Philosophy of Technology Assumptions in Educational Technology Leadership:

Questioning Technological Determinism

Dissertation

Submitted to Northcentral University

Graduate Faculty of the School of Education
in Partial Fulfillment of the
Requirements for the Degree of

DOCTOR OF PHILOSOPHY

by

MARK DAVID WEBSTER

Prescott Valley, Arizona
March 2013

APPROVAL PAGE

Philosophy of Technology Assumptions in Educational Technology Leadership:

Questioning Technological Determinism

by

Mark David Webster

Approved by:

4/26/2013

Chair: Alexandru Spatariu, Ph.D. Date

Member: Glen Gatin, Ed.D.

Member: Alexandra Hilosky, Ed.D.

Certified by:

Dr. Cindy K. Guillaume 4-30-2013

School Dean: Cindy K. Guillaume, Ph.D. Date

APPROVAL PAGE

Philosophy of Technology Assumptions in Educational Technology Leadership:

Questioning Technological Determinism

by

Mark David Webster

Approved by:

4/26/2013

Chair: Alexandru Spatariu, Ph.D. Date

Member: Glen Gatin, Ed.D.

Member: Alexandra Hilosky, Ed.D.

Certified by:

Dr. Cindy K. Guillaume 4-30-2013

School Dean: Cindy K. Guillaume, Ph.D. Date

Abstract

Scholars have emphasized that decisions about technology can be influenced by philosophy of technology assumptions, and have argued for research that critically questions technological determinist assumptions. Empirical studies of technology management in fields other than K-12 education provided evidence that philosophy of technology assumptions, including technological determinism, can influence the practice of technology leadership. A qualitative study was conducted to a) examine what philosophy of technology assumptions are present in the thinking of K-12 technology leaders, b) investigate how the assumptions may influence technology decision making, and c) explore whether technological determinist assumptions are present. The research design aligned with Corbin and Strauss qualitative data analysis, and employed constant comparative analysis, theoretical sampling, and theoretical saturation of categories. Subjects involved 31 technology directors and instructional technology specialists from Virginia school districts, and data collection involved interviews following a semi-structured protocol, and a written questionnaire with open-ended questions. The study found that three broad philosophy of technology views were widely held by participants, including an instrumental view of technology, technological optimism, and a technological determinist perspective that sees technological change as inevitable. The core category and central phenomenon that emerged was that technology leaders approach technology leadership through a practice of *Keep up with technology (or be left behind).* The core category had two main properties that are in conflict with each other, *pressure to keep up with technology*, and the *resistance to technological change* they encounter in schools. The study found that technology leaders are guided by two main

approaches to technology decision making, represented by the categories *Educational goals and curriculum should drive technology*, and *Keep up with Technology (or be left behind)*. As leaders deal with their perceived experience of the inevitability of technological change, and their concern for preparing students for a technological future, the core category *Keep up with technology (or be left behind)* is given the greater weight in technology decision making. The researcher recommends that similar qualitative studies be conducted involving technology leaders outside Virginia, and with other types of educators. It is also recommended that data from this or other qualitative studies be used to help develop and validate a quantitative instrument to measure philosophy of technology assumptions, for use in quantitative studies.

Acknowledgements

I would first of all like to thank my lovely wife, Jesselyn ("Jingjing"), for your patience and understanding, and your willingness to tolerate the sacrifices that were necessary for me to keep plugging away at this dissertation process for months and years at a time. I decided to begin this acknowledge before even finishing the dissertation, because her encouragement and faith in me during the process has kept me going. Where this road leads only God knows, but Jingjing your confidence that I can complete the journey, and your reassurances that the doctorate will bring blessings keeps me going. Thank you for your love and support.

I would also like to thank my five children, who have observed me wracking my brain at the formal dining room table, with books and binders and papers scattered about, with this academic clutter only to be moved (temporarily) for important things like Thanksgiving or Christmas dinner. (Thank goodness we have another dining table for our everyday meals.) The inspiration of my youthful children who can study with energy and less exhaustion than their older father encourages me to keep going, and your scholarly endeavors help keep me company. Dorothy, David, Joseph, Annamarie, and Teresa, thank you for your love and support. I hope that when I am finished with this process we can all take more time to enjoy fun and happy activities together.

I thank my Chair Dr. Alexandru Spatariu, who I have been working since the time of writing my concept paper, for your advice and calm perseverance, for your promptness in reading and providing feedback on my work, and for having confidence in me and my research. Thank you also to my Committee members Dr. Glen Gatin and Dr. Alexandra Hilosky for your feedback and assistance in improving my writing and documents. I would also like to thank the people of Northcentral University for making this doctorate opportunity available to a busy working professional who could not have done this through a traditional brick and mortar program.

Thanks also to all of the 31 technology professional who remain anonymous, who participated in the interviews and completed the written questionnaire. I enjoyed learning more about your philosophy of technology, and I worked hard to faithfully capture your responses in the transcripts. Your participation as research volunteers during your busy lives is much appreciated. I also thank my coworkers in Colonial Heights Public Schools who have patiently endured my approach to educational technology from a philosophical perspective. You see, philosophy matters!

I thank my Guardian Angel who somehow mysteriously opened up a document when I was most in need of a message from heaven about the purpose of this dissertation. Father God thank you for the opportunity to use the gifts that you gave me to work on my doctorate, I pray this endeavor has been according to your will for my life, and I ask you to lead me where you would have me to go, through Jesus Christ our Lord. Amen. Blessed Mother Mary I consecrate myself to you through Jesus, and I do the same with this dissertation, in the hope that God will do with this work what He wills.

Table of Contents

List of Tables

List of Figures

Chapter 1: Introduction

Scholars have observed that technological determinist assumptions appear prevalent in the popular mindset (Best, 2009; Burnett, Senker & Walker, 2008; Carr-Chellman, 2006; Friesen, 2008; Hofmann, 2006; Leonardi, 2008; Lievrouw, 2006; Selwyn, 2010b; Wyatt, 2008; Yang, 2009). Technological determinism is the philosophical perspective that assumes that technology causes inevitable change in society (Leonardi, 2008; Leonardi, 2009), exerting a control over human society with technology considered in some way to be an autonomous force operating outside of social control (Feenberg, 2010; Hofmann, 2006; Leonardi, 2009). Hofmann (2006) discussed the implications of technological determinism for persons with responsibilities for technology, and argued that when assessing technology in a context such as education, we need to examine whether technology controls us, or whether we control technology. To assume that technology determines our choices presents a dilemma for responsible leadership, and Hofmann asserted "if we really are determined by technology in one way or another, it must mean that we have less responsibility for technology" (p. 2).

Associated with technological determinism is a tendency to evaluate technology merely in terms of its functional efficiency, with technology in control, and overshadowing other human values including ethical considerations (Vermaas, Kroes, van de Poel, Franssen, & Houkes, 2011). Technological determinism is influenced by a technological rationality that assumes the best solution to any problem is the most technologically efficient one (Vermaas et al., 2011), with technology outside of ethical critique (Amiel & Reeves, 2008; Robinson & McKnight, 2007; Vermaas et al., 2011).

Such a view is problematic for educational technology leadership, because technologies can be value laden and carry ethical implications (Amiel & Reeves, 2008; Consortium for School Networking, 2011; Hofmann, 2006; Lowrance, 2010). For example, the national framework for K-12 educational technology leadership addresses ethical considerations that are integral to responsible technology leadership, including Internet safety for students, computer security, equitable access to technology, copyright compliance, personal privacy, and environmental protection and energy saving practices (Consortium for School Networking, 2011).

The qualitative study was guided by the work of Strobel and Tillberg-Webb (2009) who presented a critical and humanizing framework for educational technology that emphasizes that integrating technology into educational practice should take into account the belief systems and values informing those choices. Strobel and Tillberg-Webb (2009) asserted that a questioning of assumptions about educational technology should begin by analyzing how philosophical views about technology may correspond to the perspectives of technological determinism or social determinism. Social determinism is the opposite perspective of technological determinism, and assumes that technologies evolve and develop through being shaped by social processes, with the technologies fundamentally embedded in social systems (Kanuka, 2008; Strobel & Tillberg-Webb, 2009). Strobel and Tillberg-Webb (2009) held that educators, researchers, and policy makers should critique their own beliefs and assumptions about technology, question deeper the connection between technology and human values, and engage in critical dialogue with other educators and students concerning such beliefs.

This chapter explores issues surrounding technological determinism for the field of educational technology, and highlights why questioning assumptions about technology, such as technological determinism, can better inform educational technology professional practice. The Significance of the Study section discusses research outside of K-12 education that examined the impact of philosophy of technology assumptions such as technological determinism on technology management. The Nature of the Study, Purpose, and Research Questions describe the qualitative methods used to examine the philosophical assumptions about technology that influence the thinking and decision making of K-12 technology leaders.

Background

For the purposes of the study, the term technology refers to its broad use within the educational technology field. The Association for Educational Communications and Technology (AECT) defined educational technology as "the study and ethical practice of facilitating learning and improving performance by creating, using, and managing appropriate technological processes and resources" (Januszewski & Molenda, 2008, p. 1). Hlynka and Jacobsen (2009) discussed that the AECT definition focuses on educational technology as more than mere tools, because the emphasis is on ethical practice oriented toward leveraging technology to improve education and facilitate learning. In defining core skill areas for K-12 educational technology leadership, the Consortium for School Networking used the term educational technology in a broad sense, to reflect how educational technology involves the management and use of technology in various capacities within education (Consortium for School Networking, 2011). Educational technology includes a) information technology, such as computer systems and network infrastructure, b) digital technology used for improving teaching, learning, and communication, and c) the information and data systems used for managing the business of education (Consortium for School Networking, 2011).

Scholars have emphasized the importance of critically examining philosophical assumptions about technology, including within education and leadership (Carr-Chellman, 2005; Fisher, 2006; Hofmann, 2006; Kanuka, 2008; Kritt & Winegar, 2010; McDonald et al., 2005; M. Oliver, 2011; Orlikowski & Scott, 2008; Pearson & Young, 2002; Smith, 2006; Strobel & Tillberg-Webb, 2009; Selwyn, 2010b). Kanuka (2008) argued that by examining their philosophy of technology assumptions, thoughtful practitioners with responsibilities for educational technology are better able to make purposeful and informed decisions in selecting the right technologies for the right reasons. Strobel and Tillberg-Webb (2009) proposed a framework for educational technology that emphasizes that educators and administrators should question their philosophical beliefs about technology. The starting point for their framework involves educators examining whether technological determinist assumptions influence thinking about educational technology (Strobel & Tillberg-Webb, 2009).

The literature includes a large body of scholarship that has engaged in critiques of the theory of technological determinism. Technological determinism is the philosophical perspective that assumes that technology causes inevitable change in society (Leonardi, 2008; Leonardi, 2009), exerting a control over human society with technology considered in some way to be an autonomous force operating outside of social control (Feenberg, 2010; Hofmann, 2006; Leonardi, 2009). Granting a control or determined autonomy to technology, apart from purposeful human control and direction, would present a dilemma by limiting human agency and responsibility for technology (Fisher, 2006; Hofmann, 2006; Jonas, 2009; Jonas, 2010; Kritt & Winegar, 2010; Slack and Wise 2006; Strobel & Tillberg-Webb, 2009; Wyatt, 2008). Strobel and Tillberg-Webb (2009) stated that if technology is assumed to be driving change and this influences the decision making process, it leaves less room for the agency of the human actors involved, who perceive the world as run by technology. Out of concern not to be left behind, educators and students can find themselves preoccupied with keeping up with technological change they perceive to be inevitable, and neglect to adequately focus on the educational benefits afforded by the technologies (Strobel & Tillberg-Webb, 2009).

Associated with technological determinism is the view that technology is in control and that it overshadows human values, with technology outside of cultural and ethical critique (Amiel & Reeves, 2008; Robinson & McKnight, 2007; Vermaas et al., 2011). A similar view about technology as it pertains to values is the neutrality thesis, that holds technology is neutral with regard to values, neither good nor bad in itself. The neutrality thesis can be problematic because when viewed from this perspective, technology tools are seen as having no inherent ethical consequences (Brey, 2010; Robinson & McKnight, 2007). However, philosophers of technology have often argued that technologies are inherently value laden (Franssen, Lokhorst, & van de Poel, 2009). Decisions to implement technologies in schools should consider whether the technologies may have ethical implications (Amiel & Reeves, 2008; Consortium for School Networking, 2011; Hofmann, 2006; Lowrance, 2010; Virginia Department of Education, 2010). For example, Virginia school districts are required to integrate Internet safety instruction into curriculum, and educational leaders should consider ethical issues such as

Internet safety when making decisions about adopting educational technology (Virginia Department of Education, 2008a; Virginia Department of Education, 2010). A national framework of essential skills for K-12 technology leadership defines core skill areas for the profession, including awareness of ethical considerations that are integral to adopting educational technology (Consortium for School Networking, 2011). Ethical considerations about technology defined in the national framework include Internet safety for students, equitable access to technology, copyright compliance, personal privacy, environmental protection and energy saving practices, and ensuring that technology promotes a high-performing learning environment (Consortium for School Networking, 2011).

Scholars have observed that technological determinist assumptions appear prevalent in the popular mindset (Best, 2009; Burnett et al., 2008; Carr-Chellman, 2006; Friesen, 2008; Leonardi, 2008; Lievrouw, 2006; Selwyn, 2010b; Wyatt, 2008; Yang, 2009), and can affect media discourse (Cukier, Ngwenyama, Bauer, & Middleton, 2009; Friedman, 2009). For example, Friedman (2009) examined American media coverage of the 2009 Iranian presidential election, and the ensuing protests in Iran disputing the results, and concluded that the American media rhetoric about Twitter was influenced by technological determinist assumptions that technology causes inevitable social change. Friedman (2009) asserted that although the media attention inspired Americans to become more interested in the Iranian struggle, the discourse was influenced by the perception that utopian social transformation would inevitably occur in Iran through technology. Morozov (2009) observed that utopian views about technology, proceeding from the technological determinist assumption that it will inevitably cause the spread of democracy around the world, have been present in statements by political analysts, and U.S. presidents such as Bill Clinton and George W. Bush. Friedman (2009) noted, however, that international observers concluded a broad-based grassroots movement drove the Iranian protests more so than social networking technologies causing inevitable change. The media discourse of technological determinism minimized the role of the human agents in the complex social struggle, while exaggerating the effects of social media (Friedman, 2009).

Empirical research studies provide evidence that technological determinist assumptions about the inevitability of technology can influence the decisions and actions that leaders make on behalf of their organizations (Grant, Hall, Wailes, & Wright, 2006; Jackson & Philip, 2010; Leonardi, 2008; Leonardi & Jackson, 2004; Prakash & Sinha, 2008). For example, Leonardi and Jackson (2004) examined corporate mergers to investigate how leaders used storytelling to justify their actions to the public. The researchers found that discourse characterized by technological determinism, and the inevitability of technology, was a powerful element of the organizational narrative used in the corporations' public discourse (Leonardi & Jackson, 2004). The researchers concluded that managers relied on technological determinist rhetoric to portray their actions as uncontestable and inevitable because of technology, rather than take ownership of their decisions (Leonardi & Jackson, 2004).

Grant et al. (2006) conducted a case study to examine how technological determinist rhetoric from technology vendors influenced the actions of stakeholders and managers in organizations in their adoption of enterprise information systems. At the company where managers adopted the technological determinist assumption that the technology would guarantee transformation of business processes, the system implementation met with resistance from stakeholders, and did not produce the results promised for it (Grant et al., 2006). The Significance of the Study section explores in more depth research in fields outside of K-12 education that examined how philosophy of technology assumptions such as technological determinism can influence technology leadership.

Philosophical assumptions about technology shape interactions and discourse between educators, and influence decisions pertaining to technology integration, but assumptions can be unrecognized and outside of our explicit awareness (Kanuka, 2008; Kritt & Winegar, 2010; Strobel & Tillberg-Webb, 2009). Researchers have found that technological determinist assumptions can influence educational discourse (Fisher, 2006; Canole, 2007; Cukier et al., 2009) and affect educational policy (Clegg, Hudson, & Steel, 2003; Cukier et al., 2009; Wyatt, 2008). Using critical hermeneutic analysis and content analysis techniques, Cukier et al. (2009) examined media discourse surrounding an instructional technology initiative at Acadia University in Canada, called the Acadia Advantage. The initiative involved a university funded student laptop initiative through a partnership with IBM, and received much media attention (Cukier et al., 2009). The researchers found that hyperbole evoking a technological determinist viewpoint, with technological change portrayed as inevitable and unstoppable, was present in both academic and non-academic sources (Cukier et al., 2009). Cukier et al. found that rhetoric of the technological imperative was a dominant metaphor that distorted discourse by making exaggerated claims for the technology initiative, such as overstating its benefits for student learning without sufficient concrete evidence. The technological determinist rhetoric tended to marginalize dissenting opinions by portraying the technology initiative as inevitable (Cukier et al., 2009).

Fisher (2006) examined discourse and rhetoric about educational transformation, and observed a tendency for some discourse to be framed in technological determinist language that ascribed to technology the power to inevitably cause positive change in schools. Technological determinist assumptions were present in the hyperbole in advertising from technology vendors, in official discourse in educational policy documents, and in public comments by education officials (Fisher, 2006). Fisher (2006) concluded that such technological determinist assumptions are a problem because by ascribing autonomous change to technology, rather than to educators, the perspective shortchanges the hard work that educators must undertake to improve and transform education.

One theoretical account of technological determinism asserts that technology is partially autonomous, because even when we approach technology in deliberate and responsible ways, technology can cause inadvertent consequences that we did not anticipate, and may not be able to control (Bimber, 1994; Jonas, 2009; Vermaas et al., 2011). Technological change places pressure on schools and educational technologists to catch up or keep abreast with evolving technology (Kritt & Winegar, 2010; Selwyn, 2010b), leaving less time for considered judgment and contemplative leadership (Canole, 2007; Selwyn, 2010b). The frantic pace of technological change and dealing with new developments presents a challenge for educators and technology leaders because technology may result in unanticipated consequences and risks that were not intended (Canole, 2007; Kanuka, 2008; Nworie & Haughton, 2008). Nworie and Haughton (2008) conducted research on the adoption and implementation of innovative technology and described the instructional benefits, challenges, and unintended consequences of digital innovations for face-to-face instruction and virtual learning. The researchers concluded that along with the instructional merits afforded by technology there can be unintended consequences such as ease of cheating, and distractions from learning such as games, inappropriate content, and off task web surfing (Nworie & Haughton, 2008). Educators should be aware of the possibility that instructional disparities can widen for students who are without sufficient access to technology at home (Nworie & Haughton, 2008).

Some scholars (Kanuka, 2008; Mason & Rennie, 2010) have observed a tendency for technology advocates to eagerly embrace technology trends because of an enthusiastic but sometimes uninformed zeal that the new developments will improve education. On the one hand, anticipating technology trends can be a proactive approach to technology leadership (Battistella & De Toni, 2011). Battistella and De Toni (2011) conducted a case study to investigate whether a strategy oriented toward forecasting technological trends can be proactive and effective. The researchers concluded that successful organizations, by aligning decision making and organizational strategies with technological trends, will stand ready in advance for the future (Battistella & De Toni, 2011). However, based on discussions with technology leaders, Adomavicius, Bockstedt, Gupta, and Kauffman (2008) cautioned that forecasting technology trends can be difficult, and pursing the wrong trend by miscalculating technological developments can waste organizational resources including money and time. Gabberty and Vambery (2008) held that technological determinist assumptions of the inevitability of technology influenced companies in the late nineties to rush to invest in technological development, leading to the *dot com bust.*

Within K-12 education, if educators assume a commercial technology is inevitable, they tend to focus on how schools should adapt to technology, rather than shape the technology to meet curriculum requirements, and teachers' and students' needs (Jones & Czerniewicz, 2010). An historic example of significant public monies spent on following a commercial technology trend heading toward obsolescence involved the Texas Palm handheld initiative. Nationwide, many schools invested heavily in Palm pilots, believing they held promise for affordable one-to-one computing (Johnson, 2005; Schrum & Levin, 2008). Texas provided $2 million in grant money for Palm handhelds for elementary schools (Solomon, 2006). Lacina (2008) described how the Palm Pilots were effective reading assessment tools in the hands of Texas teachers. However, Palm handhelds were to become obsolete in 2009 when Palm discontinued the devices in favor of smartphones (Phillippi & Wyatt, 2011). Adomavicius et al. (2008) argued that in order for technology leaders to make the right decisions in forecasting future trends, it is important to study technological change while considering theories such as technological determinism. By examining philosophy of technology assumptions, thoughtful practitioners are better able to make purposeful and informed decisions in selecting the right technologies for the right reasons (Kanuka, 2008).

Technology advocates often consider technology as having the capacity to transform education (Murray & Olcese, 2011; Selwyn, 2010b). Several scholars have argued that technological determinist assumptions may influence the belief system that inspires the optimism of school technology advocates (Fisher, 2006; Friesen, 2008; Kritt

&Winegar, 2010; Selwyn, 2010b; Strobel & Tillberg-Webb, 2009). Selwyn (2010b) held that within educational technology, technological determinist beliefs have often served as the taken for granted pretext, because professionals in the field often perceive technology as an autonomous force set to inevitably change education for the better. Friesen (2008) analyzed learning technologies from a critical theory perspective, and held that an optimistic view of technology's transformative power can be associated with a technological determinist perspective that sees technology as having the power to act on its own in forcing change in schools.

Despite the optimism and persistent efforts of technology advocates through research and professional efforts, scholars have observed that many schools remain resistant to technological change and transformation (Friesen, 2008; Murray & Olcese, 2011; Selwyn, 2010b). Selwyn (2010b) argued that a type of cognitive dissonance is present in educational technology literature, because similar predictions for technology transformation have been present for over two decades. Leonardi (2008) argued that the consequences of technological determinist assumptions include the tendency to dismiss the social factors that affect technological outcomes.

Several scholars have observed a tendency in education to categorize ideological views about technology on either side of a dichotomy, with one side being generally optimistic about technology, the other side mostly pessimistic (De Vaney, 1998; Kritt & Winegar, 2010; Selwyn, Gorard, & Furlong, 2006; Strobel & Tillberg-Webb, 2009). The optimistic view can be stereotyped as holding a technological utopian position that presents technology innovation as always for the better, while the opposite view is stereotyped as holding a pessimistic Luddite position generally not open to technological innovation (Kritt &Winegar, 2010; Strobel & Tillberg-Webb, 2009). It is notable in the literature that both optimistic and pessimistic views about technology have been associated with technological determinism and seeing technology as the inevitable cause of change, whether good or bad (De Vaney, 1998; Kanuka, 2008; M. Oliver, 2011).

Kritt and Winegar (2010) argued that the false dichotomy limits possibilities, and does not represent the true range of alternative views about educational technology. Strobel and Tillberg-Webb (2009) similarly held that moderate positions are possible between the two extremes, and argued that the reductionist nature of the dichotomy calls for the critical examination of philosophical assumptions about technology. Strobel and Tillberg-Webb (2009) emphasized that educators, researchers, and educational policy makers should critically analyze their own ideological beliefs about technology, and engage in critical dialogue with other educators and students concerning such beliefs.

Several scholars (Bennett & Maton, 2010; Brown & Czerniewicz, 2010; Jones & Czerniewicz, 2010; Jones & Healing, 2010) have recently argued that popular educational discourse about young people being digital natives, or the Net Generation, appears influenced by assumptions of technological determinism. Discourse about digital natives involves the general claim that inevitable technology is causing inevitable change in students (Jones & Healing, 2010). Jones and Healing (2010) asserted that the digital native argument proceeds from a simplistic view of causality influenced by technological determinism. The discourse makes the claim that young people who have grown up with technology have been fundamentally changed by it and now have a natural aptitude for it compared with older people, who are considered immigrants (Jones & Czerniewicz, 2010). Related claims made about digital natives are that technology has caused changes in students' learning styles and even brain function (Jones & Healing, 2010; Jones & Czerniewicz, 2010). Such discourse about digital natives has been present in educational policy statements and popular rhetoric (Jones & Czerniewicz, 2010).

The digital natives discourse is an example of how educators' philosophical assumptions about technology can influence educator beliefs about students, in this case involving the technological determinist assumption that technology causes inevitable change to students and schools (Bennett & Maton, 2010; Jones & Healing, 2010). Bennett, Maton, and Kervin (2008) asserted that the digital natives discourse has used dramatic language that can create a sense of moral panic in academic circles. The discourse can affect debate on educational policy issues by presenting technological change as inevitable, and dismiss the opinions of educators who may have legitimate concerns (Bennett & Maton, 2010; Jones & Healing, 2010). The digital natives discourse can create a problem for professional development if older educators are perceived as being out of touch, and not as able to become proficient with technology because of their age and generational position (Jones & Healing, 2010). Bennet and Maton (2010) argued that educators should move beyond the digital native rhetoric toward rationale debate based on researchable issues. The Literature Review in Chapter 2 discusses findings from recent empirical studies about digital natives that investigated this issue, including its connection with technological determinism.

A tradition of decades of research on the effectiveness of instructional technology provides strong evidence for the potential of computer technology to improve teaching and learning. Tamim, Bernard, Borokhovski, Abrami, and Schmid (2011) used a meta-analysis to study and summarize forty years of research comparing instruction that employed technology with instruction that did not integrate technology. The researchers found a significantly positive effect for instruction that integrated technology compared with traditional instruction (Tamim et al., 2011). Ringstaff and Kelley (2002) conducted a review of major longitudinal studies on instructional technology that they judged to be methodologically sound. Ringstaff and Kelley (2002) concluded that technology rich learning activities can promote inquiry based learning, collaboration, and critical thinking, while motivating students to become more interested in learning. Using computers in a tutorial capacity can help to improve student achievement as measured by standardized tests (Ringstaff & Kelley, 2002).

