*

7. Is this study funded? *No.* If yes, please provide the grant proposal or any other supporting documents.

8. Is this study receiving federal funding? *No.*

9. Do you have a significant financial interest or other conflict of interest in the sponsor of this project? *No.*

10. Does your current conflicts of interest management plan include this relationship and is it being properly followed? *n/a*

11. **HUMAN SUBJECT ETHICS TRAINING**
    *Please consider taking the Collaborative Institutional Training Initiative (CITI), a free, comprehensive ethics training program for researchers conducting research with human subjects. Just click on the underlined link.

12. **ADDITIONAL INFORMATION:**

    a) If a questionnaire, survey or interview instrument is to be used, attach a copy to this proposal.

b) Attach a copy of the informed consent form to this proposal. See the IRB website for a Sample Consent Form and Informed Consent Checklist http://www.ncsu.edu/sparcs/irb/forms.html

c) Please provide any additional materials (i.e., recruitment materials, such as "flyers", recruitment scripts, etc.) that may aid the IRB in making its decision.

**If a survey instrument or other documents such as a consent form that will be used in the study are available, attach them to this request. If informed consent is not necessary, an information or fact sheet should be considered in order to provide subjects with information about the study. The informed consent form template on the IRB website could be modified into an information or fact sheet.*

**The Following are categories the IRB office uses to determine if your project qualifies for exemption** *(a review of the categories below may provide guidance about what sort of information is necessary for the IRB office to verify that your research is exempt)***:**

**Exemption Category:** *(Choose only one of the following that specifically matches the characteristics of your study that make this project exempt)*

☐ 1. Research conducted in established or commonly accepted educational settings, involving normal educational practices, such as (i) research on regular and special education instructional strategies, or (ii) research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods.

☒ 2. Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless: (i) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (ii) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability, or be damaging to the subjects' financial standing, employability, or reputation.
***Please Note- this exemption for research involving survey or interview procedures or observations of public behavior does not apply to research conducted with minors, except for research that involves observation of public behavior when the investigator(s) do not participate in the activities being observed.**

☐ 3. Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior that is not exempt under paragraph (b)(2) of this section, if: (i) the human subjects are elected or appointed public officials or candidates for public office; or (ii) federal statute(s) require(s) without exception that the confidentiality of the personally identifiable information will be maintained throughout the research and thereafter.

☐ 4. Research, involving the collection or study of existing data, documents, records, pathological specimens, or diagnostic specimens, if these sources are publicly available, or if the information is recorded by the investigator in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects.

5. Not applicable

☐ 6. Taste and food quality evaluation and consumer acceptance studies, (i) if wholesome foods without additives are consumed, or (ii) if a food is consumed that contains a food ingredient at or below the level and for a use found to be safe, or agricultural chemical or environmental contaminant at or below the level found to be safe, by the Food and Drug Administration, or approved by the Environmental Protection Agency, or the Food Safety and Inspection Service of the U.S. Department of Agriculture.