However, some scholars (McDonald et al., 2005; M. Oliver, 2011; Selwyn, 2010b) have argued that technological determinist assumptions have sometimes influenced educational technology research, by overemphasizing the impact of technology by ascribing most causal effects to it. M. Oliver (2011) analyzed research on technology and learning to consider whether studies proceeded with technological determinist assumptions, and found that some studies made unwarranted conclusions. For example, M. Oliver (2010) held that some researchers made category errors by moving from descriptions of educational practices that employ technology, to abstract from the data the conclusion that technology was the cause of phenomena observed, although it was only a part of the process. Research that assumes technology has causal power to determine human behavior is problematic by limiting the agency of educators and students (Kritt & Winegar, 2010; M. Oliver, 2011).

Based on their theoretical examination of the history of instructional technology, McDonald et al. (2005) found that technological determinist assumptions contributed to the historical decline of earlier instructional technologies such as programmed instruction (programmed instruction is discussed in the Literature Review). Early researchers assumed that the causal power of technology was so strong that by rigidly adhering to a programmed, behaviorist, and mechanistic approach to learning using technology, this would cause improvements in student learning in a determined way (McDonald et al., 2005). However, McDonald et al. (2005) noted that few studies on programmed instruction found the techniques superior to traditional methods of instructions.

While not dismissing the value of past educational technology research, Selwyn (2010b) argued that in the future, researchers should move beyond technological determinism, and pursue a more critical approach that better recognizes the social factors that affect its use in schools. Selwyn et al. (2006) emphasized that a balanced perspective on digital technology is needed that avoids deterministic and Utopian views, while not falling into the trap of pessimism about technology. Amiel and Reeves (2008) also asserted that in the past, educational technologists have sometimes accepted technological determinism as a given. Amiel and Reeves (2008) argued for a new approach to educational technology research focused on the ends of technology, and axiological questioning of technology directed by values and ethical judgment.

Statement of the Problem

Educational technology scholars have emphasized the importance of critically examining philosophy of technology assumptions such as technological determinism (Carr-Chellman, 2005; Fisher, 2006; Hofmann, 2006; Kanuka, 2008; Kritt & Winegar, 2010; McDonald et al., 2005; M. Oliver, 2011; Pearson & Young, 2002; Smith, 2006; Strobel & Tillberg-Webb, 2009; Selwyn, 2010b). Technological determinist assumptions, by granting a control or determined autonomy to technology, apart from purposeful human control and direction, can present a dilemma for educational leadership by limiting human agency and responsibility for technology (Fisher, 2006; Hofmann, 2006; Jonas, 2009; Jonas, 2010; Kritt & Winegar, 2010; Slack & Wise 2006; Strobel & Tillberg-Webb, 2009; Wyatt, 2008). Strobel and Tillberg-Webb argued that technological determinist assumptions can influence educators to feel pressure to keep up with technological change, "as if the technologies are driving changes and decisions in the instructional process" (p. 78). If educators assume a commercial technology is inevitable, they tend to focus on how schools should adapt to technology, rather than shape the technology to meet curriculum requirements, and teachers' and students' needs (Jones & Czerniewicz, 2010).

Technological determinist beliefs can influence educators to accept uncritically technological determinist rhetoric of technology vendors (Fisher, 2006; Grant et al., 2006), and pursue a quick technological fix for complex educational problems (Strobel & Tillberg-Webb, 2009). Educators may feel pressure to adopt technology that may or may not be congruent with research on learning (Nworie & Haughton, 2008), or may or may not be developmentally appropriate and align with Internet safety concerns (Peach, Bell, & Spatariu, 2012). Considering pertinent social and curriculum factors is an integral part of the educational technology adoption process (ChanLin, 2007; Straub, 2009).

Research outside K-12 education found that assumptions characterized by technological determinism were an important factor that influenced technology leadership (Grant et al., 2006; Jackson & Philip, 2010; Leonardi, 2008; Leonardi & Jackson, 2004; Prakash & Sinha, 2008). Technological determinist assumptions can influence the thinking and decisions of leaders, including their perceived agency in shaping and managing technological change, affect discourse with stakeholders, and affect how leaders manage social factors accompanying technological change (Grant et al., 2006; Jackson & Philip, 2010; Leonardi, 2008; Leonardi & Jackson, 2004; Prakash & Sinha, 2008). Recently M. Oliver (2011) and Selwyn (2010b) argued for research that critically questions technological determinist assumptions, and seeks to consider alternate ways of thinking about technology and learning that emphasizes the agency of human actors, and better recognizes the social factors involved with using technology in education. Such research can better inform professional practice and contribute to what Kanuka (2008) called philosophy in practice pertaining to technology. Educational technology leaders who question philosophy of technology beliefs and assumptions are better equipped to make informed decisions, and adopt technology practices that are better aligned with improving educational outcomes (Kanuka, 2008; Leonardi, 2008; Strobel & Tillberg-Webb, 2009).

Purpose of the Study

The purpose of the qualitative study was to a) examine what philosophical assumptions about technology are present in the thinking of K-12 technology leaders, b) investigate how the assumptions may influence technology decision making, and c) explore whether technological determinist assumptions are present. Subjects involved 31 educational technology leaders from Virginia school districts, including K-12 technology directors and instructional technology specialists. Using Corbin and Strauss methods for qualitative data analysis, and guided by three research questions, the researcher sought to better understand how philosophical assumptions about technology affect K-12 educational technology leadership, by collecting and analyzing empirical data to corroborate the conceptual themes that emerged. Data collection began with purposive sampling to select twenty participants who had been involved with planning and implementing educational technology initiatives requiring strategic reflection about a variety of key issues, including possible questioning of philosophical or ethical issues. The qualitative methods used included semi-structured interviews, and a written questionnaire with open-ended questions. Data analysis employed constant comparative analysis using open and axial coding. Data collection continued with theoretical sampling of additional subjects until data analysis showed that theoretical saturation.

Theoretical Framework

The study was guided by the work of Strobel and Tillberg-Webb (2009) who proposed a framework for educational technology that emphasizes a critical and humanistic approach to technology integration. Strobel and Tillberg-Webb (2009) asserted that historically in the field of instructional technology, the traditional focus has been on approaching technology as technical tools, more so than approaching technology integration with a view toward the broader social and human implications of technology. In presenting their humanizing framework for educational technology, Strobel and Tillberg-Webb (2009) argued that educators should critically question their philosophical assumptions and ideological perspectives about technology, because beliefs and ways of thinking about technology influence professional discourse, and affect the actions of decision makers.

The starting point for the Strobel and Tillberg-Webb humanizing framework for educational technology emphasizes that educators should question whether technological determinist assumptions influence thinking about technology (Strobel & Tillberg-Webb, 2009). Assumptions about technology often correspond to ideological perspectives associated with the opposing positions of technological determinism and social determinism (Kanuka, 2008; Strobel & Tillberg-Webb, 2009). This dichotomy of opposing views is fundamentally an ontological debate because it concerns the connection and causal relationship between technology and society, and which of the two most impacts the other by causing change (Smith, 2006; Strobel & Tillberg-Webb, 2009). Technological determinism is the philosophical perspective that assumes that technology causes inevitable change in society (Leonardi, 2008; Leonardi, 2009), exerting a control over human society with technology considered in some way to be an autonomous force operating outside of social control (Feenberg, 2010; Hofmann, 2006; Leonardi, 2009). Social determinism stands in contrast as the opposite philosophical perspective, and assumes that technologies evolve and develop through being shaped by social processes, with the technologies fundamentally embedded in social systems (Kanuka, 2008; Strobel & Tillberg-Webb, 2009). In her elucidation of philosophies of technology that are important for the educational technology professional, Kanuka (2008) similarly highlighted the perspectives of technological determinism and social determinism, while also describing uses determinism as an alternate perspective (see Literature Review).

Strobel and Tillberg-Webb (2009) elucidated on the concept of praxis in educational technology practice, and defined praxis as applying theoretical knowledge and critical reflection to professional life. Praxis for educators and administrators should include critically questioning assumptions about technology, and educational professionals should model such questioning of technology for their students (Strobel &

Tillberg-Webb, 2009). National educational technology standards for students address the importance of students thinking critically about technology, and analyzing and debating both the benefits and limitations of technology in society and the workplace (International Society for Technology in Education, 2007). Strobel and Tillberg-Webb (2009) argued that if educators are not willing to critically question their own deeply ingrained ideological beliefs about technology, and willing to assess both the positive and negative effects of technology, they are not prepared to take the lead in educating their students to do the same. By questioning their own assumptions, educators are better prepared to guide and empower students to think critically about technology and its role in society and the workplace (International Society for Technology in Education, 2007; Strobel & Tillberg-Webb, 2009). Educational technology leaders in turn should model for their fellow educators an awareness of the ethical issues associated with technology integration (Consortium for School Networking, 2011).

Associated with technological determinism is a tendency to view technology as outside of ethical critique (Amiel & Reeves, 2008; Robinson & McKnight, 2007; Vermaas et al., 2011), with technology in control and overshadowing other human values including ethical considerations (Vermaas et al., 2011). To inform the study's examination of ethical considerations that may be involved in leaders' thinking about technology, the researcher consulted the Consortium for School Networking (CoSN) framework for K-12 educational technology leadership (Consortium for School Networking, 2011). The CoSN framework defined core skill areas for the profession, including skills pertaining to leadership, vision, and management, and it highlighted ethical considerations that are integral to responsible leadership (Consortium for School

Networking, 2011). Pertinent ethical issues related to technology in the CoSN framework include Internet safety for students, computer security, equitable access to technology, copyright compliance, personal privacy, and environmental protection and energy saving practices (Consortium for School Networking, 2011). The CoSN framework addresses the importance of technology leaders modeling responsible leadership for technology, and confronting social, legal, and ethical issues related to technology (Consortium for School Networking, 2011). The CoSN framework was useful in analyzing empirical data from the study.

Scholars have argued that the debate between technological determinism and social determinism, one emphasizing technology and the other society represents a dichotomy (Bromley, 1997; Flyverbom, 2005; Frith, Morain, Cummings, & Berube, 2011; Rohr, 2008; Salazar, 2005; Smith, 2006; Strobel & Tillberg-Webb, 2009) that does not adequately explain technological or social change (Salazar, 2005; Strobel & Tillberg-Webb, 2009; Weber, 2009). While questioning how technology assumptions may correspond to technological determinism or social determinism represents a starting point in the humanizing framework, it does not represent a final destination. Strobel and Tillberg-Webb (2009) held that technological determinism and social determinism are both reductionist positions that can hinder educators from seeing the complex interrelationships between technology and society, and broader issues surrounding educational technology. Flyverbom (2005) cautioned that the dichotomy might obstruct adherents on both sides of the dichotomy "from pondering on the promising paths that may lead us beyond this deadlock" (p. 227). After examining theoretical perspectives about technology within the context of education, M. Oliver (2011) concluded that the different perspectives offer only a partial account. M. Oliver (2011) argued that research is needed to build alternative conceptions of educational technology, and move beyond positions such as technological determinism that offer only a partial perspective. Acknowledging the dichotomy associated with philosophical perspectives about technology, and their influence on educational technology leadership, represented a starting point in the effort to move toward a clearer picture of the complex issues involved (Strobel & Tillberg-Webb, 2009), in the interest of building more complete theory (M. Oliver, 2011).

Research Questions

Three research questions were defined that align with the research purpose and the research problem. To guard against any potential researcher bias, the researcher framed the first question broadly so that the study would be open to any philosophical assumptions about technology present in the thinking of technology leaders. The second research question moves from examining what assumptions are present, to investigate how assumptions may influence decision making about technology. The third research question is focused on questioning whether assumptions of technological determinism may be present in leaders' thinking or decision making. Strobel and Tillberg-Webb (2009) asserted that a questioning of assumptions about educational technology should begin by analyzing how philosophical perspectives about technology may correspond to technological determinist thinking and beliefs. Technological determinist assumptions might include the assumption technology is an inevitable force for social change (Leonardi, 2008; Leonardi, 2009). Such assumptions might involve the nomological variant of technological determinism (Vermaas et al., 2011), sometimes called hard technological determinism (Strobel & Tillberg-Webb, 2009), that sees technology as the dominant force causing social change. Another possible perspective would be soft technological determinism that sees technology as one influence among other factors causing change (Strobel & Tillberg-Webb, 2009). Other variants of technological determinism might include views characterized by either the unintended consequences account, or the normative account of technological determinism (Vermaas et al., 2011).

Q1. What broad philosophy of technology assumptions are present in the thinking of K-12 technology directors and instructional technology specialists?

Q2. How do philosophy of technology assumptions influence the decisions that leaders make about educational technology?

Q3. What assumptions characterized by technological determinism may be present in leaders' thinking or decision making?

Nature of the Study

This qualitative study involved examining what philosophical assumptions about technology were present in the thinking of K-12 technology leaders, and whether thinking included technological determinist assumptions. The study also explored how philosophy of technology assumptions influenced the decisions that leaders made concerning technology initiatives. The study's research design employed Corbin and Strauss qualitative data analysis, which can be useful for generating conceptual theory from empirical data (Corbin & Strauss, 2008). An important research goal was to develop a conceptual theory derived from the data that better explains the influence of philosophy of technology assumptions in educational technology leadership.

Participants for the study involved technology directors and instructional technology specialists from Virginia school districts. Virginia technology directors are the chief technology officers for their school districts, work closely with school superintendents and stakeholders, and provide district-wide leadership and vision for educational technology in support of school district goals (Consortium for School Networking, 2011). In Virginia, instructional technology specialists are employed according to the state's Standards of Quality, and these licensed educators provide leadership for instructional technology integration, including collaborating with and training teachers to integrate technology and software effectively (Virginia Department of Education, 2008b). The official name used by the state of Virginia for these positions is instructional technology resource teacher (ITRT), and Virginia mandates that school districts employ an ITRT at a ratio of one for every 1000 students (Virginia Department of Education, 2008b).

Data collection instruments included interviews following a semi-structured protocol, along with a written questionnaire with open-ended questions. The interviews with technology directors and instructional technology specialists were conducted over the telephone, with a small number conducted in person. While following a semi-structured series of questions, the researcher was cognizant of how Corbin and Strauss (2008) recommended that allowing a participant to tell their story openly can result in the most data dense interviews. The interview protocol began with a broad icebreaker question that allowed participants to share any philosophy of technology in their own words. The interview protocol then continued with a series of open-ended questions aligned with the research questions. Refer to Appendix A for the interview questions and protocol.

Data collection initially proceeded with purposive sampling to select twenty school technology leaders who, based on the information available to the researcher, may have worked with planning and implementing educational technology initiatives that demanded strategic reflection, and questioning of philosophical or ethical issues. Data collection then proceeded with theoretical sampling, a concept driven sampling in which the researcher sought additional data to develop concepts and themes derived from the data (Corbin & Strass, 2008). Rather than trying to approximate a representative population, theoretical sampling is responsive to the data, and involves the researcher seeking additional data to fill out the properties of categories and advance theory (Charmaz & Henwood, 2008; Corbin & Strass, 2008). While representative sampling was not used, the researcher did select technology leaders from both city and county school districts, some urban and some rural, from different regions throughout Virginia, including both men and women.

In order to enhance the validity and reliability of the qualitative study, triangulation of data was pursued by comparing data from the interviews with data obtained through a written questionnaire completed by the participants after they were interviewed. Triangulation of data is advantageous for qualitative research because using different data sources can increase insight into the phenomenon under study and develop a more comprehensive understanding, while reducing potential bias (Kitto, Chesters, & Grbich, 2008; Kuper, Lingard, & Levinson, 2008). The written questionnaire began with a broad question to allow the participants to share any philosophy of technology in their own words. Other open-ended questions in the written questionnaire were different from the interview questions but still aligned with the research questions. Refer to Appendix B for the written questionnaire.

During data analysis the researcher employed constant comparative analysis to compare incidents in the data in order to find those that were conceptually similar, code data and create conceptual categories, and find plausible relationships between concepts (Corbin and Strauss, 2008; Schram, 2006). The researcher utilized a coding process featuring open and axial coding, which are distinct yet closely related methods (Corbin & Strauss, 2008). During open coding, the researcher analyzed the data from the interviews and questionnaires by going through it line by line, and breaking it apart into segments or incidents to delineate the concepts that represented raw blocks of data (Corbin & Strauss, 2008; Shannak & Aldhmour, 2009). The researcher then used axial coding to reintegrate the data by relating the concepts to each other (Charmaz & Henwood, 2008; Corbin & Strauss, 2008; Creswell, 2008). During axial coding, the researcher selected the concept that appeared to have the greatest explanatory relevance, placed it at the center of an axis, and delineated its relationships and dimensions by relating other concepts to it (Charmaz & Henwood, 2008; Corbin & Strauss, 2008). Corbin and Strauss explained that open and axial coding are closely related, because the researcher first breaks open the data in open coding to identify the concepts, and this is followed by axial coding that puts the data back together by relating and connecting concepts to each other.

Because the data that qualitative researchers work with can be complex, Corbin and Strauss methodology employs a coding paradigm as a strategy for asking questions of the data to help draw out the complex relationships between concepts that may be present (Corbin & Strauss, 2008). The researcher used the Corbin and Strauss coding paradigm to analyze data for context, or the circumstances to which participants respond, and then identify important causal conditions and consequences. The coding paradigm was employed by the researcher in data analysis to find answers to the second research question concerning how philosophy of technology assumptions influence the decisions that leaders make about educational technology.

The technique of writing memos to write about and think critically about data, and engage in an internal dialogue with it, is an integral part of qualitative data analysis (Corbin & Strauss, 2008; Grounded Theory Institute, 2009). Memos can serve as the analytical building blocks for what may become theory (Elliot & Lazenbatt, 2005). The researcher used the qualitative data analysis application MAXQDA, recommended by Corbin and Straus in their research guide, to import transcripts, write memos, code conceptual categories, properties, and dimensions from the data, conduct data analysis, and refine conceptual theory.

To complement the constant comparative analysis used, the researcher used theoretical comparisons to help him deal with unexplained incidents in the data that required wrestling with the data to identify the significance and meaning of the unexplained (Corbin & Strauss, 2008). Theoretical comparisons are an analytical tool to stimulate logical thinking by comparing the properties and dimensions of concepts (Corbin & Strauss, 2008). In order to deal with surprising phenomenon, the methodology counts on abductive reasoning to explain the unexplained (Reichertz, 2007). Abductive reasoning attempts to close the gap by conjecturing an hypothesis, that if it were true, would cause the surprising phenomenon as a matter of course, and thereby explain it (Wuisman, 2005).

The analytical process of integrating conceptual categories continued as the researcher refined theory, checked for gaps in logic, and reworked the categories (Corbin & Strauss, 2008). The researcher continued data collection and analysis continued until the point of theoretical saturation, when the properties, dimensions, and variations of all conceptual categories were well developed (Corbin & Strauss, 2008). It was evident after collecting and analyzing data from 31 participants that theoretical saturation had been reached. Because theoretical integration should place theory within the context of other theories (Urquhart, Lehmann & Myers, 2010), the literature was consulted to stimulate questions during analysis, guide theoretical sampling, and help to validate research findings and theory (Corbin & Strauss, 2008). While writing memos within MAXQDA, the researcher included appropriate citations from the literature in memos to support the theoretical integration.

Significance of the Study

Collier (1994) argued that proceeding without examining assumptions does not mean an absence of philosophy, but rather bad philosophy. Epistemological assumptions and beliefs have been the focus of recent educational technology research (Chai, 2010; Erkunt, 2010), and research on transformational leadership in education (Brownlee, Nailon, & Tickle, 2010). Many scholars have argued that philosophy of technology assumptions, including technological determinism, can influence the thinking, discourse, and decisions of educators concerning technology (Bennett & Maton, 2010; Brown & Czerniewicz, 2010; Jones & Czerniewicz, 2010; Jones & Healing, 2010; Kanuka, 2008;

Kritt & Winegar, 2010; Leonardi, 2008; Strobel & Tillberg-Webb, 2009), and affect policy (Clegg et al., 2003; Wyatt, 2008). Technological determinism is the philosophical perspective that assumes that technology causes inevitable change in society (Leonardi, 2008; Leonardi, 2009), exerting a control over human society with technology considered in some way to be an autonomous force operating outside of social control (Feenberg, 2010; Hofmann, 2006; Leonardi, 2009). The study proceeded from the framework for educational technology proposed by Strobel and Tillberg-Webb, who asserted that philosophical assumptions about technology "are all-encompassing in our thoughts and interactions with others" (Strobel & Tillberg-Webb, 2009, p. 77). The Strobel and Tillberg-Webb framework emphasizes as a starting point that educators should question whether technological determinist assumptions influence thinking about educational technology (Strobel & Tillberg-Webb, 2009).

Philosophy of technology assumptions have been the focus of empirical studies outside of K-12 education to examine the influence of assumptions such as technological determinism on technology management and leadership. Researchers found that technological determinist assumptions can influence the thinking of leaders, including their perceived agency in shaping technological change, affect discourse, and influence the decisions that leaders make on behalf of their organizations (Grant et al., 2006; Jackson & Philip, 2010; Leonardi, 2008; Leonardi & Jackson, 2004; Prakash & Sinha, 2008). For example, Jackson and Philip (2010) conducted a study of the management of technological change in organizations, in order to assess the effectiveness of the assumptions and approaches associated with technological determinism, cultural determinism, and techno-cultural emergence. The researchers conducted a qualitative case study of public and private sector organizations, using multiple methods including interviews, analysis of documents, and observations (Jackson & Philip, 2010).

The construct of cultural determinism for the study was similar to social determinism (see Introduction section), and the researchers defined cultural determinism as the perspective that neglect of human and cultural factors is the primary cause of failed technological change (Jackson & Philip, 2010). Jackson and Philip (2010) found that a college proceeded from assumptions characterized by technological determinism, and a university proceeded from cultural determinism, and in neither case were the technological change outcomes successfully implemented. In these two cases, the college and university were not successful in managing the unanticipated improvisations to technology, and cultural issues that arose.

A technology solutions company proceeded from a more nuanced techno-cultural emergence perspective that assumed that neither technology nor social factors in isolation determined change. This perspective assumes a dynamic interaction between technology and people affects change, it assumes the process includes unanticipated cultural and technological issues that can arise over time, and it assumes both technology and culture must be refined. The company that proceeded from a techno-cultural emergence perspective approach to management successfully implemented their desired outcomes, and were successful in managing unanticipated improvisations to technology, and the cultural issues that arose. Jackson and Philip (2010) concluded that neither technological determinism nor cultural determinism are conducive for the successful management of technological change. The college that proceeded from assumptions of technological determinism mistakenly assumed that a top-down systematic approach would drive cultural change and ensure successful technological change. However, the technological determinist approach neglected important cultural issues, and even users who were expected to champion the change efforts took a reactive rather than proactive approach to change (Jackson & Philip, 2010).

Seminal research by Leonardi and Jackson (2004) found that discourse characterized by technological determinism, and the inevitability of technology, served as a powerful narrative to justify the actions of organizational leaders. The researchers examined discourse surrounding corporate mergers by analyzing press clipping, to investigate how leaders used storytelling to justify their actions to the public. Leonardi and Jackson (2004) concluded that technological determinist discourse excused managers from responsibility for their decisions, because the organizational changes were presented to the public as inevitable because technological change was seen as inevitable.

Using a critical interpretive perspective, Leonardi (2008) examined the effects of technological determinist rhetoric on technology management by reviewing the empirical data from the qualitative study conducted by Leonardi and Jackson (2004), and by reviewing the literature. Leonardi (2008) concluded that despite the importance of social factors in affecting change, when technology managers employed technological determinist discourse, the tendency was to make the indeterminate state of things appear to be determined because of the perceived inevitability of technological change. Leonardi (2008) observed that technology managers used such discourse to promote explicitly or inadvertently their own interests. Consequences of technological determinist assumptions and the accompanying rhetoric can include the tendency to dismiss social factors that impact technological outcomes, and pursuing courses of action that may inhibit the social adjustments associated with technology that would otherwise naturally occur (Leonardi, 2008).

Prakash and Sinha (2008) conducted research to test whether technological change is the result of the conscious choice of managers, or determined by random technology shocks in the business cycle. The researchers sought to investigate technological determinist claims that the activities of organizations are determined by technology, and to test the hypothesis that managers have a limited role because of the determined nature of technology shocks. Prakash and Sinha (2008) analyzed production data from Indian and US sugar industries, and concluded that changes in technology are the result of conscious choices made by managers. The data showed that new technologies were not always superior to the incumbent technology and the agency and conscious choice of managers is important in bringing about technological change (Prakash & Sinha, 2008).

Grant et al. (2006) used a case study approach to investigate the adoption of enterprise information systems in three organizations, and to evaluate whether the technological determinist rhetoric of technology vendors held true to what they promised. Grant et al. (2006) interviewed senior managers and stakeholders at two companies and one university. At the company where managers held a technological determinist viewpoint, the system implementation required altering business practices to suit the new system to the point that it met with resistance in the organization, and the new system did not produce the desired results promised for it. At the other two organizations, Grant et al. (2006) found that managers did not accept the technological determinist discourse, and instead proceeded to develop more customized information systems better suited for their organizations.

Clegg et al. (2003) critically examined higher education policy documents in the United Kingdom, and found that the dominant discourse was often characterized by technological determinism along with a passive acceptance of the premise that globalization is inevitable. Clegg et al. (2003) found that such discourse was frequently present in policy documents and commercial marketing, and argued that it created anxiety and placed pressure on individuals and organizations such as universities to uncritically pursue technological change at the risk of being left behind. Clegg et al. (2003) characterized the dominant discourse as "the emperor's new clothes" and advised educators to question the limitations of theories that rely on technological determinist assumptions (p. 39). The researchers recommended that educators pursue a critical pedagogy that accepts innovative e-learning appropriate for student learning, but not to assume any technological future is inevitable (Clegg et al., 2003).

Fisher (2006) examined discourse and rhetoric present in advertising from technology vendors, official discourse in educational policy documents, and public comments from educational officials. He observed a tendency for discourse to be framed in technological determinist language that ascribed to technology the power to cause inevitable and positive change in schools (Fisher, 2006). Fisher (2006) concluded that such technological determinist assumptions are a problem because by ascribing autonomous change to technology, rather than to educators, the perspective shortchanges the hard work that educators must undertake to improve and transform education.

In conclusion, empirical studies in fields such as information technology management, business management, and university management provide evidence that philosophy of technology assumptions, including assumptions characterized by technological determinism, are an important factor that can influence technology leadership (Grant et al., 2006; Jackson & Philip, 2010; Leonardi, 2008; Leonardi & Jackson, 2004; Prakash & Sinha, 2008). While research outside K-12 education sheds light on how assumptions about technology can be important factors for technology leadership, generalizing from the larger studies to K-12 education leaves unanswered questions. M. Oliver (2011) and Selwyn (2010b) argued for educational research that critically questions technological determinist assumptions, and seeks to consider alternate ways of thinking about technology and learning that emphasizes the agency of human actors, and better recognizes the social factors involved with using technology in education. Associated with technological determinism is the view that technology overshadows human values, with technology outside of cultural and ethical critique (Amiel & Reeves, 2008; Robinson & McKnight, 2007; Vermaas et al., 2011). A problem with this perspective as it relates to educational technology is that it views technology tools as having no inherent ethical consequences (Brey, 2010; Robinson & McKnight, 2007). The perspective may interfere with discerning how adopting technologies in schools can raise ethical questions concerning issues such as student safety, equitable access, and personal privacy (Amiel & Reeves, 2008; Consortium for School Networking, 2011; Hofmann, 2006; Lowrance, 2010).

This qualitative study to examine K-12 educational technology leaders' philosophy of technology assumptions sought to inform professional practice by contributing to what Kanuka (2008) called philosophy in practice pertaining to technology. The empirical study supported the need for research to question philosophy of technology assumptions in education, and explore alternate ways of thinking about technology and learning that transcend technological determinist assumptions (Oliver, 2011; Selwyn, 2010b; Strobel & Tillberg-Webb, 2009). Funk (2010) argued that failure to uncover and question technology assumptions can lead to disappointing results because there can be a tendency to pursue technology without clearly defining the desired educational outcomes and ends that are expected for it.

The researcher anticipated that empirical data from the qualitative study would serve to generate conceptual themes to better explain how philosophy of technology assumptions influence the thinking and decision making of K-12 technology leaders. Theory generated from empirical data and qualitative analysis would constitute a substantive theory, meaning a theory derived from the substantive area (Corbin & Strauss, 2008) that applies to the data while being independent of it (Urquhart et al., 2010). The study's findings and conclusions, including a substantive theory about technology leaders' philosophy of technology, are presented in Chapter 4 and Chapter 5. A researcher integrating theory should place theory within the context of other theories (Urquhart et al., 2010), so the study's data analysis considered theory from the literature in developing this substantive theory. Substantive theory can serve as a stepping stone to formal theory (Corbin & Strauss, 2008, Glaser, 2007b; Glaser & Strauss, 1967), which is theory that is explanatory beyond a specific group or discipline, and can have greater applicability to other disciplines and situations (Corbin & Strauss, 2008).

Definition of Key Terms

Agency. The philosophical concept of agency, which originated with St. Anselm, concerns the freedom and power to act, and what an agent or group of agents brings about through their actions, or failure to act (Buss, 2011; Troquard, Trypuz & Vieu, 2006; Uckelman, 2009a; Uckelman, 2009b). Agency has implications for the study of logic, causality, and human ethical responsibility for technology (Buss, 2011; Kritt & Winegar, 2010; Troquard et al., 2006; Uckelman, 2009a; Uckelman, 2009b).

Autonomy. The philosophical concept of autonomy concerns the ability of agents to act independently and freely without their actions being causally determined by events or forces external to them (Buss, 2011).

Axiology. Axiology is the branch of philosophy concerned with questioning the nature of value and what things have intrinsic value for their own sake (Arneson, 2009a). With regard to educational technology, axiological questioning considers the ethical issues associated with implementing technology solutions (Consortium for School Networking, 2011; Dumciene, Daukilas & Sipaviciene, 2008), and whether technologies are value neutral or value laden (Amiel & Reeves, 2008; Hofmann, 2006; Lowrance, 2010).

Bracketing. Bracketing is implicitly employed in grounded theory methodology in its concern for objectivity (Cope, 2005; Luckerhoff & Guillemette, 2011; Starks & Trinidad, 2007), and refers to an investigator's deliberate efforts to bracket out prior assumptions and practical interests, to minimize their influence on theoretical considerations (Beyer, 2011; Husserl, 1965b; Willig, 2008). The methodological technique of bracketing originated with phenomenology (Husserl, 1965b).

Constant comparative analysis. This method of data analysis examines data to find similarities and differences, and generate categories and properties that vary them, in order to find plausible relationships between concepts (Corbin & Strauss, 2008; Glaser, 2007a, Schram, 2006).

Critical realism. Critical realism recognizes the fallible character of scientific knowledge, but insists on the objective existence of natural and social realities (Elger, 2009), and accepts that research can have universal validity (Cobern & Loving, 2008).

Educational technology. The Association for Educational Communications and Technology (AECT) defined educational technology as "the study and ethical practice of facilitating learning and improving performance by creating, using, and managing appropriate technological processes and resources" (Januszewski & Molenda, 2008, p. 1). Educational technology includes a) information technology, such as computer systems and network infrastructure, b) digital technology used for improving teaching, learning, and communication, and c) the information and data systems used for managing the business of education (Consortium for School Networking, 2011).

Formal theory. Formal theory is more abstract than substantive theory (Corbin & Strauss, 2008) and considers data from different studies in the same substantive area, along with studies in other substantive areas (Glaser, 2007b). Formal theory can be explanatory beyond a specific group or discipline, and have greater applicability to other disciplines and situations (Corbin & Strauss, 2008).

Grounded theory. Corbin and Strauss (2008) used the term grounded theory in a generic way to refer to theoretical constructs that are generated from the qualitative analysis of data. Corbin and Strauss methodology has been referred to as the systematic design approach to grounded theory (Creswell, 2008), but the methodology represents a modification of classic grounded theory, and Glaser (2009) argued that modified methodologies are more accurately described as qualitative data analysis.

Grounded theory methodology. The research study used Corbin and Strauss (2008) methodology, which employs the techniques of constant comparative analysis, theoretical sampling, and theoretical saturation of categories to generate a theory, which some researchers have considered are essential techniques for grounded theory (Creswell, 2008; Holton, 2007; Hood, 2007).

Hard technological determinism. The strict perspective of hard technological determinism attributes agency to technology itself (Marx & Smith, 1994) to the extent that technology has a dominant and determined autonomy of its own to cause social change, independent of social constraints (Smith, 1994; Strobel & Tillberg-Webb, 2009).

Instrumental view of technology. The instrumental view of technology is a popular perspective on technology (Franssen et al., 2009; Jackson, 2010) that sees technology, whether equipment, tools, or machines, as a means to an end (Berger, 2011; Feenberg, 1991; Heidegger, 2009). The instrumental view of technology commonly sees technology as value neutral instruments, neither good nor bad in themselves, which are designed by engineers to be put to use by users as a means for their own purposeful ends (Franssen et al., 2009).

Nomological account of technological determinism. An interpretation of hard technological determinism, the nomological account sees technology acting as the primary cause of social change, according to the developmental laws of technology, with technology exercising causal influence, and one development leading inevitably to another (Bimber, 1994; Vermaas, 2011; Wyatt, 2008). The nomological account of technological determinism sees technology causing social change apart from the social context (Vermaas, 2011).

Normative account of technological determinism. This account of technological determinism holds that if the norms of practice or attitudes of those who create and employ technology become disconnected from broader ethical criteria, accountability to society, or consideration of means and ends, technology can be understood to have a dominance or autonomy over society (Bimber, 1994; Wyatt, 2008).

Ontology. Ontology is concerned with the philosophical investigation of the nature of existence or being (Arneson, 2009b). Ontological assumptions pertaining to agency, autonomy, causality, and structure are important for philosophy of technology theory (Franssen et al., 2009; Smith & Madon, 2007).

Philosophy of technology assumptions. Philosophy of technology examines the underlying assumptions of how technology impacts and transforms human society in ways that are philosophically relevant (Kaplan, 2009a). Philosophical debate has often considered whether or not technology develops with its own autonomy, and whether technology is value neutral or value laden (Franssen et al., 2009).

Phronesis. Phronesis is a Greek term from Aristotle that has been translated into English as practical wisdom. Phronesis can be understood in terms of the wisdom, based on good judgment and guided by a sense of a higher good, that is a key attribute required for leaders in showing the way and guiding others, and advancing the common good (Adair, 2005; Halverson, 2002).

Realism. Realism upholds the existence of universals, general truth, and commonality in nature, and maintains that there are qualities that exist in the individual thing and qualitatively identical things, while taking the position that these are not merely in the human mind (Borden, 2004; MacLeod & Rubenstein, 2005).

Social determinism. Social determinism is the opposite perspective of technological determinism, rejects the premise that technology has its own independent technology, and assumes that technologies evolve and develop through being shaped by social processes, with the technologies fundamentally embedded in social systems (Kanuka, 2008; Lievrouw, 2006; Strobel & Tillberg-Webb, 2009). Rather than considering technology as ethically neutral, the social shaping perspective emphasizes the importance of human choices in guiding technological change (Lievrouw, 2006).

Soft technological determinism. Soft technological determinism is a mitigated perspective of technological determinism that asserts that technology drives social change (Smith, 1994), but sees technology as an influence among others, occurring alongside a complex interaction of social, economic, political, and cultural factors (Marx & Smith, 1994; Strobel & Tillberg-Webb, 2009).

Substantive area. This borrowed term from grounded theory refers to the area of inquiry for research and for literature review (Lempert, 2007; Urquhart et al., 2010).

Substantive theory. Substantive theory is theory derived from analyzing data in the substantive area (Corbin & Strauss, 2008) that applies to that data while being independent of it (Urquhart et al., 2010). By considering the broader literature, a researcher can scale up a theory and contribute to generalizing the theory beyond the substantive area (Urquhart et al., 2010),

Technological determinism. Technological determinism is the philosophical perspective that assumes that technology causes inevitable change in society (Leonardi, 2008; Leonardi, 2009), exerting a control over human society with technology considered in some way to be an autonomous force operating outside of social control (Feenberg, 2010; Hofmann, 2006; Leonardi, 2009).

Technological imperative. The technological imperative involves rhetoric and underlying assumptions that technology has a controlling influence (Hofmann, 2006) that is inevitable and unstoppable (Chandler, 1995; Cukier et al., 2009; Leonardi, 2008) and creates an imperative to keep up with technological developments or be left behind (Strobel & Tillberg-Webb, 2009). Discourse characterized by the technological imperative and the inevitability of technology can be employed to persuade others, with the rhetoric creating an ideological orientation in a culture toward technological change (Cukier et al., 2009; Leonardi, 2008).

Technological dystopianism (or Luddism). In valuing the results of technological change, this position is pessimistic and generally not open to technological innovation, and resists technological change (Kritt &Winegar, 2010; Strobel & Tillberg-Webb, 2009; Vermaas et al., 2011).

Technological utopianism. Technological utopianism embraces the promise of technology, and is an optimistic position that presents technological innovation as something for the better (Kritt &Winegar, 2010; Strobel & Tillberg-Webb, 2009; Vermaas et al., 2011).

Theoretical sampling. Rather than being focused on approximating a representative sample of the population, theoretical sampling involves the researcher deciding what data to collect next based on what analysis indicates, in order to develop the properties of categories or shed light on emerging theory (Corbin & Strauss, 2008; Charmaz & Henwood, 2008; Holton, 2007; Hood, 2007), until theoretical saturation is reached.

Theoretical saturation. Theoretical saturation refers to the point in data analysis when no new properties or dimensions are emerging for the categories, meaning that each concept is theoretically saturated (Corbin & Strauss, 2008; Glaser, 2007a; Holton, 2007: Hood, 2007).

Theoretical sensitivity. Theoretical sensitivity concerns the researcher's ability to see relevant data through his or her theoretical insights in the area of research (Kelle, 2007), while being open to new and unexpected interpretations of data, and it depends upon the skills with which the researcher combines literature, data, and experience (Suddaby, 2006).

Unintended consequences. This account of technological determinism asserts that technology is partially autonomous, because even when human decision makers willfully approach technology in deliberate and responsible ways, technology can cause unintended consequences that we did not anticipate and cannot control (Bimber, 1994; Jonas, 2009; Vermaas, 2011).

Summary

Using Corbin and Strauss methods for qualitative data analysis, the qualitative study sought to a) examine what philosophical assumptions about technology are present in the thinking of K-12 technology leaders, b) investigate how the assumptions may influence technology decision making, and c) explore whether technological determinist assumptions are present. Subjects involved 31 technology directors and instructional technology specialists from Virginia school districts, and data collection involved interviews following a semi-structured protocol, and a written questionnaire with open-ended questions. The study was guided by the work of Strobel and Tillberg-Webb (2009), who proposed a critical and humanizing framework for educational technology that emphasizes that educators and administrators should question their philosophical beliefs about technology. The starting point for this framework involves educators examining whether technological determinist assumptions influence thinking about educational technology (Strobel & Tillberg-Webb, 2009).

Technological determinism is the philosophical perspective that assumes that technology causes inevitable change in society (Leonardi, 2008; Leonardi, 2009), exerting a control over human society with technology considered in some way to be an autonomous force operating outside of social control (Feenberg, 2010; Hofmann, 2006; Leonardi, 2009). Assumptions characterized by technological determinism can be prevalent in the popular mindset (Best, 2009; Burnett et al., 2008; Carr-Chellman, 2006; Friesen, 2008; Hofmann, 2006; Leonardi, 2008; Lievrouw, 2006; Selwyn, 2010b; Wyatt, 2008; Yang, 2009), and can influence educational discourse (Fisher, 2006; Canole, 2007) and affect educational policy (Clegg et al., 2003; Wyatt, 2008). Educational technology leaders should examine philosophical assumptions about technology, because if technology were assumed to operate with autonomy, apart from purposeful human control, this presents a dilemma by limiting human agency and responsibility for technology (Fisher, 2006; Hofmann, 2006; Jonas, 2009; Jonas, 2010; Kritt & Winegar, 2010; Slack and Wise 2006; Strobel & Tillberg-Webb, 2009; Wyatt, 2008).

Associated with technological determinism is the view that technology overshadows human values, with technology outside of cultural and ethical critique (Amiel & Reeves, 2008; Robinson & McKnight, 2007; Vermaas et al., 2011). Such a view can be problematic for educational technology leadership, because technologies can be value laden (Amiel & Reeves, 2008; Hofmann, 2006; Lowrance, 2010) and decisions about them can involve considering ethical issues (Consortium for School Networking, 2011). Many ethical considerations are integral to K-12 technology leadership, including Internet safety for students, computer security, equitable access to technology, copyright compliance, personal privacy, and environmental protection and energy saving practices (Consortium for School Networking, 2011).

Although there is a gap in the literature concerning empirical studies of philosophy of technology assumptions in K-12 education, empirical studies in other fields (see Significance of the Research) have examined the influence of philosophy of technology assumptions such as technological determinism on technology management. Technological determinist assumptions can influence the thinking of leaders, including their perceived agency in shaping and managing technological change, affect discourse with stakeholders, and influence the decisions that leaders make on behalf of their organizations (Grant et al., 2006; Jackson & Philip, 2010; Leonardi, 2008; Leonardi & Jackson, 2004; Prakash & Sinha, 2008). In a case study investigating the management of technological change, Jackson and Philip (2010) found that when managers proceeded from technological determinism, organizations had difficulty in achieving desired outcomes, managing unanticipated technological improvisations, and dealing with cultural issues that arose during technological change. Leonardi (2008) found that when technology managers employed technological determinist discourse, the tendency was to make the indeterminate state of things appear to be determined because of the perceived inevitability of technological change, and managers used such discourse to promote explicitly or inadvertently their own interests. The consequences of technological determinist assumptions and rhetoric can include the tendency to dismiss social factors that impact technological outcomes, and pursuing courses of action that may inhibit the social adjustments associated with technology that would otherwise naturally occur (Leonardi, 2008).

Although philosophical assumptions about technology can be unrecognized and outside of our explicit awareness (Kanuka, 2008; Kritt & Winegar, 2010; Strobel & Tillberg-Webb, 2009), professionals with educational technology responsibilities should critically examine philosophy of technology assumptions, because the assumptions can shape interactions between educators and students, and influence decisions pertaining to technology integration (Kanuka, 2008; Kritt & Winegar, 2010; Strobel & Tillberg-Webb, 2009). The pace of technological change presents challenges for reflective leadership (see pp. 9-11), and technology can result in unanticipated consequences and risks that were not intended (Canole, 2007; Kanuka, 2008). Kanuka (2008) argued that by examining their philosophy of technology assumptions, thoughtful practitioners with responsibilities for educational technology are better able to make purposeful and informed decisions in selecting the right technologies for the right reasons. By questioning their assumptions about technology in a humanistic context that considers ethical implications (Consortium for School Networking, 2011; Kritt & Winegar, 2010; Strobel & Tillberg-Webb, 2009), educators are better prepared to invest limited public monies on the right technologies best suited to meet educational needs and requirements (Carr-Chellman, 2006; Jones & Czerniewicz, 2010; Kritt & Winegar, 2010; Shelly, Cashman, Gunter, & Gunter, 2008).

The empirical study supported the need for research to question philosophy of technology assumptions in education, and explore alternate ways of thinking about technology and learning while thinking critically about technological determinist assumptions (Oliver, 2011; Selwyn, 2010b; Strobel & Tillberg-Webb, 2009). Through qualitative analysis of empirical data pertaining to philosophy of technology assumptions, the researcher endeavored to generate a substantive theory (Corbin & Strauss, 2008) that applies to the data while being independent of it (Urquhart et al., 2010). Transcripts from the interviews and written questionnaires were coded using open and axial coding, and the researcher employed constant comparative analysis being used to generate categories, properties, and dimensions from the data. The study's findings and conclusions, including a substantive theory about the educational technology leaders' philosophy of technology, are presented in Chapters 4 and 5.

Chapter 2: Literature Review

Using Corbin and Strauss methods for qualitative data analysis, the purpose of the qualitative study was to a) examine what philosophical assumptions about technology are present in the thinking of K-12 technology leaders, b) investigate how the assumptions may influence technology decision making, and c) explore whether technological determinist assumptions are present. The qualitative study was guided by the work of Strobel and Tillberg-Webb (2009) who presented a critical and humanizing framework for educational technology that emphasizes that integrating technology into educational practice should take into account the belief systems and values informing those choices (see Theoretical Framework in Chapter 1). The Strobel and Tillberg-Webb framework highlights as a starting point the questioning of how assumptions about technology may correspond to the philosophical perspectives of technological determinism or social determinism (Strobel & Tillberg-Webb, 2009). After exploring influential foundations in philosophy of technology, the literature review analyzes and synthesizes the published body of literature pertaining to technological determinism and social determinism, and their pertinence for the field of educational technology.

The literature review explores empirical studies in fields outside of K-12 education, that provide evidence that philosophy of technology assumptions, including assumptions characterized by technological determinism, are an important factor that can influence technology leadership (Grant et al., 2006; Jackson & Philip, 2010; Leonardi, 2008; Leonardi & Jackson, 2004; Prakash & Sinha, 2008). The review explores the importance of why educators charged with responsibilities for technology leadership should critically question philosophical assumptions about technology. For example, the review explores scholarship that has maintained that educators who question philosophical assumptions about technology are better equipped to make informed decisions (Kanuka, 2008), and are more cognizant of the importance of human agency and responsibility in practicing technology leadership (Kanuka, 2008; Kritt & Winegar, 2010; M. Oliver, 2011; Strobel & Tillberg-Webb, 2009). The review examines the connection between technology and values, and discusses pertinent ethical considerations that are integral to educational technology decisions. Scholars have argued that technology leaders should be prepared to consider pertinent ethical issues that impact technology implementations (Hoffman, 2006), and to manage any unintended consequences of technology (Canole, 2007; Kanuka, 2008; Nworie & Haughton, 2008).

Documentation

The literature search strategy involved exhaustive work over a long period that began in February of 2010, when the author was completing assignments for the NCU course EDR7000, Educational Research Strategies. At that time in 2010, the author identified his general dissertation topic, and the literature review commenced, and continued over the sequence of NCU research and dissertation courses that followed from 2010 through 2012. The literature search strategy included the use of general search engines such as Google and Bing, the meta-search engine Yippy for searching multiple search engines simultaneously, and specialized search engines such as Google Books, Google Scholar, and Google Uncle Sam. The researcher searched and mined library and academic databases including ProQuest, EBSCOhost, Gale Academic OneFile, Sage Education, SAGE Reference Online, Wilson OmniFile Full Text, Ebrary, and similar databases to find scholarly articles and other publications. Relevant key words and search terms were used that describe pertinent concepts and themes related to philosophy of technology, theories including technological determinism and social determinism, ideologies such as techno-utopianism, and ethical considerations that are integral to educational technology leadership.

While the NCU online library was invaluable for much of the literature search, the researcher also obtained articles through interlibrary loan, visited other libraries, and purchased specialized books or articles on philosophy of technology topics and qualitative research methods. In reading and reviewing scholarly articles and publications, the author was careful to identify the sources generally recognized as important and authoritative by other researchers. While the literature review places emphasis on more recent literature, it also covers important seminal works, and explores foundations in philosophy of technology.

Importance of Examining Philosophy of Technology Assumptions

Collier (1994) argued that proceeding without examining assumptions does not mean an absence of philosophy, but rather bad philosophy. Epistemological assumptions and beliefs have been the focus of recent educational technology research (Chai, 2010; Erkunt, 2010), and research on transformational leadership in education (Brownlee et al., 2010). Although there is a gap in the literature concerning empirical research into philosophy of technology assumptions in school technology leadership, research in fields outside of K-12 education have examined the influence of philosophical assumptions about technology. Research in fields such as information technology management, business management, and university management provide evidence that assumptions characterized by technological determinism are an important factor that can influence technology leadership (Grant et al., 2006; Jackson & Philip, 2010; Leonardi, 2008; Leonardi & Jackson, 2004; Prakash & Sinha, 2008). After exploring this research in fields outside of K-12 education, the ensuing discussion will focus on why examining philosophy of technology assumptions is important for educational technology leadership and practice.

Research on the impact of technological determinist assumptions on management. Jackson and Philip (2010) were concerned with how leaders manage technological change, and conducted a qualitative study to assess the relative effectiveness of three approaches that leaders use in managing techno-change. The three management approaches and related assumptions studied by the researchers were technological determinism, cultural determinism, and techno-cultural emergence (Jackson & Philip, 2010). The researchers conducted a case study of public and private sector organizations, using multiple methods including interviews, analysis of documents, and observations (Jackson & Philip, 2010).

Jackson and Philip (2010) understood technological determinism as the view that technology drives cultural change in organizations, and the view considers cultural factors as being generally unimportant in influencing change. According to a technological determinist perspective, because of the inherent deterministic capabilities of technologies, a top-down approach to management can be effective in managing technological change and dealing with technical issues (Jackson & Philip, 2010). The researchers defined cultural determinism as the perspective that neglect of human and cultural factors are the primary cause of failed technological change (Jackson & Philip, 2010). According to Jackson and Philip (2010), the cultural determinist perspective also tends toward a top-down approach to management based on the assumption that managers can affect the cultural changes necessary prior to implementing technology initiatives. The third perspective, the techno-cultural emergence perspective holds that changing culture in isolation from technical factors cannot ensure technological change, nor can technological change proceed with a focus on technology apart from cultural concerns (Jackson & Philip, 2010). The techno-cultural emergence perspective assumes that a dynamic interaction between technology and people affects change, and that this process includes unanticipated cultural and technological issues that can arise over time (Jackson & Philip, 2010). Rather than a top-down approach to management, the techno-emergence perspective takes an ad-hoc and incremental approach that assumes not all cultural and technological factors can be planned for and managed in advance (Jackson & Philip, 2010).

Jackson and Philips (2010) found that with a college that proceeded from technological determinism, and a university that proceeded from cultural determinism, in neither case were desired technological change outcomes implemented successfully. Neither the college nor university were successful in managing the unanticipated technological improvisations that became necessary, nor were they successful in dealing with cultural issues that arose (Jackson & Philip, 2010). Managers at the technology solutions company proceeded from a more nuanced techno-cultural emergence perspective that assumed that neither technology nor social factors in isolation determine change (Jackson & Philip, 2010). The company that proceeded from a techno-cultural emergence perspective successfully implemented their desired outcomes, and were successful in managing unanticipated improvisations to technology, and the cultural issues that arose (Jackson & Philip, 2010).

The college that proceeded from assumptions of technological determinism mistakenly assumed that a top-down systematic approach would drive the needed changes in organizational culture, and ensure successful technological change (Jackson & Philip, 2010). However, the technological determinist approach neglected important cultural issues, and even users who were expected to champion change efforts took a reactive rather than proactive approach to change (Jackson & Philip, 2010). The university that proceeded from a cultural determinist perspective was not prepared for technical difficulties that arose, and ended up reverting back to using their old system (Jackson & Philip, 2010). However, the company that proceeded from a techno-cultural emergence perspective successfully implemented their desired outcomes, and were successful in managing unanticipated improvisations to technology, and the cultural issues that arose (Jackson & Philip, 2010).

The study' theoretical framework was be guided by the work of Strobel and Tillberg-Webb (2009) who proposed a framework for educational technology that includes an awareness of the need to transcend the dichotomy between technological determinism and social determinism. The construct of cultural determinism in the Jackson and Philip (2010) study was similar to social determinism (see p. 2 for definition). The results of the Jackson and Philip (2010) study are interesting; neither technological determinism nor cultural determinism were conducive for the successful management of technological change, while the techno-emergence perspective that recognized the importance of both technological and social factors in causing change was more successful.

An important theme arising from research into the impact of technological determinist assumptions in management concerns the power of rhetoric to persuade others, especially when used by leaders or officials (Fisher, 2006; Grant et al., 2006; Leonardi & Jackson, 2004; Leonardi, 2008). Leonardi and Jackson (2004) conducted a qualitative study to examine the discourse surrounding corporate mergers to investigate how leaders used storytelling and technological determinist rhetoric to justify their actions to the public. The researchers analyzed press clippings associated with the merger of US West and Qwest, and AOL and Time Warner, and found that discourse characterized by technological determinism, and the inevitability of technology, served as a powerful narrative to justify the actions of managers (Leonardi & Jackson, 2004). Leonardi and Jackson (2004) found that leaders of organizations used technological determinist discourse strategically to suppress controversy and deflect the opinions of those opposed to the mergers, and mask alternate views and interpretations. Managers presented organizational change as being inevitable because technological change was viewed as inevitable, and the discourse of inevitability had a tendency to excuse managers from responsibility for their decisions (Leonardi & Jackson, 2004). If technology leaders assume that technology operates with its own autonomy, this presents a dilemma by limiting human agency and responsibility for technology (Fisher, 2006; Hofmann, 2006; Jonas, 2009; Jonas, 2010; Kritt & Winegar, 2010; Slack and Wise 2006; Wyatt, 2008).

Findings from research conducted by Prakash and Sinha (2008) called into question the assumption that technological change runs an inevitable course, and underscored the importance of human decision making. Prakash and Sinha (2008) conducted research to test whether technological change is the result of the conscious choice of managers, or determined by random technology shocks in the business cycle. The researchers sought to investigate technological determinist claims that corporate activities are largely determined by technology, and to test the hypothesis that managers have a limited role because of the determined nature of technology shocks. Prakash and Sinha (2008) analyzed production data from Indian and US sugar industries, and concluded that changes in technology are the result of conscious choices made by managers. The data showed that new technologies were not always superior to the incumbent technology and the agency and conscious choice of managers is important in bringing about technological change (Prakash & Sinha, 2008).

Rhetoric characterized by assumptions of technological determinism can be a powerful discursive strategy for advancing interests and marginalizing dissenting opinions (Cukier et al., 2009; Leonardi & Jackson, 2004; Leonardi, 2008). Using a critical interpretive perspective, Leonardi (2008) examined the effects of technological determinist rhetoric on technology management by reviewing data from a qualitative study conducted by Leonardi and Jackson (2004), and by reviewing the literature. Leonardi (2008) concluded that despite the importance of social factors in affecting change, when technology managers employed technological determinist rhetoric, the tendency was to make the indeterminate state of things appear to be determined because of the perceived inevitability of technological change. Managers used such discourse to promote explicitly or inadvertently their own interests (Leonardi & Jackson, 2004; Leonardi, 2008). Consequences of technological determinist assumptions and accompanying rhetoric can include the tendency to dismiss social factors that impact technological outcomes, and pursuing courses of action that may inhibit the social adjustments associated with technology that would otherwise naturally occur (Leonardi, 2008).

An essential skill and responsibility of educational technology managers involves selecting technology solutions, negotiating with technology vendors, and making good purchasing decisions (Consortium for School Networking, 2011). In evaluating technology solutions, research suggests that managers who hold technological determinist assumptions can make bad choices by selecting technology systems that do not live up to rhetorical promises (Grant et al., 2006). Grant et al. (2006) used a case study approach to investigate the adoption of enterprise information systems in three organizations, and to evaluate whether the technological determinist rhetoric and promises of technology vendors held true in their technology systems. The researchers interviewed senior managers and stakeholders at two companies and one university (Grant et al., 2006). At the company where managers held a technological determinist viewpoint that assumed the new technology would transform practices in a determined way, apart from the organizational context, the implementation met with some unforeseen problems. The project required altering business practices to suit the new system to the point that it met with resistance in the organization, and the new system did not produce the desired results promised for it (Grant et al., 2006). At the other two organizations, Grant et al. (2006) found that managers did not accept the technological determinist discourse, and instead proceeded to develop more customized information systems better suited for their organizations.

Importance of questioning philosophy of technology assumptions in education. Praxis involves applying theoretical knowledge and critical reflection to professional life, and praxis for educators should include critically questioning assumptions about technology (Strobel & Tillberg-Webb, 2009). Kanuka (2008) argued that by questioning philosophy of technology assumptions, practitioners are better able to make purposeful and informed decisions. Broader philosophical assumptions and beliefs inspire the activities of educators, help to clarify values, and give direction to educational practices (Kanuka, 2008). Philosophies of technology influence how and why educators select technologies to support educational goals, and how they assess the consequences of choices (Kanuka, 2008).

Because national educational technology standards for students emphasize thinking critically about technology, educators should model for their students such questioning of technology (Strobel & Tillberg-Webb, 2009). National educational technology standards for students address the importance of students thinking critically about technology, and analyzing and debating both the benefits and limitations of technology in society and the workplace (International Society for Technology in Education, 2007). Strobel and Tillberg-Webb (2009) argued that if educators are not willing to critically question their own deeply ingrained ideological beliefs about technology, and willing to assess both the positive and negative effects of technology, they are not prepared to take the lead in educating their students to do the same. By questioning their own assumptions, educators are better prepared to guide and empower students to think critically about technology and its role in society and the workplace (International Society for Technology in Education, 2007; Strobel & Tillberg-Webb, 2009).

Educational technology leaders in turn should model for their fellow educators an awareness of the ethical issues associated with technology integration (Consortium for School Networking, 2011). Critical dialogue between educators is needed to question assumptions about technology, in order to champion human values and place priority on a humanizing framework for technology integration (Kritt & Winegar, 2010; Strobel & Tillberg-Webb, 2009). As educators discuss what types of persons our schools will produce, philosophies of technology matter because they embody values concerning the proper role for technology in achieving the ends intended for education (Kanuka, 2008). By becoming more aware and knowledgeable of their own personal philosophy of technology, and the philosophies of others, educational technologists can better understand why they think and act as they do in making professional decisions that involve technology (Kanuka, 2008). Questioning of philosophy of technology assumptions can facilitate more effective dialogue with other stakeholders about the benefits and risks for students associated with technology (Kanuka, 2008; Kritt & Winegar, 2010; Strobel & Tillberg-Webb, 2009).

In the spirit of critically examining philosophical assumptions of instructional technology, McDonald et al. (2005) examined parallels between contemporary instructional technology and one of its historic precursors, programmed instruction. Programmed instruction influenced later models of instructional design (Molenda, 2008), and laid the groundwork for contemporary instructional technology (McDonald et al., 2005). Programmed instruction was influenced by behaviorist principles and a concern for the limitations of group lectures, and involved using teaching machines and drill and practice exercises to individualize instruction and provide immediate reinforcement (Molenda, 2008). Teaching machines employed the use of a punchboard for students to record their responses to multiple-choice questions, and provided for self-paced instruction and instant feedback (Gregg, 2011).

McDonald et al. (2005) analyzed the historical decline of programmed instruction and found that deterministic assumptions, including technological determinist assumptions that technology would inevitably cause learning gains, contributed to its demise. Early researchers assumed that the causal power of technology was so strong that by rigidly adhering to a programmed, behaviorist, and mechanistic approach to learning using technology, this would cause improvements in student learning in a determined way (McDonald et al., 2005). After the initial popularity of teaching machines in schools (Gregg, 2011), their use declined after few studies on programmed instruction found the techniques superior to traditional methods of instructions (Gregg, 2011; McDonald et al., 2005). McDonald et al. (2005) observed that some of the same technological determinist assumptions that were operative in programmed instruction are currently operative in contemporary instructional technology. McDonald et al. (2005) proposed that instructional technologists can benefit from examining their philosophical assumptions, in order to avoid placing an unrealistic faith in the power of technology, and expecting from it more than it can deliver.

Technological determinist assumptions can be pervasive. Philosophy of technology assumptions can be unrecognized and outside of our explicit awareness

(Kanuka, 2008; Kritt & Winegar, 2010; Strobel & Tillberg-Webb, 2009). Scholars have argued that assumptions of technological determinism are pervasive in popular perceptions and culture (Carr-Chellman, 2006; Leonardi, 2008; Lievrouw, 2006; Yang, 2009). Friedman (2009) examined American media coverage of the 2009 Iranian presidential election, and the ensuing protests in Iran disputing the results, and concluded that American media rhetoric about Twitter and social networking was influenced by technological determinism. Although the media attention inspired Americans to become more interested in the Iranian struggle, the discourse was influenced by the perception that utopian social transformation can inevitably occur through technology (Friedman, 2009). Friedman (2009) noted that international observers had concluded the Iranian protests were driven by a broad-based grassroots movement, more so than social networking technologies causing inevitable change. The media discourse of technological determinism minimized the role of the human agents in the complex social struggle, while exaggerating the effects of social media (Friedman, 2009).

Researchers have found that technological determinist assumptions can be present in the media discourse, and rhetoric by educational officials, that can accompany public discussion about educational technology (Bennett & Maton, 2010; Brown & Czerniewicz, 2010; Clegg et al., 2003; Cukier et al., 2009; Fisher, 2006; Jones & Czerniewicz, 2010; Jones & Healing, 2010). Using critical hermeneutic analysis and content analysis techniques, Cukier et al. (2009) examined media discourse surrounding an instructional technology initiative at Acadia University in Canada, called the Acadia Advantage. The initiative involved a university funded student laptop initiative through a partnership with IBM, and received much media attention (Cukier et al., 2009). Cukier et al. (2009) found that hyperbole evoking a technological determinist viewpoint was present in both academic and non-academic literature. The researchers found that rhetoric of the technological imperative was a dominant metaphor that distorted discourse by making positive claims for the technology initiative that were ill supported by evidence (Cukier et al., 2009). The technological determinist rhetoric tended to marginalize dissenting opinions by portraying the technology initiative as inevitable (Cukier et al., 2009).

Fisher (2006) observed a tendency for educational discourse in the United Kingdom about educational technology to be framed in technological determinist rhetoric that ascribed to technology the power to inevitably cause transformation in schools. The researcher observed technological determinist assumptions in hyperbole in advertising from technology vendors, in official educational policy documents, and in public comments by education officials (Fisher, 2006). Such technological determinist assumptions and rhetoric are problematic because by ascribing change to autonomous technology, the perspective shortchanges the hard work that educators must undertake to improve and transform education (Fisher, 2006). Another problem with technological determinist assumptions is that they influence educators to focus on how schools should adapt to technology, rather than shaping the technology to suit unique educational needs and requirements (Jones & Czerniewicz, 2010). Fisher (2006) argued for the necessity of critically examining discourse about educational technology in order to avoid technological determinist thinking or assumptions of techno-utopianism.

Technological determinism and contemporary technology issues. There has been recent discussion in the educational technology field concerning bring your own device (BYOD) initiatives, whereby students are allowed to bring their own mobile devices to school, including phones, tablets, and laptops (Noonoo, 2012; Norris & Soloway, 2011; Schachter, 2012). The literature suggests that technological determinist assumptions about the inevitability of BYOD may play a part in the thinking on this particular issue. For example, Schachter (2012), Noonoo (2012), and Norris and Soloway (2011) all made the claim that BYOD initiatives are inevitable in schools.

Noonoo (2012) made the claim that the widespread practice of deploying small numbers of PCs in classrooms has not made a significant improvement in student achievement, but that the "irreversible" trend toward mobile technology will fulfill the promise of one-to-one technology (p. 46). Such rhetoric can be a problem by dismissing the instructional value of traditional classroom computers. Longitudinal research studies have been conducted to investigate the benefits of using small numbers of classroom computers, and the findings support the conclusion that the practice can result in significant gains in student achievement in core subject areas (Ringstaff & Kelley, 2002).

Despite the fact that the majority of schools prohibit students from using cell phones in class, Norris and Soloway (2011) made the claim that it is inevitable that bring your own device (BYOD) initiatives involving handheld technology will become the heart of school change efforts. Such claims for the inevitability of handheld devices seem to exaggerate the instructional benefits of handhelds, while minimizing the advantages of traditional computers such as laptops. Motiwalla (2007) conducted research on student use of wireless handheld devices for instruction, by developing an application to link the handheld devices to course websites. Based on observations and student surveys, the researcher concluded that handheld devices were complimentary and useful learning tools, but stated that the small screen on smartphones can be an impediment, and the devices cannot replace other instructional technologies (Motiwalla, 2007).

As educators encounter claims concerning the perceived inevitable shift from traditional computers to handheld devices (Noonoo, 2012; Norris & Soloway, 2011, we might recall that research has found traditional laptops to be effective instructional tools (Bebell & Kay, 2010; Bebell & O'Dwyer, 2010). Bebell and O'Dwyer (2010) analyzed the results of four empirical studies involving one-to-one student laptop computer initiatives, and found that such initiatives were associated with positive changes in the instructional practices of teachers, and improved student outcomes. Laptop initiatives were associated with increased student engagement, increases in student achievement, and the role of the teachers in the effectiveness of the initiatives was found to be essential (Bebell & O'Dwyer, 2010). Bebell and Kay (2010) found that middle school students participating in one-to-one laptop initiatives achieved statistically significant gains on state standardized assessments.

Digital natives discourse and technological determinism. Jones and Czerniewicz (2010) asserted that despite academic criticism of technological determinism, discourse characterized by the viewpoint persists. Clegg et al. (2003) critically examined educational discourse characterized by technological determinism, and advised educators to expose the limitations of theories that rely on technological determinist assumptions. One such theory revolves arguably around the assumptions that educators can have about their students, and their students' use of technology. Recent scholarship on the digital natives debate suggests the dominant educational discourse about young people being digital natives, or the Net Generation, is influenced by technological determinism. (Bennett & Maton, 2010; Brown & Czerniewicz, 2010; Jones & Czerniewicz, 2010; Jones & Healing, 2010).

Discourse about digital natives includes the general claim that inevitable technology is causing inevitable change in students (Jones & Healing, 2010). Jones and Healing (2010) asserted that the digital natives argument proceeds from a simplistic view of causality influenced by technological determinism. The discourse makes the claim that young people who have grown up with technology have been changed by it and now have a natural aptitude for it compared with older people, who are considered immigrants (Jones & Czerniewicz, 2010). Related claims made about digital natives are that technology has caused changes in students' learning styles and even brain function (Jones & Healing, 2010; Jones & Czerniewicz, 2010). Such discourse about digital natives has been widespread in educational policy statements and popular rhetoric (Jones & Czerniewicz, 2010).

According to Bennett and Maton (2010) and Jones and Healing (2010) the discourse about digital natives is influenced by technological determinism and the assumption that technology causes inevitable and radical change to both students and schools. Scholars have argued that assumptions about digital natives may inhibit balanced debate from occurring in schools on some educational technology policy issues (Bennett & Maton, 2010; Jones & Healing, 2010). Bennett et al. (2008) asserted that the digital natives discourse uses dramatic language that has created moral panic in academic circles. Jones and Healing (2010) observed the digital natives discourse created a panic in schools whereby older educators were perceived as being out of touch, and not as able to become proficient with technology because of their age and generational position.

Educational technology standards call for schools to prepare students with 21st-century skills that will equip them to be successful in a global economy (Schrum & Levin, 2009; Striano, 2009). This challenge can involve managing the transformation of educational practices, and leveraging technology as integral to the change process (Schrum & Levin, 2009; Striano, 2009). However, the tone of the digital natives discourse can dismiss the opinions of educators who may have legitimate concerns, and portray educators who may resist more radical change efforts as being out of touch (Jones & Healing, 2010).

Empirical research on digital natives. Bennet and Maton (2010) argued that educators should move beyond debate characterized by digital natives rhetoric toward rationale debate based on researchable issues. Jones and Czerniewicz (2010) called for further research to examine the current reality of young people and their use of technology, in part to dispel technological determinist assumptions and rhetoric. Bennett and Maton (2010) conducted a review of research and concluded that the broad claims about digital natives were not supported by research evidence. Rather than students being inevitably changed by technology in determined ways, empirical research showed that the choices which students make based on their purposes and interests shape how they engage with technology (Bennett & Maton, 2010; Jones & Healing, 2010). Bennett and Maton (2010) found that the frequency and use of technology by students was highly variable, and students chose technology for its value and suitability for particular purposes and interests.

Witt (2012) argued that digital technologies have important implications for gifted students, and that gifted students are often ahead of their peers in becoming proficient with technology. Brown and Czerniewicz (2010) found that a small group of talented students shared characteristics of digital natives. However, Jones and Healing (2010) investigated college freshmen and found that students were not a homogenous group in terms of their use and skill with technology, and significant variations were present in their competencies. Based on an ongoing six-year study, Brown and Czerniewicz (2010) found that age was generally not a factor in determining students' use of digital technology. Even though students may have a wide exposure to using technologies, this can be a superficial exposure that does not develop the technology skills needed to be successful in their coursework, such as creating their own content (Bennett et al., 2008; Jones & Healing, 2010). Bennett et al. (2008) referred to a lack of evidence that digital natives are uniquely suited for multitasking compared with other generations. The findings from recent empirical studies about digital natives calls into question the technological determinist assumptions that educators may have about technology causing inevitable change to students (Jones & Healing, 2010).

Philosophy of technology assumptions and ethical considerations in leadership. Technology leaders face many ethical issues important for responsible educational technology practice (Consortium for School Networking, 2011). Ethical considerations pertaining to responsible K-12 technology leadership have been defined in national professional standards as a core skill area for school technology leaders (Consortium for School Networking, 2011). The framework of essential skills for technology leadership includes addressing ethical issues that pertain to policy-making and enforcement, and the ethical purchasing and utilization of technology (Consortium for School Networking, 2011). The technology leadership framework emphasizes ethical considerations such as Internet safety of students, equitable access to technology, copyright compliance, personal privacy, information security, environmental protection and energy saving practices, and ensuring that technology promotes a high-performing learning environment (Consortium for School Networking, 2009; Consortium for School Networking, 2011).

Hofmann (Hofmann, 2006; Lillehammer University College, 2006) examined the axiological connection between technology and values, and asserted that when professionals with responsibilities set out to assess technology in a context such as education, they need to take into account whether technology controls us or is controlled by us. The rate at which digital technology evolves places pressure on schools and educational technologists just to keep up with new developments (Kritt & Winegar, 2010; Selwyn, 2010b), and this pace of change presents challenges for contemplative leadership (Canole, 2007; Selwyn, 2010b). There is little time for considered judgment and there can be a reflexive rather than reflective response to new information (Canole, 2007).

Associated with technological determinism is the view that technology is in control and that it overshadows human values, with technology outside of cultural and ethical critique (Amiel & Reeves, 2008; Robinson & McKnight, 2007; Vermaas et al., 2011). A similar view about technology as it pertains to values is the neutrality thesis, that holds technology is neutral with regard to values, neither good nor bad in itself. The neutrality thesis can be problematic because when viewed from this perspective, technology tools are seen as having no inherent ethical consequences (Brey, 2010; Robinson & McKnight, 2007). Such a view seems to be in conflict with the national framework for K-12 technology leadership, since the core skill areas reflect the view that technologies can be value laden and carry ethical implications (Amiel & Reeves, 2008; Consortium for School Networking, 2011). Decisions to implement technologies in schools should consider ethical considerations pertaining to technology, including Internet safety for students, equitable access to technology, copyright compliance, personal privacy, environmental protection and energy saving practices, and ensuring that technology promotes a high-performing learning environment (Consortium for School Networking, 2011).

The implementation of technology has resulted in unforeseen consequences and risks that were not originally intended or predicted (Canole, 2007; Jonas, 2009; Kritt & Winegar, 2010; Nel, 2006; Nworie & Haughton, 2008). The Internet has exacerbated problems that impact schools such as plagiarism, risks to the security of information, loss of privacy, bullying, and threats to student safety (Biddle et al., 2008; Canole, 2007; Chang, 2010; Consortium for School Networking, 2011; Livingstone & Haddon, 2009). Nworie and Haughton (2008) examined the adoption and implementation of innovative technology for both traditional face-to-face instruction and virtual learning environments, and described the instructional benefits, challenges, and unintended consequences of digital innovations. The researchers concluded that along with the instructional merits afforded by technology there can be unintended consequences such as ease of cheating, and distractions from learning such as games, inappropriate content, and off task web surfing (Nworie & Haughton, 2008). Educators should be aware of the possibility that instructional disparities can widen for students who are without sufficient access to technology at home (Nworie & Haughton, 2008). While our predictive knowledge and ability to foresee the consequences of technology may be limited (Jonas, 2009), and individuals may feel a lack of power over technological development, technology is not outside of responsible human control (Kanuka, 2008).

Educators may face ethical challenges and even dilemmas when wrestling with the implications of instructional technology (Lally et al., 2010). How must educational technology leaders simultaneously lead the infusion of innovative technology, while remaining aware of ethical concerns? Both of these responsibilities are essential skills in the framework for competent K-12 technology leadership (Consortium for School Networking, 2009). As educators deliberate over Web 2.0 technologies and ubiquitous mobile devices, they are faced on the one hand with tools that that can promote online collaboration and enhance learning (Jennings, Sutherlin, & Counts, 2010; Lally et al., 2010). On the other hand, the use of the Internet and ubiquitous mobile devices can present risks to student safety (Biddle et al., 2008; Canole, 2007; Chang, 2010; Consortium for School Networking, 2011; Lally et al., 2010; Livingstone & Haddon, 2009).

Popular Web 2.0 technologies with possibilities for education include social networking sites such as Facebook, social bookmarking sites such as Delicious, media sharing sites such as Flickr and YouTube, blogs, wikis, podcasts, and virtual worlds (Greenhow, Robelia, & Hughes, 2009; Hazari, North, & Moreland, 2009; Meyers, 2009; Purcell, 2011; Wang & Hsua, 2008). Web 2.0 technologies are characterized by social interaction and the ability for users to easily and inexpensively create, post, rate, and tag content (Buffington, 2008). There is a focus on the users as much as the content they upload (Greenhow, Robelia, & Hughes, 2009).

Creating and publishing content using Web 2.0 technologies is generally easy and inexpensive (Buffington, 2008), and in a national study, 62% of teachers reported that Web 2.0 offers improved resources for teaching in content area subjects (IESD, 2011). Research suggests that Web 2.0 tools motivate students by stimulating their attention and supporting their confidence during learning (Huang & Yoo, 2010). Teachers can find in blogs an effective way to maintain and share online electronic portfolios of student work, and allow for students to express their opinions, reflect on topics, and receive constructive feedback (Buffington, 2008; Wang & Hsua, 2008). Wikis can promote collaboration in group assignments and allow students to build on the knowledge of other students (Hazari et al., 2009).

However, some critics have argued that the Internet can emphasize speed of access and superficial observations of the world, rather than depth of knowledge (Kakutani, 2007; Kritt & Winegar, 2010). Critics have alleged that Web 2.0 has led to consequences such as a shift toward a culture of amateurism and mediocrity, promoting speculation rather than considered judgment, and blurring the distinction between fact and opinion (Kakutani, 2007; Kakutani, 2010). While popular open source Internet resources such as Wikipedia usually have accurate information, and occasionally inaccuracies, Keen (2008) asserted that the problem with Wikipedia is not so much accuracy, but the problem it poses for students who may lack media literacy. In debating Web 2.0 with Jimmy Wales, the founder of Wikipedia, Keen (2008) argued that because there is no hierarchy of knowledge on Wikipedia, students can have difficulty evaluating the importance of information, as mundane topics often receive more attention than essential knowledge.

Student safety is an ethical concern that needs to be addressed by educators when considering Web 2.0 technologies. Nationwide, Internet safety is an important issue to be considered in curriculum (DeFranco, 2011). In Virginia, schools are required to integrate Internet safety instruction into curriculum (Virginia Department of Education, 2007). In a national study of educators 55% of respondents reported student safety to be the most frequently identified barrier for utilizing social networking in schools (IESD, 2011). Virginia's Board of Education recommends that local school districts formulate policy on social networking that considers the safety of students, an action taken partly in response to the conviction of a Virginia teacher for molesting a student after exchanging messages with the victim and other students on Facebook (Sieff, 2011).

Virtual worlds such as Second Life are online environments in which users through avatars play, socialize, explore or engage in other behaviors online (Meyers, 2009). Herrington, Reeves, and Oliver (2007) argued that employing cognitive realism when using simulated virtual environments and immersive technologies can enhance the authenticity of learning. There has been interest in the educational community on schools promoting the use of virtual worlds. Establishing an island on Second Life was a major initiative of the Virginia Society for Technology (VSTE, 2009). Meyers (2009) asserted educators should begin leveraging virtual worlds for learning and problem solving rather than blocking them. Greenhow et al. (2009) advocated for young people to "experiment with different identities online" (p. 251). While recognizing the value of social media for promoting dialogue and solidarity, Pope Benedict XVI (Campbell, 2011) cautioned against the dehumanizing temptation of using artificial profiles, and living a parallel type of existence that focuses on excessive virtual contact rather than genuine human contact.

Virtual worlds can be problematic from an ethical perspective, and present issues related to student safety. The Federal Trade Commission found (Devaney, 2010) that virtual worlds aimed at teenagers or adults contained a moderate to heavy amount of explicit content. Even among those intended for children under 13, half of the virtual worlds contained some explicit content (Devaney, 2010). Jackson, Zhao, Witt, Fitzgerald, and von Eye (2009) examined children's beliefs about moral behavior in the real world and virtual worlds, and found that overall there was a relationship between moral orientation in virtual worlds and the real world.

Lally et al. (2010) examined the literature and identified ethical dilemmas that educators and researchers must face when pursuing technology enhanced learning. The researchers (Lally et al., 2010) discussed that ethical dimensions of instructional technology include risks to students such as bullying, intrusions to personal privacy, access to harmful content, and creation of inappropriate content. Lally et al. (2010) concluded that ethical frameworks can help to raise important questions, invite reflection, and inspire debate on pertinent ethical considerations that involve instructional technology. The researchers argued that by examining the ethical dimension of instructional technology, and discussing ethical values surrounding technology, researchers and educators can better promote a disciplined and ethically informed conversation about technology enhanced learning (Lally et al., 2010).

In arguing for why educators should examine philosophical assumptions about technology, Strobel and Tillberg-Webb (2009) asserted "before approaching technology integration in instruction, it is imperative to examine one's own assumptions and beliefs about technologies and their impact on human users" (p. 77). Deeper dialogue between educators about technology can better recognize cultural and moral dimensions, and consider the positive benefits of technology while identifying potential problems (Kritt & Winegar, 2010). Philosophical assumptions that technology drives society and education can be dehumanizing, and despite technological utopian rhetoric that sees technology as leveling social inequalities, a digital divide for students with disparity of access to technology continues to persist (Fuchs, 2009; Strobel & Tillberg-Webb, 2009). Technological development may enhance the advantage of some regardless of the expense to others (Sabatino, 2007), and development driven by competition and market forces may not serve the common good (Kritt & Winegar, 2010). Selwyn (2010b) argued that a critical approach to educational technology research would be more cognizant of social justice issues concerning equitable access to digital technology.

Assumptions characterized by technological determinism can find educators facing pressure to keep up with technology or fall behind, and educators may feel like they have little sense of agency in a world run by technology (Strobel & Tillberg-Webb, 2009). Kritt and Winegar (2010) considered the question whether technology will be transformed by its human users, or whether people will be more transformed by technology. Kritt and Winegar (2010) argued for the importance of human agency directing future evolution of educational technology. The critique of technological determinism that follows later in the literature review will examine and critique this theory of technology in depth, including different variations of the technological determinist perspective.

Foundations in Philosophy of Technology

Franssen et al. (2009) asserted that technology is a major cultural and economic force that operates as a framework to hold contemporary society together. Philosophy of technology examines the underlying assumptions of how technologies impact and transform human society in ways that are philosophically relevant (Kaplan, 2009a). While earlier philosophers such as Plato, Aristotle, and Marx examined the technology in their eras from a philosophical perspective, philosophy of technology is largely a field of endeavor that began in the twentieth century, as attention was turned to technology as a focal point of human existence (Hanks, 2010). Because of the centrality of technology in everyday life, Jonas (2010) held that philosophy of technology is essential, and asserted that it can encompass elements from all other branches of philosophy. Ermer (2009) wrote that philosophy of technology as a disciple has placed importance on analyzing any problems or harm to society connected with technology, and proposing ways to direct technology to avoid pitfalls. As it applies to educational technology, understanding philosophical assumptions about technology help clarify how technologies pertain to educational ends and goals, and prepare educators to make informed decisions when integrating technology (Kanuka, 2008). The ensuing discussion of foundations in philosophy of technology will cover the thought of central figures, along with discussion of how their thought has applications for educational technology. Among the philosophers who contributed to the foundations of philosophy of technology, including Ellul, Jonas, and Heidegger, there tended to be a focus on ethical issues associated with technology, and the implications for human responsibility, along with a somewhat pessimistic view of technology (Ellul, 2010; Franssen et al., 2009; Heidegger, 2009;

Jonas, 2009; Jonas, 2010). The section on foundations of technology will explore the thought of key thinkers such Ellul, Jonas, and Heidegger, and conclude with a discussion of the thought of Borgmann, who pursued a more nuanced and balanced approach. Borgmann held that technology can be pursued in a way that focal things and practices are kept at the center of human life (Borgmann, 2009).

Classical philosophers and philosophy of technology roots. Franssen et al. (2009) summarized the foundations of the philosophy of technology by articulating three important themes from Plato and Aristotle that later influenced modern philosophical thinking about technology. First, Plato held that the technological artifacts created by man were invented by imitating nature (Franssen et al., 2009). Similarly, Aristotle observed this same phenomenon of imitation in man-made artifacts, but held that man not only imitates nature, but completes what in nature was unfinished (Franssen et al., 2009).

A second important theme from classical philosophy involves Aristotle's ontological distinction between the things of nature and man-made artifacts (Franssen et al., 2009). Natural things have their principle of generation from their natural internal properties and can reproduce themselves, while man-made artifacts are brought into being by man through outward causes, and last for a time and then decay (Franssen et al., 2009). A third important theme from classical philosophy that has continued to influence philosophical investigations about technology involves Aristotle's theory of the four causes (Franssen et al., 2009, Heidegger, 2009). Aristotle's theory of the causes influenced debate about means and ends as it relates to technology, it influenced the popular instrumental view of technology, and was important for Heidegger's questioning of technology (Franssen et al., 2009, Heidegger, 2009).

Instrumental view of technology. The instrumental view of technology is a popular perspective on technology (Franssen et al., 2009; Jackson, 2010) that sees technology, whether equipment, tools, or machines, as a means to an end (Berger, 2011; Feenberg, 1991; Heidegger, 2009). The instrumental view of technology commonly sees technology as value neutral instruments, neither good nor bad in themselves, which are designed by engineers to be put to use by users as a means for their own purposeful ends (Franssen et al., 2009). Kroes, Franssen, and Bucciarelli (2009) explained that means and ends reasoning starts with emphasizing the purposeful ends that one wishes to realize through a technological solution, and then proceeds toward identifying possible means of achieving those ends. Practical reasoning that considers the relations between means and ends is an integral part of computer engineering (Hughes, Kroes, & Zwart, 2007).

Means and ends reasoning is important for educational technology, because the customary role for technology is normally the means to achieve the educational ends intended for it (Kanuka, 2008). Leaders should shape technology to suit educational needs and requirements (Jones & Czerniewicz, 2010), with curriculum driving technology integration, rather than technology driving curriculum (Shelly et al., 2008). However, technology can distort the ends for which it is a means, with the technology becoming in effect an end in itself (Ellul, 2010). Scholars have argued that often there is pressure for schools to adapt educational environments to new commercial technologies, rather than clarifying educational ends, and then proceeding to adapt the technology as a means to solve educational problems or achieve educational goals (Amiel & Reeves, 2008; Jones & Czerniewicz, 2010). Amiel and Reeves (2008) asserted "educational technologists are frequently more concerned with the possibilities of using a new technology (means), such as a newer course management system or the hottest wireless device, than seriously considering the ultimate aims of its use and its consequences" (p. 33).

The instrumental view of technology's approach to technology as neutral with regard to values is referred to as the neutrality thesis (Vermaas, 2011). The position of technology as neutral with regard to values assumes that there are no inherent moral implications in using technology (Vermaas, 2011). The philosopher of technology Feenberg held that one of the major implications of the neutrality thesis is that it assumes the technology tool has no ability to control, that the user is always in control of the technology tool (Jackson, 2010).

A problem with the instrumental view with regard to educational technology is that seeing technology as value neutral may interfere with discerning how technologies raise ethical considerations, and we may fail to recognize how some technology decisions can be value laden (Amiel & Reeves, 2008; Consortium for School Networking, 2011; Hofmann, 2006; Lowrance, 2010). Educational technologies are interconnected in an integral way not only with educational goals, but also with economic issues, political agendas, and social issues that call for considering axiological factors (Amiel & Reeves, 2008). Amiel and Reeves (2008) argued that a new critical approach to educational technology research is needed that places priority on axiology, with values and principles directing a proper focus on how educational technology can be a means to achieving educational ends.

Martin Heidegger and questioning technology. The German philosopher Martin Heidegger proposed a philosophy of technology that has been considered by many scholars to have been the most influential of all (Kaplan, 2009b; Lewin, 2010). Westera (2004) asserted that philosophical insights about technology influenced by Heidegger's thinking are central to philosophical debate on innovative educational technology. Heidegger (2009) conducted an examination of the essence of technology by considering technology from an ontological perspective. Heidegger recognized that technology is commonly viewed using an instrumental definition that sees technology as a means to achieve other human ends (Heidegger, 2009). However, after proceeding to examine technology using the four causes in Aristotle's theory of causality, Heidegger concluded that the essence of technology goes beyond mere means, and that technology involves more than human doing (Heidegger, 2009). Heidegger examined how the Greek philosophers understood technology (technê in the original Greek), and held that technê is a mode of knowing with ontological significance (Brogan, 2007).

Heidegger held that technology is a mode of ontological revealing such that technology serves to unveil dimensions of the world that were previously hidden (Heidegger, 2009; Sabatino, 2007). Westera (2004) analyzed philosophy of technology principles that support the understanding of innovative educational technology, and stated that in moving beyond the instrumental view of technology, Heidegger recognized that technology fundamentally changes human existence, and becomes an integral part of life. While the instrumental view of technology focuses on human beings as makers and users of tools, Heidegger emphasized that technology has more ontological significance for life by mediating and giving form to how we experience the world (Westera, 2004).

According to Heidegger, the essence of technology shows itself to be what Heidegger termed enframing (Heidegger, 2009). Enframing is a frenzied and technological manner of ordering things in standing-reserve, such that everything is ordered to stand by on call for further ordering, "driving on to the maximum yield at the minimum expense" (Heidegger, 2009, p. 14). Dreyfus (2009) interpreted that for Heidegger standing-reserve means efficiency for its own sake. Heidegger asserted that as human beings conduct themselves toward the world with a technological orientation (Introna, 2011), this blocks other ways of revealing existence, and blocks and conceals more primal truth (Heidegger, 2009). Heidegger explained that an existential threat is the danger that everything in reality will viewed as standing-reserve (Heidegger, 2009). Things are perceived as having meaning and purpose to the extent to which they can be made available to be used, or disposed of when needed (Sabatino, 2007). Eventually man comes to the point that human beings are treated as standing-reserve, and Heidegger (2009) pointed out how language such as the concept of human resources gives evidence of this.

For Heidegger, modern technology is a phenomenon that has a tendency to frame our relations with things and with human beings in a one-dimensional way with everything viewed as resources available to us (Introna, 2011). In interpreting Heidegger's view of standing-reserve as efficiency for its own sake, Dreyfus (2009) wrote that people are treated as resources in the same way we deal with things, using them like things and then disposing of them when no longer needed. Heidegger (2009) argued that the essence of technology as enframing may block more original ways of revealing truth, so that man sees only his own constructions. However, if we see only our own constructions, enframing prevents mankind from finding our own essence (Heidegger, 2009). Human beings become resources to be enhanced like things, and greater realities such as answering our vocation to service to God and our fellow man may become neglected (Dreyfus, 2009). Such a view focused on people functioning as resources when needed stands in contrast with a broader view of education focused on what types of persons our schools will produce (Kanuka, 2008).

It should be noted that Heidegger was not a Luddite who was always against technology (Dreyfus, 2009). Heidegger affirmed the usefulness of technology, and saw how the pursuit of technological advances can challenge us (Dreyfus, 2009). Heidegger held out the possibility that instead of mankind being caught up merely in a technological way of being, if we reflect on the essence of technology, we can bring forth a saving power and gain a free relation to technology (Heidegger, 2009; Dreyfus, 2009). Dreyfus (2009) explained that Heidegger held that we can use and even depend on technology, but can remain true to ourselves without letting technological devices dominate our live. Westera (2004) discussed how educational technology can move beyond a strict focus on efficiency. Education has a role to play in preparing students for a fulfilling life, and educational technology can promote a more intriguing and challenging educational environment (Westera, 2004).

For Heidegger, a characteristic of modern technology is the shrinking of distance, but the irony is that the shortening of distance does not equate to bringing things truly near to us (Lewin, 2010). Strobel and Tillberg-Webb (2009) stated that online learning and virtual worlds involve a way of being and interacting with others that is different from interacting face-to-face. From a Heideggerian perspective, Lewin (2010) claimed the notion of an online community could be considered an oxymoron. Lewin (2010) asserted that the Internet may not only shrink distances, but shrink "our existential commitment to stand for what we say" by cheapening dialogue about topics through ubiquitous opinions, often masked by anonymity (p. 351).

However, in considering Heidegger's idea that we can gain a free relation to technology, we might emphasize how innovative educational technology can have a transformative character (Westera, 2004). Whether asynchronous or synchronous, the collaborative features of learning management systems can be conducive for helping working professionals collaborate in authentic, realistic activities (Woo, Herrington, Agostinho, & Reeves, 2007). With younger students, online learning can similarly offer authentic benefits. Using a qualitative grounded theory design, Jahnke (2010) examined the impact of collaborative online tools with high school students using Blackboard discussion forums. Jahnke (2010) found that students did not see using the collaborative tools as a superficial activity, but the experience was supportive to them, offered opportunities for improved learning outcomes, and opportunities for interacting and collaborating with other students.

Employing Heidegger's philosophy of technology, Fidalgo (2009) examined modern mobile technology to find out if a balanced view of cell phones is compatible with Heidegger's thought. Fidalgo (2009) studied whether a cell phone can be considered an indispensable element in our contemporary society, or a factor that contributes to existential alienation. On the one hand, Fidalgo (2009) discussed that because of the way ubiquitous mobile phones invite chatter into our lives, and uniformity instead of individuality, they can lend themselves to inauthentic human existence, and dull the voice of conscience. However, Fidalgo (2009) argued that cell phones can lead to living authentic or inauthentic lives. Cell phones can intrude into our face-to-face lives at the wrong time or place (Fidalgo, 2009). Cell phones can also be used in ethical and courteous ways, enabling communication that breaks open boundaries of time and place, and new possibilities of being human (Fidalgo, 2009).

Gabriel Marcel and technological dependency. Gabriel Marcel, the French philosopher and playwright, cautioned that technology can be dehumanizing if we forget the human quest for meaning and what defines human existence, while becoming dependent upon disposable technological devices to make our lives intelligible and meaningful (Tunstall, 2009). For Marcel, a characteristic of the modern world, which he considered broken, is that we can become overly dependent on technology and see in technology the solution to every problem (Treanor, 2010). A recent example of seeing technology as the answer to educational problems involves the claim being made that it is inevitable that bring your own device (BYOD) initiatives involving handheld technology will become the heart of school change efforts (Norris & Soloway, 2011). Marcel emphasized that life is more than technical problems, and man is at risk of losing sight of the mystery of being because technical things cannot answer important existential questions (Marcel, 2001; Treanor, 2010). Concerning the matter of dependency on technological devices and how this might affect students, Ko, Cheong, Park, Kang, and Park (2011) conducted research to analyze factors associated with addictive cell phone behavior in middle school students, and mental health. The researchers found a correlation between higher levels of addictive cell phone behavior, and lower levels of mental health in the middle school children (Ko et al., 2011).

Jacques Ellul and the autonomy of technology. The French philosopher Jacques Ellul held a generally pessimistic view of technology, and saw it as having autonomy over human life, to the extent that it reduces man to a "technical animal" who becomes subservient to technology (Ellul, 2010, p. 70). Ellul's perspective was a technological determinist view that perceived technology as a powerful force that dominates all aspects of society and human life (Bimber, 1994; M. R. Smith, 1994). Ellul has been considered to be the principal proponent of the philosophical position that ascribes to technology an autonomy over human life and events (Ermer, 2009). For Ellul, the autonomy and power of technology is of such force that technology can distort the ends that are intended for it, and bend the will of its users so they treat technology as an end in itself (Ellul, 2010). Ellul held that technological development proceeds in a way that ethical considerations do not play a role, and moral judgments are suspended (Ellul, 2010; Westera, 2004).

Ellul, like Marcel, viewed mystery as necessary to human life, and argued that technology removes the sacred and mystery from life, by reducing the world to technical explanations (Ellul, 2010; Marcel, 2001). Ellul asserted that because man cannot live without a sense of mystery, our sense of the sacred is transferred to technology, which can instill in us both a sense of magic and fear. Ellul as a philosopher of technology saw his mission to be one of calling mankind to become the master of technology, and also of diagnosing a disease, although Ellul was uncertain of what treatment was necessary (M. R. Smith, 1994).

Hans Jonas and human responsibility for technology. Hans Jonas (2010) proposed a philosophy of technology that examined the traits of modern technology as a whole, and considered its use in everyday life, and its evolution over time. Jonas also presented an ethics of technology that largely takes a pessimistic view toward technology (Jonas, 2009; Jonas, 2010). While the perspective of Jonas is largely negative toward technology, Jonas elucidated important insights on the connection between technology and human responsibility for it (Jonas, 2009; Jonas, 2010).

Jonas (2010) saw the formal dynamics of modern technology as being very different from technology from previous eras when technological development moved more slowly. For Jonas, modern technology is an enterprise driven by a relentless quest founded on the premise of striving toward indefinite progress. Jonas' philosophical thinking about technology goes beyond the simple instrumental view of technology. He held that the ends to be achieved through technology tend to be fluid, and that new technologies proceed outward in new directions through scientific discovery, innovation, and competitive pressure. Jonas saw this technological momentum as something driven by a restless pursuit of progress and novelty for its own sake, with the process creating and imposing new ends for technology from the invention of new means. Jonas observed that the evolution of technology has tended toward the systematic delivery of commodities, beginning with electricity, and evolving to electronics and information technology.

Jonas (2010) was troubled by the prospect that biotechnology might evolve to the point that the human race takes its own biological evolution in our own hands. Jonas (2010) argued that mankind may be unprepared to provide the wisdom and ethical judgment necessary to deal with technological momentum, and possible threats to the quality and future preservation of human life. Jonas (2009) held that traditional ethical norms are generally confined to the immediate setting of ethical deliberations, but that the unforeseen consequences of modern technology require a new ethics of technology capable of a larger perspective. Jonas (2009) argued that our predictive knowledge and ability to foresee the consequences of technology cannot keep pace with rapidly changing technical knowledge, and that this presents ethical dilemmas for human responsibility for technology. In order to meet this ethical challenge, Jonas (2009) proposed a new ethical imperative similar to Kant's categorical imperative, but which places the ethical maxim in the context of ensuring that actions are compatible with "the permanence of genuine human life" (p. 179). Jonas (2009) criticized utopian ideas about technology, and held that human responsibility for technology can involve a responsible restraint toward some technologies, given how we can be ignorant of some of the unforeseen consequences and ultimate implications of technology.

Albert Borgmann and technology, focal things, and the good life. Influenced by Heidegger's philosophy of technology, Albert Borgmann (2009) proposed a reform of technology that proceeds from a nuanced view about its benefits, and compatibility with the good life. Borgman's philosophy of technology articulates a distinction between devices and focal things (Kaplan, 2009b), and can provide important philosophical insights for educational technology (Westera, 2004). Devices such as technological devices are simply instruments used for a particular purpose, while focal things tend to engage mind and body and center our lives (Borgmann, 2009; Kaplan, 2009b, Fallman, 2011). In contrast with philosophers such as Marcel, Ellul, and Jonas who tended to focus on a pessimistic view of technology (Ellul; 2010; Jonas, 2009; Jonas, 2010; Treanor, 2010), Borgmann recognized that technology has provided relief from some of the drudgery, misery, and toil that was characteristic of pre-technological life (Borgmann, 2009).

Borgmann's philosophy of technology views technology largely in terms of a device paradigm that focuses on the usefulness of technology, with ubiquitous technological devices ready at hand to make our lives easier (Borgmann, 2009). Technological devices are generally characterized by hidden mechanisms with buttons and other interfaces designed to make them user friendly and not a burden to use (Borgmann, 2009; Fallman, 2011; Lewin, 2010). Borgmann observed that technology has helped to contribute to a prosperous society, and it provides us with the means, resources, and leisure time to pursue excellence in various cultural and scientific fields of endeavor (Borgmann, 2009). However, Borgmann argued that technological devices can add to the clutter of our lives, and subvert the external goods for which technology is intended to be a means (Borgmann, 2009). Borgmann believed that technology can have a seductive power that influences people to focus on disposable material goods, while becoming disengaged from other persons and concerns (Fallman, 2011).

In contrast to devices, Borgmann held that focal things are characterized by a unity and harmony of means and ends, and of mind and body, and focal things implore our full and engaging presence (Borgmann, 2009; Fallman, 2009; Introna, 2011). Focal things center our lives, just like a fireplace is the focal point in a traditional country home, or the dinner table the focal point in the family (Borgmann, 2009; Fallman, 2011). Borgmann (2009) articulated that focal things and practices, such as those centered on family, or professional practice guided by commitment to excellence and virtue, are essential for the quality of human life. Focal things have a commanding presence and a centering power (Fallman, 2010). For Borgmann, the irony of technology and the device paradigm is that as technology promises to unburden our lives, we can become captive to this promise, and come to believe the good life is dependent on technology (Fallman, 2011; Kaplan, 2009b). However, technology remains silent as to what constitutes a fulfilling human life (Kaplan, 2009b).

Borgmann considered Heidegger's contention that technology can limit human openness to important existential concerns, but held that a reform of technology can discover technological sources of strength that will proceed from focal things (Borgmann, 2009). Borgmann concluded that technology, although not a focal thing and practice in itself, can be utilized intelligently and selectively to benefit the good life (Borgmann, 2009). In interpreting Borgmann, Ermer (2009) wrote that technologies which best facilitate focal things should be favored. Although it can be a challenge for professionals to master technical information in their field, and technical mastery is concerned with means rather than the ultimate ends of life, Borgmann held that technology can be pursued in a way that focal things and practices are kept at the center of our lives (Borgmann, 2009).

Westera (2004) discussed that Borgmann's thought can provide insights for understanding the philosophical aspects of innovative educational technology. Heidegger's view of the essence of technology as standing-reserve underscored how things and people are perceived as available resources to be used (Heidegger, 2009). However, Borgmann's philosophy places more importance on involvement than availability, and focal things are characterized by a high degree of involvement including discipline, perseverance, and the concentrated mastery of skills (Westera, 2004). In applying Borgmann's thought to education and educational technology, Westera (2004) stated that learning itself is a focal practice that requires a level of involvement by students characterized by motivation, self-reliance, and responsibility. Educational technology can promote the active involvement and motivation of students through active manipulation of objects, participation in games, simulations, and communities, and preferences defined by the individual user (Westera, 2004). Westera (2004) held that an advantage of Borgmann's thought for understanding innovative educational technology is that Borgmann's theory of technology cautiously combines elements of technological optimism, with a recognition that technology can cause alienation or detachment from important existential concerns.

In her philosophical discussion of pervasive computing, Michelfelder (2010) interpreted Borgmann by stating that the technologies associated with pervasive computing are designed to transparently recede into the background of the daily contexts in which we use the technologies. However, Borgmann emphasized that critical reflection is needed to bring to the forefront how ubiquitous digital technologies shape our lives (Michelfelder, 2010). Michelfelder (2010) argued that such philosophical reflection about pervasive technology is important in order to preserve the moral good of personal privacy, and maintain existential autonomy so that we do not lose control over our personal information.

Critique of Technological Determinism

Questioning technological determinism. Misa (2009) argued that technological determinism is a scholarly and practical problem that has merited philosophical reflection and critique for decades. What follows is a critique of technological determinism that considers different accounts and interpretations of technological determinism, and examines their adequacy as purported theories for explaining the interconnections between technology and society. As presented previously in the Introduction, technological determinism is the ideological viewpoint that sees technology as an autonomous causal agent and force driving inevitable change in society (Kanuka, 2008; Leonardi, 2008; Marx & Smith, 1994; Smith, 1994). The critique will critically examine the assumptions implicitly held in the technological determinist perspective, which include technology operating according to its own internal logic (Strobel & Tillberg-Webb, 2009), in an inevitable manner (Instone, 2004; Leonardi, 2008) as an autonomous force outside of social control (Feenberg, 2010; Leonardi, 2009). The critique will contrast the differences between hard technological determinism, which sees technology acting as a singularly autonomous agent, and soft technological determinism, which asserts that technology drives social change, but does so along with a complex interaction of social factors (Marx & Smith, 1994). Above all, a crucial issue for inquiry concerns the relationship between human agency and technological development and implementation, and the responsibility that human beings have for technology in society and education (Hofmann, 2006; Kritt & Winegar, 2010).

Few people admit to being proponents of the technological determinist philosophical viewpoint, and the label of technological determinism tends to have negative connotations (Kanuka, 2008). The characterization of technological determinism in the literature often uses highly critical terms. For example, technological determinism has been described as a misconception (Aibar, 2010; Pearson & Young, 2002), a myth (Buckingham, 2006; Burnett, Senker & Walker, 2008; Friesen, 2008), and a fallacy (Friesen, 2008). Even the futurist David Thornburg, in a forward to the book *Windows on the Future: Education in the Age of Technology*, published at the dawn of the twenty-first century, stated that he was not a believer in technological determinism (McCain & Jukes, 2001). After asserting the primary importance of transforming our systems of education, Thornburg clarified his position that how technology is used is more important than if it is used. In pondering technology now in the twenty-first century, the doctoral researcher is reminded from a dusty book how Saettler (1968) cautioned decades ago against the tendency to be preoccupied with technological devices, rather than on instructional content and the differences of individual learners.

Rhetoric of technological determinism. Integrating technology into instruction offers advantages for teaching and learning, but a shift is taking place in education that moves beyond technology integration, to place emphasis on a broader agenda concerned with transforming schools (Schrum & Levin, 2009; Zucker, 2009). Gaining traction in contemporary education are efforts to transform schools through technology in order to emphasize instruction in 21st century skills (Schrum & Levin, 2009; Zucker, 2009). In arguing that our current educational systems are not adequately preparing students for their future, Schrum and Levin (2009) seemed to echo the conventional wisdom when they wrote, "We know life will be different for our students . . . given the pace of change in a technologically driven world" (p. 7). That we should prepare students for the information age economy is by and large an unquestioned premise (Carr-Chellman, 2005). A case can be made based on research evidence that economic growth is closely connected with the digital economy, and that this requires policy makers to help ensure that all citizens are prepared with the skills to benefit from the digital economy (Atkinson & McKay, 2007). However, the ontological assertion posed by Schrum and Levin (2009) can be challenged. Does technology indeed drive our world?

The introduction of new technologies has long been accompanied by rhetorical promises and hype that it will transform education (Canole, 2007). Selwyn (2010b) observed that optimistic rhetoric concerning instructional technology has been a characteristic feature of educational technology scholarship for over two decades. Selwyn (2010b) argued that a type of "cognitive dissonance" pervades the educational technology literature because the transformation of education by technology is something that has long been eagerly anticipated, although methods of teaching and learning resist change (p. 66).

Fisher (2006) examined discourse and rhetoric about educational transformation, and observed a tendency for discourse to be framed in language that had characteristics of technological determinism. He observed this in the hyperbole in advertising from technology vendors, in the official discourse in educational policy documents, and in public comments by education officials. Fisher noted that the meaning of transformation is broader than what is meant simply by the word change, and observed that the word carries connotations in education of change for the better. He asserted that frequently discourse about transformation in education involves the use of new technologies, but argued for the necessity of critically examining this discourse to avoid technological determinist thinking or assumptions of techno-utopianism.

Selwyn (2010b) asserted that educational technology research should move beyond a view focused on aligning mind and machine. Fisher (2006) held that technology is not a silver bullet for educational problems, and technological determinist language creates a climate of expectation that can be disappointing. In arguing for the importance of digital equity, Gorski (2008) asserted that a deeper scholarship is needed that critiques notions of technological determinism, and distinguishes between technological progress and humanistic progress. Technological progress does not necessarily lead to social or humanistic progress (Gorski, 2009).

It would come as no surprise if technological determinist assumptions influence the thinking of educators, because scholars have argued that technological determinism is a prevalent viewpoint that persists in popular culture (Best, 2009; Burnett, Senker & Walker, 2008; Carr-Chellman, 2006; Friesen, 2008; Leonardi, 2008; Lievrouw, 2006; Selwyn, 2010b; Wyatt, 2008; Yang, 2009). Morozov (2009) argued that utopian views about technology, proceeding from the technological determinist assumption that it will inevitably cause the spread of democracy around the world, have been prevalent even in statements by sober analysts, and U.S. presidents such as Bill Clinton and George W. Bush. Friedman (2009) examined American media coverage of the 2009 Iranian presidential election, and the ensuing protests in Iran disputing the results, and concluded that the American media rhetoric about Twitter and social networking was influenced by technological determinism. Friedman (2009) argued that although the media attention inspired Americans to become more interested in the Iranian struggle, the media discourse was influenced by the perception that utopian social transformation would inevitably occur through technology. In contrast with the technological determinist rhetoric of Western media, international observers concluded that a broad-based grassroots movement drove the Iranian protests more so than social networking technologies causing inevitable change (Friedman, 2009). The media discourse of technological determinism minimized the role of the human agents in the complex social struggle, while exaggerating the effects of social media (Friedman, 2009).

Media discourse influenced by popular perceptions of technological determinism can also be associated with educational technology initiatives. Using critical hermeneutic analysis and content analysis techniques, Cukier et al. (2009) examined media discourse surrounding an instructional technology initiative at Acadia University in Canada, called the Acadia Advantage. The initiative involved a university funded student laptop initiative through a partnership with IBM, and received much media attention (Cukier et al., 2009). Cukier et al. (2009) found that hyperbole evoking a technological determinist viewpoint was present in both academic and non-academic literature. Rhetoric of the technological imperative was a dominant metaphor that distorted discourse by making positive claims for the technology initiative that were ill supported by evidence (Cukier et al., 2009). Technological determinist rhetoric tended to marginalize dissenting opinions by portraying the technology initiative as inevitable (Cukier et al., 2009).

Rhetoric of the technological imperative and globalization. Clegg et al. (2003) critically examined higher education policy documents in the United Kingdom, and found that the dominant discourse was characterized by technological determinism along with a passive acceptance of the premise that globalization is inevitable. Dramatic growth in technology has occurred in the context of a global economy in which Western nations shift from a manufacturing to a service-based economy, while nations in the East experience rapid economic growth (Collarbone, 2009). Fueled by a revolution in information and communication technologies, globalization has created new expectations, challenges, and opportunities for education, and has been a powerful force of change for education (Fullan & Scott, 2009; Striano, 2009). Enhancing workplace performance requires an adaptable workforce so that companies can better respond to global competition (Collarbone, 2009), and education has a central role to play in a nation's strategic efforts to compete in a rapidly changing knowledge-based economy (Wedell, 2009). Globalization creates pressures for educational organizations to introduce e-learning strategies (MacKeogh & Fox, 2009; Selwyn, 2010a). E-learning can expand educational opportunities for students, improve retention rates, and improve the life chances for graduates, and in light of these benefits there can even be a moral imperative to embrace change (Scott, Coates, & Anderson, 2008). However, the imperative for schools to pursue educational technology because of the global economy can be problematic, because concerns shift to maximizing a nation's economic performance, rather than realizing the potential of what technology offers for teaching and learning (Selwyn, 2010a). Discourse dominated by globalization and technological determinism can create anxiety and place pressure on individuals and organizations to uncritically pursue technological change or be left behind (Clegg et al., 2003).

Ideas about the inevitability of technology and its capacity to create a utopian world can be tantalizing. The founder of Wired magazine, Kevin Kelly, proposed a theory of technology in society which he termed the technium, that presents a vision of technology as an evolving super organism driven by the collective imagination, with technological change as inevitable, and mostly tending toward a utopian world (Edward, 2010; Pollock, 2010). Assumptions of technology as inevitable are present in the rhetoric used to explain the function of early and late adopters in the inevitable diffusion of technological progress through society (Instone, 2004).

The view of the autonomous development of technology as being inevitable and unstoppable has been described as the technological imperative (Chandler, 1995; Cukier et al., 2009; Hofmann, 2006; Leonardi, 2008; Martin, 2008; Poser, 2009). The technological imperative may seem reasonable from an historical perspective. Technological progress has relentlessly marched forward over the decades, and even technology pioneers have underestimated the pace of technological change (Selwyn, 2010a; Selwyn, 2010b). Bill Gates at one point dismissed the Internet as "a passing fad" (Selwyn, 2010a, p. 32). Educational technology professionals tend to focus eagerly on the next wave of technological development, while hesitating to reflect critically on the appropriate role for present technologies, and becoming forgetful of past technologies that have come and gone (Selwyn, 2010a).

The technological imperative assumes that if a technology can be developed it ought to be developed, and will be developed, without regard for ethical considerations or making value judgments about the technology (Martin, 2008; Poser, 2009). The technological imperative assumes that once technological development is inevitably underway, users should learn to cope with it (Chandler, 1995) because they cannot help but use technology (Leonardi, 2008) and must keep up or be left behind (Strobel & Tillberg-Webb, 2009). Beliefs about the inevitability of technology may affect behavior, and individuals faced with an uncertain future may treat technology as if it were inevitable for cognitive relief (Leonardi, 2008). The previous section in the Literature Review entitled Importance of Examining Philosophy of Technology Assumptions discussed empirical research on the impact of technological determinist assumptions on organizational management. An important theme arising from management studies research concerns the power of technological determinist rhetoric to persuade others, especially when used by leaders or officials (Fisher, 2006; Grant et al., 2006; Leonardi & Jackson, 2004; Leonardi, 2008).

Educational technologists and academic research influenced by the technological imperative generally proceeds from the assumption that technology will inevitably change education for the better (Selwyn, 2010b). However, technology is often viewed as a force operating outside of education, with education lagging behind as a late adopter (Instone, 2004). Instone (2004) argued that from a cause and effect standpoint, technological change does not necessarily transform education and bring improvement, and it is important to recognize that things and events can turn out differently in the course of technological change.

In the section above concerning the importance of examining philosophy of technology assumptions, Heidegger's theory was discussed that the essence of technology involves a technological understanding of being that upholds efficiency for its own sake (Dreyfus, 2009). Although Heidegger saw danger in the domination of technology (Dreyfus, 2009), he argued the essence of technology does not equate to a technological imperative (Heidegger, 2009). For Heidegger, technology may be our destiny, but it is not an inevitable fate that compels us to obey it (Dreyfus, 2009; Heidegger, 2009). There can be a saving power when we get into a right relation to technology, neither rejecting technology, nor seeing technological efficiency as an imperative, but maintaining a comportment toward technology that remains open to meaning that would otherwise be hidden (Dreyfus, 2009; Heidegger, 2009).

Rhetoric of inevitability and the importance of practical wisdom. Rhetoric of the inevitability of technological development and globalization may pose a threat to education by obscuring successful continuity of practice (Clegg et al., 2003). Such rhetoric does not adequately take into account how educators can be guided by practical wisdom and good pedagogy in shaping the implementation of innovative technology, or in envisioning instructional alternatives (Clegg et al., 2003). Halverson (2002) explored how practical wisdom, or phronesis, in the Aristotelian sense, can guide school technology leaders in integrating innovative multimedia technology. Phronesis can be understood in terms of the wisdom, based on good judgment and guided by a sense of a higher good, that is a key attribute required for leaders in showing the way and guiding others, and advancing the common good (Adair, 2005; Halverson, 2002). Lally et al. (2010) argued that research on digital technology should proceed from the standpoint of phronesis, with a focus on ethically informed practical reasoning. Lally et al. (2010) reasoned that by examining the ethical dimensions associated with digital technology, researchers and educators can better promote a disciplined and ethically informed conversation about technology enhanced learning (Lally et al., 2010). The study's theoretical framework will leverage ethical considerations integral to educational technology that were defined in national standards for school technology leaders (Consortium for School Networking, 2011).

Dichotomy of techno-utopianism and Luddism. Scholars have observed a tendency in education to categorize general attitudes about technology into one of two diametrically opposed ideological camps, described as techno-utopianism and Luddism (Buckingham, 2006; Kritt & Winegar, 2010; Selwyn, 2011; Strobel & Tillberg-Webb, 2009). The technological utopian camp presents technology innovation as inevitable and always for the better, while the Luddite camp is not open to technological innovation, or resists adopting new technologies (Kritt & Winegar, 2010; Strobel & Tillberg-Webb, 2009). While recognizing that fundamental differences in values exist concerning technology, Kritt and Winegar (2010) emphasized that categorizing views about educational technology into these two extreme categories presents a false dichotomy that limits possibilities, and does not represent the true range of alternative views.

Strobel and Tillberg-Webb (2009) similarly argued that it is a false dichotomy to assume that unless one subscribes to the technological utopian view, one is essentially a Luddite. They held that educators, researchers, instructional designers, and policy makers should critique their own beliefs and assumptions about technology, and engage in critical dialogue with other educators and students concerning such beliefs (Strobel & Tillberg-Webb, 2009). Strobel and Tillberg-Webb (2009) proposed that an authentic, humanizing framework for instructional technology integration would consider broader social and cultural issues, and focus on human learners and larger educational goals. Kritt and Winegar (2010) also emphasized the importance of a nuanced examination of the issues involved in the adoption of technology, and asserted that technology momentum does not equate to specific technologies being inevitable. Deeper dialogue about technology would move beyond stereotypes, recognize cultural and moral dimensions, and assess the positive benefits of technology while identifying potential problems (Kritt & Winegar, 2010).

Buckingham (2006) examined the impact of new media on the lives of children, and contrasted the view that technology holds great promise for the future, with the opposite view focused on the risks of technology for children and the anxieties that this provokes. Buckingham described the dichotomous views as parallel mythologies, and wrote: "On the one hand, children are seen to possess a natural, spontaneous creativity, which is somehow (perhaps paradoxically) released by the machine; while on the other, children are seen as vulnerable, innocent and in need of protection" (p. 2). While Buckingham stated that such parallel mythologies may overstate the situation, he emphasized that the contrasting viewpoints challenge parents and others concerned with the welfare of children to face the complex dilemmas introduced by new media. He emphasized that we must move beyond just providing children with technology, and naïve optimism about its potential, to engage in a deeper dialogue, and better distinguish the educational benefits of technology vs. their entertainment value. Buckingham (2006) asserted that school policy makers should better recognize the social contexts in which students encounter digital media, rethink the contexts in schools in which technology is used, and provide better support and education to students so their interaction with technology is more productive.

It is interesting that views characterized by both optimism and pessimism about technology have been associated with technological determinist assumptions, by seeing technology as the cause of change, whether good or bad (M. Oliver, 2011). De Vaney (1998) asserted that whether technology is treated as having heroic power to rescue beleaguered students and save educational institutions, or something villainous that will corrupt the morals of students, the mythological assumption is that the machine has causal powers that limit the agency of human beings. Kanuka (2008) asserted that both instructional technology advocates and opponents have beliefs influenced by technological determinist assumptions and the idea that the effects of technological change are inevitable.

In the previous discussion of Foundations in Philosophy of Technology, it was stated that an advantage of Borgmann's theory of technology is that it combines elements of technological optimism, with a recognition that technology can cause alienation or detachment from existential concerns of life (Westera, 2004). In contrast with philosophers such as Marcel, Ellul, and Jonas who tended to focus on a pessimistic view of technology (Ellul; 2010; Jonas, 2009; Jonas, 2010; Treanor, 2010), Borgmann recognized that technology has provided relief from some of the drudgery, misery, and toil that was characteristic of pre-technological life (Borgmann, 2009). Borgmann also held that technology can be pursued in a way that focal things and practices are kept at the center of our lives (Borgmann, 2009). In applying Borgmann's thought to educational technology, Westera (2004) stated that innovative technology can promote the active involvement and motivation of students through active manipulation of objects, participation in games, simulations, and communities, and preferences defined by the individual user (Westera, 2004).

Theoretical explanations of technological determinism. Various accounts and theories have been proposed to explain the degree to which technology is purported to drive society and history. The debate sometimes focuses on whether or not autonomy can imputed to technology itself, independent of social constraints, or whether technology's agency occurs within a complex interaction of social factors (Marx & Smith, 1994; Smith, 1994). One framework that has been proposed involves the categories of hard and soft determinism (Marx & Smith, 1994; Strobel & Tillberg-Webb, 2009).

Hard and soft technological determinism. The perspective of hard technological determinism attributes agency to technology itself (Marx & Smith, 1994) to the extent that technology has a determined and dominant autonomy of its own to cause social change, independent of social constraints (Smith, 1994; Strobel & Tillberg-Webb, 2009). The view of soft technological determinism also asserts that technology drives social change (Smith, 1994), but sees technology as one influence among others, occurring alongside a complex interaction of social, economic, political, and cultural factors (Marx & Smith, 1994; Strobel & Tillberg-Webb, 2009). Even if hard technological determinism is rejected such that technology is not imputed to act as an autonomous agent, the soft technological determinist view that emphasizes that technological power is a secondary change agent still presents a dilemma for human responsibility. If technology operates with any determinative efficacy, driving historical events and society, this limits free human agency (Marx & Smith, 1994; Kritt & Winegar, 2010). Any claim that we do not control technology, but are controlled by it is a renunciation of human responsibility for technology (Hofmann, 2006; Slack & Wise, 2006; Wyatt, 2008).

Bimber's conceptual framework for technological determinism. Bimber (1994) argued that the term technological determinism had been utilized in the literature in imprecise ways to explain the impact of technology on history, and he proposed an alternate conceptual framework made up of three categories. Bimber's nomological account of technological determinism makes an ontological claim about technology, and is an interpretation of hard technological determinism. The nomological account sees technology acting as the primary cause of social change according to the laws of nature, with technology exercising causal influence, and one development leading inevitably to another (Bimber, 1994; Wyatt, 2008). According to the nomological account, technology is autonomous and develops according to science and the internal developmental laws of technology, independent of the social context (Vermaas, 2011).

Bimber's normative account of technological determinism is different in that rather than making a strictly ontological claim about the impact of technology on society, the account is primarily concerned with cultural matters and human attitudes (Bimber, 1994). Bimber (1994) asserted that the normative account is the most common interpretation of technological determinism. The normative account holds that if the norms of practice or attitudes of those who create and employ technology become disconnected from broader ethical criteria, accountability to society, or consideration of means and ends, technology can be understood to have a dominance or autonomy over society (Bimber, 1994; Wyatt, 2008). In the normative account of technological determinism, technological norms such as function and efficiency take precedence over other values such as ethical or social norms (Vermaas, 2011).

Thirdly, the unintended consequences interpretation according to the Bimber framework observes that technology causes inadvertent consequences that were not intended or anticipated (Bimber, 1994; Vermaas, 2011). The unintended consequences view holds that technology is partially autonomous, because even when human decision makers willfully approach technology in deliberate and responsible ways, technology causes inadvertent consequences that we did not predict and cannot control (Bimber, 1994; Vermaas, 2011). Scholars have observed that the implementation of technology can result in unforeseen consequences and risks that were not originally intended (Canole, 2007; Jonas, 2009; Nel, 2006; Vermaas, 2011).

As it relates to education the unintended consequences view can provide insights pertaining to technology integration in schools. Nworie and Haughton (2008) examined the adoption and implementation of innovative technology for both traditional face-to-face instruction and virtual learning environments, and described the instructional benefits, challenges, and unintended consequences of digital innovations. The researchers concluded that along with the instructional merits afforded by technology there can be unintended consequences such as ease of cheating, and distractions from learning such as games, inappropriate content, and off task web surfing (Nworie & Haughton, 2008). Educators should be aware of the possibility that instructional disparities can widen for students who are without sufficient access to technology at home (Nworie & Haughton, 2008). The possibility of unintended consequences underscores the importance that educators and technology leaders should pause for considered judgment, and approach technology integration in a reflective way (Canole, 2007).

In his analysis of these three interpretations of what is often meant by technological determinism, Bimber (1994) argued that the term technological determinism should be reserved for the nomological account. Bimber (1994) asserted that only this view makes the strict claim that technology causes social change in a determined way, apart from any social context. However, Bimber's conclusion misses the nuances of technological determinism present in other interpretations. For example, beyond the question of strict causality, Slack and Wise (2006) emphasized that regardless of actual cause and effect, our attitudes toward technology are important. Slack and Wise (2006) considered the question of whether, if we become so dependent on our technology tools, we create a "de facto technological determinism" (p. 2). Day (2010) discussed how our predictions of technological futures can become real, and a self-fulfilling prophecy, if we believe them to be true.

Braman (2004) described different classes of technology and their characteristics, and examined how technologies are introduced and begin to come into wider use. She took a position midway between technological determinism and social shaping of technology. Braman asserted that technology has structural effects on both society and the individual, but also stated that society and policy makers determine how technologies will be used. After illustrating different types of technology systems, including stand-alone and embedded systems, she suggested that while technologies shape our world, in actuality there is not a strict technological determinism. Rather, the philosophical differences that exist indicate differences in attitude toward technology. Braman (2004) goes on to explain that these differences matter from a policy making standpoint because the different positions affect perception of risks and opportunities.

Technology, and human agency and responsibility. The technological determinist position ascribes agency to technology, rather than to educators, and Fisher (2006) was concerned that this perspective shortchanges the hard work that educators must undertake to improve and transform education. He argued against technological determinism, and for keeping the emphasis in educational change on the human agents involved, supported by technological tools (Fisher, 2006). Wyatt (2008) held that technological determinism presents a dilemma for human responsibility, and asserted that perceiving autonomy in technology leaves little room for human decision making, and "absolves us from responsibility for the technologies we make and use" (p. 169). Kritt and Winegar (2010) also argued for the importance of human agency shaping educational technology, rather than seeing technology development as occurring in an inevitable and determined way.

Slack and Wise studied (2006) the relationship between technology and culture, while discussing issues pertaining to agency, causality, and human responsibility. They reviewed the literature concerning the question of whether technology as a thing in itself can be said to have a type of agency apart from human agency. They concluded that there is a risk to seeing agency in technology because this undermines human responsibility.

Hofmann (2006) conducted an axiological study to consider the connection between technology and values. He investigated the view that we are subject to a technological imperative, with inevitable technology exercising a controlling influence over society. Hofmann's research supports the conclusion that the technological imperative is a myth that can negatively impact ethical decision making and responsibility. Hofmann argued that the deterministic logic of the technological imperative undermines human responsibility ethical accountability. If human society is driven by the inevitability of technology, such logic implies we are not fully in control of technology, and we can only be held to account for actions and situations we can actually do something about (Hofmann, 2006).

Scholars have observed that the technological imperative implies the suspension of ethical judgment, with technology in control and becoming an end it itself (Chandler, 1995; Ellul, 2010; Hofmann, 2006; Martin, 2008). Ellul (2010) argued that technology has an autonomy that distorts the purposeful ends that are proposed for it, and that man is at risk of being a servant to technology. Similarly, Hofmann (2006) accepted that technology does change our environment, actions, and ideas. However, the technological imperative can consider the pursuit of technology as an end in itself, to such an extent, that we continually adapt our lives to technology (Hofmann, 2006). Hofmann (2006) argued that such a mindset is problematic because technology was intended to be a means to improve life and provide greater freedom. He asserted that technology as an end in itself results in a type of technological enslavement, and called the technological imperative a reverse adaptation that results in the reduction of human autonomy and responsibility (Hofmann, 2006). Hofmann (2006) argued that a proper focus must remain on human responsibility, with technology as a means to achieve other external ends that benefit humanity, rather than viewing technology as an end in itself (Hofmann, 2006).

Technology as value neutral or value laden. Associated with technological determinism is the premise that technology is a neutral tool for storing, processing, and accessing information that is outside of cultural or personal critique (Amiel & Reeves, 2008; Robinson & McKnight, 2007). In the previous discussion of Foundations in Philosophy of Technology, it was discussed that the neutrality thesis is associated with the popular instrumental view of technology. The instrumental view considers technology as a means to an end (Berger, 2011; Feenberg, 1991; Heidegger, 2009), as value neutral instruments, neither good nor bad in themselves, which are put to use by users as a means for their own purposeful ends (Franssen et al., 2009).

The neutrality assumption tends towards a dismissal of the social, ethical, and philosophical implications of technology, and focuses on data or information, rather than knowledge or wisdom, and technical skills rather than citizenship (Robinson &

McKnight, 2007). Hofmann (2006) argued that viewing technology as value neutral is a fallacy, because a proper teleological view of the nature of technology would place emphasis on ultimate ends that are supported through means such as technology. Because the ends of technology can have an ethical character, we should understand that technology raises value questions and makes them topical (Hofmann, 2006). A problem with the instrumental view with regard to educational technology is that seeing technology as value neutral may interfere with discerning how technologies raise ethical considerations, and we may fail to recognize how some technology decisions can be value laden (Amiel & Reeves, 2008; Consortium for School Networking, 2011; Hofmann, 2006; Lowrance, 2010). Technological determinist assumptions can influence educators not to question the philosophical or ethical issues involved with how technology affects our perceptions and engagements with the world (Robinson & McKnight, 2007).

Fisher (2006) held that technological determinism is inadequate as a theory of technology for education. He observed the necessity for a more complete framework to explain the connection between society and technology, while accounting for the importance of technology, and recognizing the complex interplay of social factors that impact the use of technology. The ensuing discussion on social shaping of technology (SST) will examine another theory of technology that stands opposed to technological determinism (Lievrouw, 2006).

Critique of Social Determinism

Contrast to the technological determinist position. The section on Theoretical Framework in Chapter 1 explained that the dissertation study leverages the critical and humanizing framework for educational technology proposed by Strobel and Tillberg-Webb (2009). Strobel and Tillberg-Webb (2009) emphasized as a starting point the questioning of how assumptions about technology may correspond to perspectives on the opposing sides of the scholarly debate between technological determinism and social determinism. The previous section presented a critique of technological determinism. The technological determinist position holds that technology drives inevitable change in society (Leonardi, 2008), and is the fundamental force for social change (Strobel & Tillberg-Webb, 2009). The competing perspective of social determinism emphasizes that technologies evolve and develop through being shaped by social processes, with the technologies fundamentally embedded in social systems (Kanuka, 2008; Strobel & Tillberg-Webb, 2009). How (2010) explained that determinism is about effects and causality, and stated technological determinism and social determinism are opposing positions that either posit technology as the cause of social change, or social factors as the cause of technological change.

Social shaping of technology. In reaction to technological determinism, scholarly work has turned to investigating the interactions between technology and society (Yang, 2009). Rather than accept that technology develops according to its own technical logic, scholars opposed to the technological determinist position have turned to examining the social processes involved in technological innovation (Williams & Edge, 1996). In the literature, besides the term social determinism, terms such as social shaping of technology (SST) or social construction of technology (SCOT) have also been used (M. Oliver, 2011; Williams & Edge, 1996). SST and SCOT have generally been taken to be equivalent (Williams & Edge, 1996), and this position emphasizes how technological artifacts are shaped or constructed in social settings, with no specific technological outcome being inevitable (Smith, 2006; Williams & Edge, 1996). SST rejects the premise that technology is value neutral or has its own autonomy, and emphasizes human decision making and action, and the need to formulate policies to guide technology development so that the benefits of technology are more humanistic (Lievrouw, 2006).

Pedersen (2001) considered the question of technological determinism within education and whether technology has internal logic of its own. Petersen (2001) discussed that the SST position sees technology as being shaped by interplay of social, cultural, and historical factors, and pointed out how social forces and groups outside of education, including vendors and public officials, are influential in advocating for technology. Fisher (2006) examined the social shaping of technology, and asserted that many dynamics shape technology, including science, technology, economics, and the state as a social institution. However, M. Oliver (2011) asserted that research from a SCOT perspective is mostly absent from instructional technology literature.

Slack and Wise (2006) considered a range of issues concerned with technology and society, including whether or not technology drives social change, the question of human dependence on technology, and the connection between technology and values. Slack and Wise (2006) held that technological determinism and the position that technology is value neutral should be rejected, and stated we are not slaves to technology. Pedersen (2001) suggested that moving away from technological determinism to a socially constructed view of technology would promote a broader public debate on the role of technology in education. Pedersen (2001) asserted that technology is neither good, bad, or neutral but can have both good and bad consequences, including some unintended.

Weaknesses of social determinism. A dilemma for the social shaping of technology perspective is that a recognition of unintended consequences of technology means addressing a phenomenon that can be considered an account of technological determinism (Bimber, 1994; Pedersen, 2001). While focusing on the social construction of technology, the social shaping view may downplay the real impact that technologies may have in shaping practice (M. Oliver, 2011). Wyatt (2008) asserted that assumptions of technological determinism continue to persist because a majority of people recognize that technology has a significant impact on society. People see the perspective of technological determinism as a common sense way to understand the relationship between technology and society (Wyatt, 2008). Wyatt (2008) argued that among those who study science, technology, and society, many researchers still harbor technological determinist assumptions, and this influences researchers in their investigations. Researchers may need to take the influence of technological determinism more seriously, given that the perspective can be used by decision makers to justify their actions with respect to technology (Wyatt, 2008).

While technological determinism stresses the impact of technology on society, but neglects how society shapes technology (Kanuka, 2008), SCOT has been criticized for replacing technological determinism with social determinism (M. Oliver, 2011). In maintaining that technological artifacts are socially constructed, there can be a neglect of user control (Kanuka, 2008). By overly focusing on larger social contexts, a social determinist perspective can miss how individual users in social settings such as schools exercise personal choices and control over technology (Kanuka, 2008).

A social determinist perspective can also neglect how technology may present material limits (Kanuka, 2008). Jordan (2009) argued that the problem of computer hacking points to a mutually determinative relationship between technology and society. Jordan (2009) asserted that the activities of computer hackers place serious material limits on technology that constrain how it can be used. In a sociological analysis of innovation from the SST perspective, Weber (2009) observed that technical artifacts and technology infrastructure impose constraints on how society can shape technology and these constraints limit its diffusion. From an SST perspective, although technological change is generally open to shaping, an honest phenomenological examination of technological change must recognize that innovation tends to follow certain conduits and trajectories (Weber, 2009). Attempts by SST researchers to explain these trajectories of technological change and innovation have tended to have technological determinist characteristics, and have emphasized broader technology trends (Weber, 2009).

In exploring paradoxical issues connected with the future of digital learning, Warschauer (2007) discussed several controversial issues, while taking into account the social factors that shape and transform educational systems. Warschauer considered whether there are legitimately new forms of literacy related to the use of information technology or multimedia, whether students in the twenty-first century will require more autonomy in their learning, and whether learning should involve different settings apart from the traditional school. Warschauer held that social and economic factors work in conjunction with technology to transform instruction, but that technology cannot transform learning by itself.

The dichotomy between technological determinism and social determinism. Warschauer concluded that neither technological determinism, nor an instrumental SST focus that views technology simply as tools to be shaped by purposeful human users, can account for the dynamic interactions that take place between society, human agents, and technology. Flyberbom (2005) critiqued the dichotomy of technological determinism vs. social construction of technology in order to consider whether it is reasonable to conclude that either technology impacts society or society shapes technology. Flyberbom (2005) held that the dichotomy is too simplistic, and that in order to meet the challenge of shaping effective policy for an information-based society, neither position is sufficient for a comprehensive framework or policy. From his critique, Flyberbom concluded that the two theories view their research objects in different ways, with technological determinists focusing on material aspects, and SST concerning themselves with the relationship between technology and society (Flyberbom, 2005). In order to help move beyond the dichotomy, Flyberbom proposed keeping the categories of technology and society, and while not viewing technologies as agents, he recognized how in a passive way technologies can facilitate and constrain social forces (Flyberbom, 2005).

How (2010) stated that intermediate positions are possible between the technological determinist and social determinist perspectives, and that technology and society might be viewed as inseparable. However, Bromley (1997), in accepting neither technological determinism nor social determinism, asserted that because of its unforeseen consequences on society, technology should be taken seriously as an independent factor.

Smith (2006) took a more nuanced view when considering the dichotomy between technological determinism and social shaping of technology, and did not dismiss a causal role for technology in affecting social change. Concerning the debate between technological determinism and social shaping of technology, Smith stated that researchers tend to recognize that both the social and technological have influence (Smith, 2006). Smith (2006) saw the debate between these two viewpoints as presenting a dichotomy that cannot be overcome without rethinking philosophical assumptions, and offered critical realism as a possible framework. He argued that theory-practice inconsistencies have plagued information systems and technology research, and asserted that philosophical assumptions are sometimes uncritically held by researchers. Smith asserted that in the final analysis, the debate is about ontological assumptions, and called for the reconsideration of ontological premises in technology research and practice.

Uses determinism. Another philosophy of technology position that challenges technological determinism involves uses determinism, which emphasizes how users employ technology as tools, with the user controlling the tool, rather than the tool controlling how it is used (Kanuka, 2008). This position is related to the instrumental view of technology that emphasizes viewing technology as tools and instruments for solving problems (Leidlmair, 1999), with technological tools as a means to an end (Berger, 2011; Feenberg, 1991; Heidegger, 2009). Uses determinism has one similarity with technological determinism in that there is a focus on viewing technology as neutral tools, neither good nor bad, but serving whatever objectives or ends for which they're utilized (Kanuka, 2008). Unlike technological determinism, the position emphasizes user control and autonomy over their technological tools. However, in emphasizing the agency of individual users of technology, uses determinism largely ignores the larger social contexts that shape technologies, and like the social determinist perspective, may also underestimate how technology can impact users (Kanuka, 2008).

Treating technologies as neutral tools can mean a narrow engineering focus that emphasizes technical matters, with engineers approaching technological development in such a neutral way that technology becomes separate from broader human interests (Leidlmair, 1999). The manner in which uses determinism and the instrumental view treats technology as neutral tools can be ethically problematic, because technologies raise ethical issues and educational technology decisions can be value laden (Consortium for School Networking, 2011; Hofmann, 2006; Lowrance, 2010). Berger (2011) wrote the logic of the instrumental view of technology implies, because technology is value neutral, and oriented toward being a means to end, that employing it to solve any problem becomes the only rationale stance, regardless of the cost. However, as noted earlier in the section on Foundations in Philosophy of Technology, scholars such as Ellul (2010) have argued that we can use technology in a way that distorts the ends intended for it, with technology becoming an end in itself.

Summary

Using Corbin and Strauss methods for qualitative data analysis, the purpose of the qualitative study was to a) examine what philosophical assumptions about technology are present in the thinking of K-12 technology leaders, b) investigate how the assumptions may influence technology decision making, and c) explore whether technological determinist assumptions are present. The literature review explores reasons why educators charged with responsibilities for technology leadership need to critically question philosophical assumptions about technology, and focus on human agency and moral sensitivity (Kritt & Winegar, 2010; M. Oliver, 2011; Strobel & Tillberg-Webb, 2009). In their critical and humanizing framework for educational technology, Strobel and Tillberg-Webb (2009) emphasized as a starting point the questioning of how assumptions about technology may correspond to perspectives on the opposing sides of the scholarly debate between technological determinism and social determinism. After a discussion of important foundations in the philosophy of technology, the review analyzes and synthesizes the published body of literature pertaining to the competing ideologies of technological determinism and social determinism.

The pace of technological change presents challenges for reflective leadership, and technology can result in unforeseen consequences and risks that were not intended (Canole, 2007). Technologies are value laden and decisions about them often have an ethical dimension, so educators must recognize the responsibility and control they have for technology (Hofmann, 2006). By questioning their assumptions within a humanistic framework for technology integration, and considering the ethical implications of technology (Kritt & Winegar, 2010; Strobel & Tillberg-Webb, 2009), educators are better prepared to invest limited public monies (Carr-Chellman, 2006; Kritt & Winegar, 2010) on the right technologies that best support the curriculum (Shelly et al., 2008). Strobel and Tillberg-Webb (2009) also contended that educators should critically question their own deeply ingrained ideological beliefs about technology, and be willing to assess both the positive and negative effects of technology, in order to help students achieve educational technology standards. Strobel and Tillberg-Webb (2009) reasoned that because national educational technology standards for students emphasize thinking critically about technology, educators should model for their students such questioning of technology.

The review of literature explores influential philosophy of technology theories that have been proposed to explain the nature and significance of technology, and how technology mediates and transforms human experience (Kaplan, 2009a). Among the foundational theories critiqued includes those with both a pessimistic and optimistic view toward technology. Included is an analysis and discussion of Heidegger's philosophy of technology, considered by scholars to have been the most influential theory (Kaplan, 2009b; Lewin, 2010). For Heidegger, technology is a mode of ontological revealing that can unveil dimensions of the world that were previously hidden, while blocking other ways of revealing existence (Heidegger, 2009; Sabatino, 2007). Heidegger held that modern technology has a tendency to frame our relations with things and with human beings in a one-dimensional way with everything viewed as resources available to us (Introna, 2011). However, Heidegger held out the possibility that instead of mankind being caught up in a technological way of being, if we reflect on the essence of technology, we can bring forth a saving power and gain a free relation to technology (Heidegger, 2009; Dreyfus, 2009).

The exploration of foundations in the philosophy of technology concludes by covering the thought of Borgmann, whose theory of technology involves a device paradigm that focuses on the usefulness of technology, with ubiquitous technological devices ready at hand to make our lives easier (Borgmann, 2009). For Borgmann, technology can provide relief from some of the drudgery characteristic of life without technology, but technological devices can also add to the clutter of our lives, and subvert the external goods for which technology is intended to be a means (Borgmann, 2009). In contrast to devices, Borgmann emphasized that focal things, such as those centered on family or professional practice, are characterized by a unity and harmony of means and ends, and of mind and body, and implore our full and engaging presence (Borgmann, 2009; Fallman, 2009; Introna, 2011). Borgmann concluded that technology, although not a focal thing and practice in itself, can be utilized intelligently and selectively to benefit focal concerns and the good life (Borgmann, 2009).

The review places special emphasis on critiquing issues connected with technological determinism and social determinism, two dominant theories and ideologies that influence scholarly debate about the relationship between technology and society (Salazar, 2005; Strobel & Tillberg-Webb, 2009). The critiques of these theories provide evidence to explain why scholars have argued that it is necessary to move beyond the theoretical dichotomy of technological determinism vs. social determinism (Fisher, 2006; Flyverbom, 2005; Salazar, 2005; Strobel & Tillberg-Webb, 2009), and why research on alternate conceptions of technology is important (M. Oliver, 2011). Ontological matters related to issues such as agency, autonomy, causality, and inevitability are inspected. Arguments that technology has its own determined autonomy are examined, in order to critique the extent to which technology can be considered to control society, events, and human action. The implications of technology having its own autonomy beyond human control are examined, and how such autonomy presents problems for human agency (Fisher, 2006; Jonas, 2010; Kritt & Winegar, 2010; Marx & Smith, 1994), and for human responsibility for technology (Hofmann, 2006; Jonas, 2009; Slack & Wise 2006; Wyatt, 2008).

Axiological questions are taken into account in order to consider human responsibility for technology while appraising its benefits and risks, and assessing whether technology is value neutral or value laden. Technologies can raise ethical questions that may test the limits of traditional ethics (Kaplan, 2009c), and the literature review explores ethical theories pertaining to technology. The critique examines the debate between techno-utopianism vs. pessimism about technology, and ways that this dichotomy can be overcome (Kritt & Winegar, 2010; Selwyn et al., 2006, Strobel & Tillberg-Webb, 2009).

The review of literature presents a critique of technological determinism using recent literature and important seminal works. The critique examines rhetoric connected with technological determinism, such as how the introduction of new technologies can be accompanied by rhetoric that it will transform education (Canole, 2007; Cukier et al., 2009; Fisher, 2006). There is also discussion of rhetoric characteristic of the technological imperative (Hofmann, 2006) that sees technology as inevitable (Leonardi, 2008) and unstoppable (Cukier et al., 2009), and creates an imperative to keep up with technological developments by keeping up or being left behind (Strobel & Tillberg-Webb, 2009).

Associated with technological determinism is a tendency in education to categorize general attitudes about technology using a dichotomy of techno-utopianism vs. a Luddite position of being opposed to technology (Kritt & Winegar, 2010; Strobel & Tillberg-Webb, 2009). The literature review discusses scholarly critiques of this dichotomy, and considers alternate ways of viewing technology in a value context. For example, Strobel and Tillberg-Webb (2009) proposed an authentic, humanizing framework for instructional technology integration that would consider broader social and cultural issues, and focus on human learners and larger educational goals.

After the critique of technological determinism, the literature review examines the competing view of social determinism, or social shaping of technology (SST). Social determinism emphasizes that technologies evolve and develop through being shaped by social processes, with the technologies fundamentally embedded in social systems (Kanuka, 2008; Strobel & Tillberg-Webb, 2009). Strengths of the social determinist perspective are examined, including how the theory posits that many social dynamics shape technology (Fisher, 2006). The shortcomings of social determinism are also addressed, and why, despite much research on the social shaping of technology, some researchers still harbor technological determinist assumptions (Wyatt, 2008).

By shedding light on the study's research problem, and laying out a survey of concepts and issues pertaining to technological determinism and social determinism, this sets the stage to be ready to analyze phenomena and data from research, and to conceptualize theory. A goal of the study was to move beyond the current theoretical dichotomy. Smith (2006) held that researchers tend to recognize that both the social and technological have influence, and saw the debate between technological determinism and social determinism as presenting a dichotomy that cannot be overcome without rethinking philosophical assumptions. The study supported the need for research to question philosophy of technology assumptions in education, and explore alternate ways of thinking about technology and learning that transcend technological determinist assumptions (M. Oliver, 2011; Selwyn, 2010b; Strobel & Tillberg-Webb, 2009).

Chapter 3: Research Method

Technological determinism is a philosophy of technology belief that assumes technology causes inevitable change in society (Leonardi, 2008; Leonardi, 2009), exerting a control over human society with technology considered in some way to be an autonomous force operating outside of social control (Feenberg, 2010; Hofmann, 2006; Leonardi, 2009). Technological determinist assumptions, by granting a control or determined autonomy to technology, apart from purposeful human control and direction, can present a dilemma for leadership by limiting human agency and responsibility for technology (Fisher, 2006; Hofmann, 2006; Jonas, 2009; Jonas, 2010; Kritt & Winegar, 2010; Slack & Wise 2006; Strobel & Tillberg-Webb, 2009; Wyatt, 2008). Researchers have conducted empirical studies in fields outside of K-12 education (see Significance of the Study in Chapter 1), and found that assumptions characterized by technological determinism were an important factor that influenced technology leadership (Grant et al., 2006; Jackson & Philip, 2010; Leonardi, 2008; Leonardi & Jackson, 2004; Prakash & Sinha, 2008). Researchers found that technological determinist assumptions can influence the thinking of leaders, including their perceived agency in shaping and managing technological change, affect discourse with stakeholders, and influence the decisions that leaders make on behalf of their organizations (Grant et al., 2006; Jackson & Philip, 2010; Leonardi, 2008; Leonardi & Jackson, 2004; Prakash & Sinha, 2008).

Recent educational technology scholars have argued that research is needed that critically questions technological determinist assumptions, and considers alternate ways of thinking about technology and learning that emphasizes the agency of human actors, and better recognizes the social factors involved with using technology in education (M.

Oliver, 2011; Selwyn, 2010b). An important theme in the literature concerns the importance for educational technology of critically examining philosophy of technology assumptions such as technological determinism (Carr-Chellman, 2005; Fisher, 2006; Hofmann, 2006; Kanuka, 2008; Kritt & Winegar, 2010; McDonald et al., 2005; M. Oliver, 2011; Pearson & Young, 2002; Smith, 2006; Strobel & Tillberg-Webb, 2009; Selwyn, 2010b). Questioning philosophy of technology assumptions can inform both research and professional practice, but there is a gap in the literature concerning how technological determinist assumptions may influence thinking and decision making in K-12 technology leadership (Kanuka, 2008; McDonald et al., 2005; M. Oliver, 2011; Selwyn, 2010b; Strobel & Tillberg-Webb, 2009). The purpose of the qualitative study was to a) examine what philosophical assumptions about technology are present in the thinking of K-12 technology leaders, b) investigate how the assumptions may influence technology decision making, and c) explore whether technological determinist assumptions are present.

Overview of research questions and research method. Chapter 3 explores the qualitative methods used for the study, and describes the research design that aligns with Corbin and Strauss qualitative data analysis. The subjects for the study included Virginia school district technology directors, and instructional technology specialists who provide leadership for classroom technology integration. Data collection methods involved semi-structured interviews and a questionnaire with open-ended questions.

Three research questions were defined that align with the research purpose and the research problem. To guard against any potential researcher bias, the researcher framed the first question broadly so that the study would be open to any philosophical assumptions about technology present in the thinking of technology leaders. The second research question moved beyond examining what assumptions were present, to investigate how assumptions influence decision making about technology. For example, decisions about technology can involve considering ethical issues such as Internet safety or equitable access (Consortium for School Networking, 2011).

The third research question focused on questioning whether assumptions of technological determinism may be present in leaders' thinking and decision making. Strobel and Tillberg-Webb (2009) asserted that a questioning of assumptions about educational technology should begin by analyzing how philosophical views about technology may correspond to technological determinism. Technological determinist assumptions might include the nomological variant of technological determinism (Vermaas et al., 2011), sometimes called hard technological determinism (Strobel & Tillberg-Webb, 2009), soft determinism, or other variants of technological determinism such as the unintended consequences account, or normative technological determinism (Vermaas et al., 2011).

Q1. What broad philosophy of technology assumptions are present in the thinking of K-12 technology directors and instructional technology specialists?

Q2. How do philosophy of technology assumptions influence the decisions that leaders make about educational technology?

Q3. What assumptions characterized by technological determinism may be present in leaders' thinking or decision making?

Research Methods and Design

Research paradigm of critical realism. The study was guided by the work of Strobel and Tillberg-Webb (2009), who presented a critical and humanizing framework for educational technology (see Theoretical Framework in Chapter 1). This framework highlighted as a starting point that educators should question whether technological determinism or social determinism influence their thinking about technology (Strobel & Tillberg-Webb, 2009). Smith (2006) held that theoretical debate between positions such as technological determinism and opposing positions that emphasize the role of social factors in causing technological change requires the rethinking of philosophical assumptions. In order to advance theory and research, Smith (2006) asserted that research from the perspective of critical realism would help to move past theoretical dichotomy and alleviate theory-practice inconsistencies. Recently Boucher (2011) recommended critical realism as a research paradigm for resolving issues in the debate between technological determinism vs. social determinism. The study's research questions dealt with assumptions concerning the connection between technology and society, and involved philosophical issues including causality. Miller and Tsang (2010) held that research to study causality and identify causal mechanisms can benefit from qualitative research designs from a critical realist perspective.

The researcher proceeded from a research paradigm of critical realism. Critical realism provides a philosophical structure for pursuing research that recognizes the fallible character of scientific knowledge, but insists on the objective existence of natural and social realities (Elger, 2009). Critical realism remains committed to moving ever closer to a truthful understanding of reality (Trochim & Donnelly, 2008), and this can involve revising, changing, or discarding theory over time (Cobern & Loving; 2008). Critical realism rejects the polarized debate between positivism and constructivism (Elger, 2009), can help a researcher to remain critically reflective, and the perspective allows for theory to emerge from research that investigates a phenomenon and its mechanisms at a deep level (Crawford & Wright, 2010). The critical realist position maintains that although scientific knowledge of the world is fallible and theories may require revision, objective knowledge about a real world is attainable (Cobern & Loving, 2008; Elger, 2009; Trochim & Donnelly, 2008).

Critical realism can be uniquely suited for qualitative research that seeks to plumb the depths and understand social phenomenon such as strategic management in order to develop or evaluate theory (Kraus, 2005; Miller & Tsang, 2011). Hodgkinson-Williams (2006) conducted qualitative research from a critical realism paradigm because of the advantages that the conceptual framework offered for understanding technology integration. Unlike positivism that tends to view the research setting as a closed system, critical realism is more open and can better recognize the larger social reality that affects teachers and students (Hodgkinson-Williams, 2006).

Appropriateness of qualitative data analysis as a research method. In examining philosophy of technology assumptions from a critical realist perspective, a research design should be conducive for discovering what assumptions are present in the thinking of technology leaders, while providing research methods that can limit bias and better ensure objectivity (Willig, 2008). The researcher employed Corbin and Strauss methods for qualitative data analysis to investigate what philosophical assumptions about technology influence the thinking and decision making of K-12 technology leaders, examine whether technological determinist assumptions are present, and generate a conceptual theory derived from empirical data. The research design aligned with Corbin and Strauss methods for qualitative data analysis presented in the guide *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory* (Corbin & Strauss, 2008). Corbin and Strauss methodology emphasizes a structured and procedure oriented approach to grounded theory methods that can guide beginning researchers (Mello & Flint, 2009). Corbin and Strauss methods for qualitative data analysis are accommodating of institutional requirements for research questions, literature review prior to research, and a theoretical framework (Corbin & Strauss, 2008).

While the study did not employ classic grounded theory methods, Corbin and Strauss qualitative data analysis methods include grounded theory techniques such as theoretical sampling, constant comparative analysis, and theoretical saturation of categories to generate a theory (Corbin & Strauss, 2008). Participants involved educational technology leaders, including K-12 technology directors and instructional technology specialists from Virginia school districts. Using purposive sampling and theoretical sampling, the researcher recruited subjects by contacting technology leaders through email or by telephone. Data collection methods focused on interviews following a semi-structured protocol, and a written questionnaire with open-ended questions. Data analysis utilized the Corbin and Strauss coding paradigm that employs open and axial coding to move from description to conceptualization, to draw out the complex relationships that can exist between concepts (Corbin & Strauss, 2008). The goal of the data analysis was theoretical saturation when additional data collection yields little new information (Hood, 2007), and concepts are well developed so that no new properties or dimensions emerge (Corbin & Strauss, 2008; Glaser, 2007a).

In considering how to proceed to study the research problem, a quantitative approach was first considered, because the researcher was impressed with the Ross-Barger Philosophic Inventory, a validated quantitative instrument that Barger (2008) used for examining philosophic worldviews among computer professionals. However, no validated instrument could be found suitable for measuring ontological or axiological assumptions about technology. Within her discussion of qualitative research in the context of leadership, Ospina (2004) wrote that a key reason to use qualitative research is to explore a phenomenon that has not been previously investigated, and which may be examined subsequently through quantitative research. Qualitative analysis can help to clarify assumptions of participants and researchers (Corbin & Strauss, 2008).

The researcher had initially planned to pursue a phenomenological study. It was reasoned that phenomenology, through its rigorous approach to describing phenomenon (Finlay, 2009; Husserl, 1965a) and principle of bracketing (Husserl, 1965b), would be conducive for discovering rich descriptive themes pertaining to philosophy of technology assumptions. Bracketing in the phenomenological tradition involves setting aside, without abandoning, one's own prior assumptions, practical interests, and bias (Beyer, 2011; Husserl, 1965b; Starks & Trinidad, 2007; Willig, 2008). However, a research design more conducive to generating theory was desirable, and it became apparent that research from the grounded theory tradition would provide a greater theoretical sensitivity, and interpretive insight concerned with building theory (Suddaby, 2006).

Some scholars (Cope, 2005; Luckerhoff & Guillemette, 2011; Starks & Trinidad, 2007) have asserted that grounded theory methods incorporate in an implicit way the phenomenological technique of bracketing in its concern that the researcher must recognize his own prior theoretical assumptions in order to better proceed with an open mind (Urquhart et al., 2010). A researcher employing grounded theory methodology seeks to reduce the impact of bias and subjectivity through the use of the memo technique, in which the researcher writes about and analyzes data, while reflecting on his or her own bias (Elliot & Lazenbatt, 2005; Luckerhoff & Guillemette, 2011). During qualitative data analysis the use of comparisons presses researchers to examine their own bias and assumptions, and those of participants (Corbin & Strauss, 2008). Grounded theory methodology was selected for its approach that emphasizes proceeding with an open mind (Urquhart et al., 2010) to investigate philosophy of technology assumptions of educational technology leaders, and to generate an explanatory conceptual theory (Corbin & Strauss, 2008).

Researchers have used grounded theory methods to examine philosophical beliefs and assumptions such as the axiological beliefs and ethical reasoning important for nursing practice (Callister, Luthy, Thompson, & Memmott, 2009), ethical beliefs influential in organizational leadership (Ardichvili, Mitchell, and Jondle, 2009), and spiritual beliefs important for business leadership (Fernando, Beale, & Geroy, 2009). Callister et al. (2009) conducted a study to examine ethical reasoning in nursing practice, and invited nursing students to do reflective writing in clinical journals, and the researchers analyzed the data using grounded theory methods to generate themes. Ardichvili et al. (2009) used grounded theory methods to study the ethical beliefs and assumptions of business leaders, and to identify the general characteristics of ethical organizational cultures, and develop a conceptual model. The researchers used purposive sampling to select business leaders from a variety of industries and from academia who were likely to have firsthand knowledge of business ethics, interviewed the leaders, and analyzed the data using a clustering technique to find similarities (Ardichvili et al., 2009). Fernando et al. (2009) examined philosophical beliefs of business leaders, with an emphasis on examining the relationship between spiritual beliefs and leadership. The researchers used purposive sampling to select business leaders who were interviewed using a semi-structured protocol (Fernando et al, 2009). Data was gathered on the meaning of spirituality and its role in the workplace and in leadership, and the data was analyzed and coded using grounded theory methods to identify themes (Fernando et al, 2009).

Role of literature review. Strauss and Corbin (1990) accepted the reviewing of all kinds of literature prior to beginning a research study (Kelle, 2005). Corbin and Strauss (2008) took a similar position that reviewing relevant literature is useful prior to commencing research, but that an exhaustive review prior to research is not necessary, as it is not possible to know beforehand what new problems or relevant concepts will emerge from data. The researcher's strategy for literature review aligned with recommendations from Corbin and Strauss, except that an exhaustive review of relevant literature was conducted prior to research, with literature review continuing during and after research. The continuing literature review served to stimulate questions during analysis and confirm research findings (Corbin & Strauss, 2008). As concepts emerged from data analysis, the literature was consulted to examine any similarities and differences with how concepts had been discussed by other researchers and scholars (Corbin & Strauss, 2008).

Population

Subjects involved 31 educational technology leaders working in Virginia school district, including K-12 technology directors and instructional technology specialists. Virginia technology directors are the chief technology officers for their school districts, work closely with school superintendents and stakeholders, and they provide professional leadership and vision for educational technology in support of school district goals (Consortium for School Networking, 2011). Technology directors manage all technology and related support resources, must be cognizant of ethical issues related to technology use throughout the district, and should model responsible decision-making (Consortium for School Networking, 2011). In Virginia, instructional technology specialists generally serve as instructional technology resource teachers (ITRT), a state mandated position that provides leadership for instructional technology integration, including collaborating with and training teachers to integrate technology and software effectively (Virginia Department of Education, 2008b). While most school districts have a single technology director, instructional technology resource teachers are employed by districts according to Virginia's Standards of Quality, which stipulate that school boards employ an ITRT at a ratio of one for every 1000 students (Virginia Department of Education, 2008b).

Strategy for selecting and recruiting participants. The selection process focused on identifying technology directors and technology specialists who had been involved with planning or implementing educational technology initiatives requiring strategic reflection about a variety of key issues, including possible questioning of philosophical or ethical issues. To identify technology leaders who had been involved with pertinent technology initiatives, the researcher consulted technology conference publications, school district technology plans, school district and educational technology websites, professional blogs, and minutes from consortium meetings. For example, there has been recent discussion in the educational technology field concerning bring your own device (BYOD) initiatives, whereby students are allowed to bring their own mobile devices such as laptops, phones, and tablets to school. The literature suggests that technological determinist assumptions may play a part in the thinking on this particular issue, as Schachter (2012), Noonoo (2012), and Norris and Soloway (2011) claimed that BYOD initiatives are inevitable in schools. Technology leaders who had worked with implementing initiatives such as BYOD, or other innovative technology initiatives, including iPad initiatives, were considered as subjects for the qualitative study. During data analysis, an emphasis on preparing students with 21st century skills using technology emerged as a conceptual theme, and participants were approached who had been involved with leading and implementing 21st century skills in schools.

In selecting the participants, the researcher, who serves as a Virginia school district technology director, leveraged professional relationships forged through educational technology conferences and consortiums. Participants were recruited through email and over the telephone. A script for each approach was used that avoided undue pressure on potential participants, promoted informed consent, and emphasized that participating in the study would be voluntary. A recruiting adjustment made by the researcher early in the study involved a shift to placing greater emphasis on telephone recruiting, since recruiting or scheduling interviews through email often did not garner a response. For participants within a reasonable driving distance of the researcher, a personal interview was an option. Two interviews were conducted in person, with all other interviews conducted over the telephone.

Sample

Purposive sampling and theoretical sampling. Data collection proceeded by purposive and theoretical sampling. The approach to data sampling in qualitative data analysis does not attempt to obtain representative population distributions (Charmaz & Henwood, 2008; Corbin & Strauss, 2008), and does not stop after data is collected from a predetermined sample (Hood, 2007). Rather, theoretical sampling involves the researcher deciding what data to collect next in order to facilitate the generation of concepts and theory (Corbin & Strauss, 2008; Holton, 2007; Morse, 2007). The researcher continued data collection until the point of theoretical saturation was reached when additional data collection yielded little new information (Hood, 2007).

Theoretical sampling is different from purposive sampling, but these methods can complement each other. Research can begin with a purposeful selection of the initial sample, and then shift to theoretical sampling when data analysis begins to reveal theoretical concepts (Breckenridge & Jones, 2009). Kenealy and Cartright (2007) described a study that commenced with purposive sampling to recruit 24 participants for interviews. After subsequent data analysis, theoretical sampling prompted the researchers to conduct further interviews in order to develop the abstract concepts.

This approach of leveraging both purposive sampling and theoretical sampling was utilized in this qualitative study. Data collection initially proceeded with purposive sampling to select twenty participants who work in educational technology leadership, including district technology directors, and instructional technology resource teachers. Purposive sampling is a form of non-probability sampling that proceeds by selecting subjects according to a pre-defined criterion (Cozby, 2009). The participants were selected in a nonrandom way, in order to purposefully select participants who have been involved with notable technology initiatives (see next sub-heading concerning the strategy for selecting and recruiting participants). Half of the initial participants were technology directors, so that a strong sample of district-wide technology leadership would be included in the study. The other half of the initial participants were instructional technology resource teachers who provide leadership for technology integration, collaborate with teachers, and deliver technology professional development.

After beginning with purposive sampling, as data collection and analysis progressed, the process shifted to theoretical sampling to develop the conceptual categories and emerging theory (Charmaz & Henwood, 2008; Stern, 2007). Researchers can use theoretical sampling to seek out participants who have had particular experiences, or in whom particular concepts appear significant (Morse, 2007), in order to gather data related to conceptual categories and their properties (Corbin & Strauss, 2008). During data analysis, the emerging theory prompted the researcher to pursue interviewing additional subjects to build the abstract concepts. The data analysis led to additional data collection, to seek out data from other sources that might be conceptually relevant.

Data collection continued until theoretical saturation had been reached, and 31 subjects had participated in the study, including 15 technology directors and 16 instructional technology specialists. Among the 31 participants, there were 17 men and 14 women, from 19 school districts from different geographic areas of the state, including

Central Virginia, Southside, Hampton Roads and the Virginia Peninsula, Northern Neck and Middle Peninsula, Northern Virginia, and Southwest Virginia and the foothills of the Blue Ridge Mountains. Both city and county school districts were included. A technology leader from one of the Governor's Schools in the state also participated.

Materials/Instruments

Data collection instruments included the Interview Questions and Protocol (Appendix A), that used a semi-structured protocol, followed by the Written Questionnaire (Appendix B) with open-ended questions. Other research instruments included the School District Permission Form (Appendix C) and Informed Consent Form (Appendix D). To guide the process of contacting potential participants using a consistent procedure that emphasized that participating was voluntary, two introductory scripts were used that included the Letter of Introduction – Email (Appendix E), and Introductory Script – Telephone (Appendix F).

The researcher utilized a semi-structured interview protocol (Ayres; 2008; Harrell & Bradley, 2009; Lahman & Geist, 2008) that took a funnel approach by beginning with a broad open-ended question, followed by more focused questions and probing questions to elicit further information and clarify responses (Harrell & Bradley, 2009). The researcher began by inviting participants to speak openly to describe their philosophy of technology in their own words. This broad opening interview question served to provide data pertaining to the study's first research question, concerned with the broad philosophy of technology assumptions present in the thinking of technology leaders. The ensuing interview questions followed a standardized open-ended approach to interviewing (Turner, 2010) that involved asking each participant the same structured, open-ended interview questions that were aligned with the study's research questions. The standardized but still open approach to interviews provided consistency from one interview to the next, accommodated probing questions, and allowed participants to provide as much information as they felt comfortable sharing (Turner, 2010). The researcher used probing strategies, such as asking for clarification, specificity, or elaboration on responses, to elicit thoughtful and complete responses (Harrell & Bradley, 2009; Persaud, 2010). Concluding the interviews and bringing closure to the process included allowing time for participants to clarify any response, winding things down in a courteous manner, and thanking the participant (Persaud, 2010).

In order to enhance the validity and reliability of the qualitative study, triangulation of data was achieved by comparing data from the interviews with data obtained through a written questionnaire completed by the participants after they were interviewed. Triangulation of data is advantageous for qualitative research because using different data sources can increase insight into the phenomenon under study and develop a more comprehensive understanding, while reducing potential bias (Kitto, Chesters, & Grbich, 2008; Kuper, Lingard, & Levinson, 2008). Questionnaires in qualitative research can be an efficient way to gather data pertinent to the research questions, and written questionnaires can be used in conjunction with interviews (Race, 2008). The written questionnaire began with a broad question to allow the participants to share any philosophy of technology in their own words. Additional open-ended questions followed that were different from the interview questions, but still aligned with the research questions.

After receiving approval from the Institutional Review Board of Northcentral University, the interview questions and written questionnaire were pilot-tested with a small group of five educational technology leaders, to prepare for research with the rest of the study participants. Pilot testing of interviews can help with finding flaws or limitations in the interview protocol, and making any revisions necessary prior to implementing the full study (Turner, 2010). The data from the early interviews was found to be valuable and no changes to the interview questions were made. The expected timeframe was found to be accurate, although some interviews exceeded that length of time. The pilot helped the researcher to ascertain that typing interview responses on a laptop computer using the electronic document that would later be used for transcribing the interview, was more practical than using handwriting on paper. Working with electronic files on a password protected computer also improved security of the data compared with using paper.

Pilot testing of questionnaires is beneficial for checking that instructions and questions are clear, finding out how the long the questionnaire takes to complete it, and ascertaining whether it yields useful data (Bell, 2010). The data from the early written questionnaires was found to be valuable, and no changes were made to the written questionnaire after the pilot study. However, the researcher realized from the pilot that some participants would take a few days or more before completing and returning their written questionnaire, and he learned to politely remind participants about completing it.

Data Collection, Processing, and Analysis

Interviews. Data collection focused on interviews with school district educational technology leaders, conducted over the telephone or in person, followed by a written questionnaire. Subjects included technology directors and instructional technology specialists from Virginia school districts. If participants gave written permission on the informed consent form to record the interview, interviews were audio recorded with an iPod, to aid the researcher in transcribing the interview. To record telephone interviews, an iPod was connected to an iPhone via a splitter, which allowed both the headset and iPod to receive the audio signal. The recordings were kept secure using a passcode on the iPod, and then the audio files were transferred to a password protected computer. The researcher deleted the recordings after data analysis was complete.

To obtain pertinent data for the study's research questions, the researcher used a series of open-ended interview questions with interviews conducted using a semi-structured protocol (Ayres; 2008; Harrell & Bradley, 2009; Lahman & Geist, 2008) that featured a broad opening question, followed by structured questions. The interview protocol (see Materials/Instruments section) began with a broad icebreaker question at the beginning to invite the subjects to speak openly about their philosophy of technology. Open-ended questions were used throughout the interview, because of their value for providing insight into what people are thinking, and how they view the world (Cozby, 2009), and to provide a richness of data that can explain the complexity of social phenomenon (Creswell, 2008).

Written questionnaire. Triangulation of data was achieved by comparing data from the interviews with data obtained through a written questionnaire completed by the participants after they were interviewed. The written questionnaire, in the form of a Microsoft Word document, was delivered to participants via email. After they completed the written questionnaire participants could simply attach the file and return it via email. Completed written questionnaires were received from all 31 participants.

Qualitative data analysis software. In considering whether or not to utilize qualitative data analysis software, the researcher recognized that software does not really analyze qualitative data, but human beings do the analysis (Patton, 2002). The researcher must reflect on the data, write memos, and become engaged in the thoughtful and logical process of data analysis (Corbin & Strauss, 2008). Computers cannot intelligently formulate concepts (Holton, 2007; Patton, 2002). However, data analysis software can help to remove some of the drudgery from data analysis, and can be useful organizing, managing, searching, and coding data (Corbin & Strauss, 2008; Patton, 2002). The researcher used the qualitative data analysis application MAXQDA, recommended by Corbin and Straus in their research guide, to import transcripts, write memos, code conceptual categories, properties, and dimensions from the data, conduct data analysis, and refine conceptual theory.

Transcripts. Using the Microsoft Word interview protocol document, the researcher typed participant responses during the interviews, which expedited the transcription process. In some cases, all that became necessary after the interviews was correcting spelling or grammar errors. In some cases, listening to the audio recordings was beneficial for filling out nuances of the interview previously missed. On rare occasions, listening to the recordings slowly, while pausing and rewinding, was even critical for capturing all of the richness of the responses.

After completing the interview transcriptions, and receiving the written questionnaires back from the participants, the researcher saved the Microsoft Word documents in Rich Text Format (RTF), and imported them into MAXQDA. A document set was created in MAXQDA for each participant, named using the pseudonym for that participant. The personal identifiers from each of the documents including the name, title, and school district were cut from the documents, so that they would not be referenced in any codes or exported reports, and were moved to hidden document memos within the database.

Memos and diagrams. The process of data collection and analysis emphasized the technique of writing memos, an integral part of qualitative data analysis, to write about and think critically about the emerging data, and engage in an internal dialogue with it (Corbin & Strauss, 2008; Grounded Theory Institute, 2009). Through writing memos, the researcher was able to engage with the data to ask questions of it, and integrate relevant material from the literature to support the theoretical integration (Grounded Theory Institute, 2009; Lempert, 2007). Memo writing is an essential component of the researcher engaging with the data, and allowing emerging patterns and concepts to be transformed into theory (Lempert, 2007). Figure 1 is an example of a code memo in which the researcher was engaging with a concept that was emerging as important for theory.

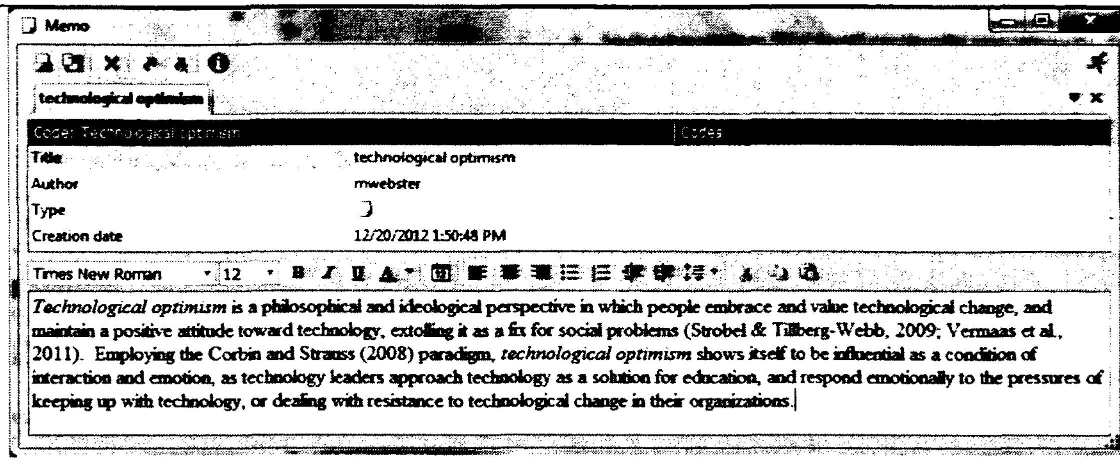

Figure 1. Example of a code memo in MAXQDA.

Memos can serve as the analytical building blocks for what may become theory (Elliot & Lazenbatt, 2005). The researcher leveraged the code memos and document memos when writing up the research findings and conclusions. The researcher also used memo writing to reduce the impact of subjectivity by analyzing data while reflecting on and bracketing out his own bias in order to become aware of it, and transcend it as much as possible (Elliot & Lazenbatt, 2005; Luckerhoff & Guillemette, 2011). In addition to creating written memos, the researcher created visual diagrams during data analysis, first on paper, and then using Microsoft Video, to depict relationships between concepts (Corbin & Strauss, 2008).

Open and axial coding. In grounded theory methodology, data collection and analysis work in a spiral fashion manner, with alternating episodes of data collection followed by analysis (Luckerhoff & Guillemette, 2011). The researcher began coding soon after data collection began, immediately after the first interview, and continued this spiral process of data collection followed by analysis during the remainder of the study.

The researcher utilized a coding process featuring open and axial coding, which are distinct yet closely related methods (Corbin & Strauss, 2008).

During open coding, the researcher analyzed the data from the interviews and questionnaires by going through transcripts line by line, and breaking it apart into segments or incidents to delineate the concepts, called categories, that represent raw blocks of data (Corbin & Strauss, 2008; Shannak & Aldhmour, 2009). Segments of data demarcated during open coding can be short phrases, a sentence or two, or paragraphs (Shannak & Aldhmour, 2009). During open coding, the researcher also worked to qualify the conceptual categories by defining properties, which are characteristics that describe the concepts, and identifying dimensions, which are variations within properties that provide specificity (Corbin & Strauss, 2008).

The researcher then used axial coding to reintegrate the data by relating concepts to each other (Charmaz & Henwood, 2008; Corbin & Strauss, 2008). During axial coding, the researcher selected the concept that appeared to have the greatest explanatory relevance, placed it at the center of an axis, and related and connected other concepts to it (Charmaz & Henwood, 2008; Corbin & Strauss, 2008). Corbin and Strauss (2008) explained that open and axial coding are so closely related that the distinction between the two is somewhat artificial. The researcher first breaks open the data in open coding to define the concepts, and this is followed by axial coding that puts the data back together by relating concepts to each other (Corbin & Strauss, 2008).

***Coding and constant comparison*.** Patton (2002) beautifully wrote, "Analysis begins during a larval stage that, if fully developed, metamorphoses from caterpillar-like beginnings into the splendor of the mature butterfly" (p. 432). With such a goal in mind, the researcher's work of data analysis was guided by constant comparison to compare incidents in the data with other incidents, and find similarities and differences between concepts, and plausible relationships between concepts (Corbin & Strauss, 2008; Schram, 2006). The use of comparisons presses the researcher to examine his or her own bias and assumptions, and those of participants (Corbin & Strauss, 2008). While qualitative research and grounded theory methods designed to discover connections between concepts originating from data is often described (Glaser, 2009; Suter, 2012) as an inductive process, Corbin and Strauss (2008) argued that the method also uses deduction. The analysis is inductive because findings are derived from data, but the researcher in interpreting the data employs deductive logic (Corbin & Strauss, 2008).

Scholars have also argued that data analysis in the grounded theory tradition employs the logical inference of abduction (Reichertz, 2007; Shannak & Aldhmour, 2009), and the researcher found this to be the case. To complement the constant comparative analysis used, the researcher used theoretical comparisons to help him deal with unexplained incidents in the data that required wrestling with the data to identify the significance and meaning of the unexplained (Corbin & Strauss, 2008). Theoretical comparisons are an analytical tool to stimulate logical thinking by comparing the properties and dimensions of concepts (Corbin & Strauss, 2008). In order to deal with surprising phenomenon, the methodology counts on abductive reasoning to explain the unexplained (Reichertz, 2007). Abductive reasoning attempts to close the gap by conjecturing an hypothesis, that if it were true, would cause the surprising phenomenon as a matter of course, and thereby explain it (Wuisman, 2005). Theoretical comparisons can involve the use of metaphors and similes in order to illustrate significance and meaning (Corbin & Strauss, 2008). The analytical process of integrating conceptual categories continued as the researcher refined theory, checked for gaps in logic, and reworked the categories (Corbin & Strauss, 2008).

Coding paradigm. Because the data that qualitative researchers work with can be complex, Corbin and Strauss methodology employs a coding paradigm as a strategy for asking questions of the data to help draw out the complex relationships between concepts that may be present (Corbin & Strauss, 2008). The coding paradigm is based on a model of human action and interaction influenced by pragmatism (Kelle, 2007). The researcher used the coding paradigm to build an axis for developing the properties of categories (Kelle, 2007), by selecting a core category that appeared to have the greatest explanatory relevance, placed it at the center of an axis, and then related the other concepts to it (Corbin & Strauss; 2008; Creswell, 2008). The coding paradigm was used to analyze data for context, or the circumstances to which participants respond, and then identify important causal conditions and consequences (Corbin & Strauss; 2008). The coding paradigm uses a conditional/consequential matrix and helps the researcher to sort through different factors that affect human actions, to integrate in a structured way the possible conditions and consequences that can enter into the context (Corbin & Strauss, 2008).

Theoretical saturation and theoretical integration. A movement from description to conceptualization characterizes the process of integrating categories around a core category (Corbin & Strauss, 2008). The goal of the qualitative data analysis was theoretical saturation, when the categories were well developed so that no new properties or dimensions emerged, meaning that each concept was theoretically saturated (Corbin & Strauss, 2008; Glaser, 2007a). During data analysis the researcher linked concepts around the core category, and the process moved toward achieving theoretical integration, when abstract and interrelated concepts had general applicability to the different cases in the study, and explained the variations and differences in the cases (Corbin & Strauss, 2008). During data analysis the researcher considered theories from the literature, because theoretical integration should place theory within the context of other theories (Urquhart et al., 2010). The researcher continued data collection and analysis continued until the point of theoretical saturation, when the properties, dimensions, and variations of all conceptual categories were well developed (Corbin & Strauss, 2008). It was evident after collecting and analyzing data from 31 participants that theoretical saturation had been reached.

Theoretical sensitivity and strategic concern of positioning. Theoretical sensitivity concerns the researcher's ability to see relevant data through his or her theoretical insights in the area of research (Kelle, 2007), while remaining attentive to subtleties of meaning (Suddaby, 2006). Schram (2006) explained that the strategic concern for fieldwork of positioning involves being in a position to understand and make use of data, and figure out how things connect together and to the big picture. The researcher's experience working as a technology director and instructional technology specialist contributed toward the strategic consideration of positioning, helped with theoretical sensitivity, and provided insight for discerning concepts and theory pertaining to philosophy of technology assumptions in leadership. The researcher was mindful that theoretical sensitivity involves the researcher being open to new and unexpected interpretations of data, and striving to be skillful in combining literature, data, and experience (Suddaby, 2006).

Triangulation

Triangulation is a technique for strengthening a study's interpretive rigor, quality, and credibility by combining multiple methods, data, or theoretical perspectives (Kitto et al., 2008; Kuper et al., 2008). In the researcher's investigation of philosophy of technology assumptions, triangulation of different sources of data (Kuper et al., 2008) was pursued by including participants from two different groups of technology leaders, technology directors and instructional technology specialists, who have complimentary but different roles in technology leadership. See the section Nature of the Study for an explanation of these technology leadership positions. The study used triangulation of different methods for gathering data (Kuper et al., 2008) by leveraging a semi-structured interview protocol, followed by a written questionnaire. Questionnaires in qualitative research can be an efficient way to gather data pertinent to the research questions, and written questionnaires can be used in conjunction with interviews (Race, 2008). Using different methods for gathering data can increase insight into the phenomenon under study and develop a more comprehensive understanding, while reducing potential bias (Kitto et al., 2008; Kuper et al., 2008). Jonsen and Jehn (2009) asserted that grounded theory research should use more than interviews for data collection, because it serves to better lift data to the conceptual level, while increasing credibility and validity.

Theory triangulation involves using different theoretical frameworks to interpret data and gain insights into phenomenon, and is advantageous for validating, challenging, and extending findings, while alleviating bias (Kitto et al., 2008; Turner & Turner, 2009). This study employed theory triangulation by cross-validating and corroborating theory by comparing it to theories from relevant literature (Jonsen & Jehn, 2009). Because theoretical integration should place theory within the context of other theories (Urquhart et al., 2010), the study's data analysis considered pertinent theories from the literature, including different variants of technological determinism, including hard and soft, nomological, normative, and unintended consequences, and other pertinent theories such as social determinism, the instrumental view of technology, and technological optimism and pessimism.

Assumptions

The participants in the qualitative study included technology directors and instructional technology specialists. The assumption that these two professional positions best represent Virginia K-12 educational technology leadership was based on the official roles and duties of the positions. Virginia technology directors are the administrators who oversee on behalf of their school district strategic efforts to design, develop, and implement technology into instruction (Virginia Department of Education, 2010). Similar to district technology directors in other states, Virginia technology directors are the chief technology officers for their school districts, work closely with school superintendents and stakeholders, and provide district-wide leadership and vision for educational technology (Consortium for School Networking, 2011). While information technology administration is an integral part of the duties of technology directors (Consortium for School Networking, 2011), their educational technology leadership is crucial for the success of school district technology integration (Virginia Department of Education, 2008b).

Instructional technology specialists in Virginia are educators holding teaching licensure who provide leadership for instructional technology integration, and collaborate with and train teachers to integrate technology and software effectively (Virginia Department of Education, 2008b). The official name used by the state of Virginia for these positions is instructional technology resource teacher (ITRT), and Virginia mandates that school districts employ an ITRT at a ratio of one for every 1000 students (Virginia Department of Education, 2008b). According to state guidelines, while those in the ITRT position hold teaching licensure, they are not to be assigned classroom teaching duties, but rather their role is to train, lead and mentor fellow educators (Virginia Department of Education, 2008b). Instructional technology specialists in Virginia often work under the supervision of district technology directors (Virginia Department of Education, 2008b).

The researcher employed a Corbin and Strauss (2008) approach to qualitative data analysis, which has some differences from the classic grounded theory methodology originally proposed by Glaser and Strauss (1967). Methodological assumptions of the Corbin and Strauss approach include an acceptance of distinct research questions that can frame a topic and establish the boundaries for research (Corbin & Strauss, 2008). The methodology also accepts the reviewing of relevant literature prior to commencing research (Corbin & Strauss, 2008).

Compared with classic grounded theory, Corbin and Strauss methodology typically utilizes a coding paradigm based on a model of human action and interaction influenced by pragmatism (Kelle, 2007). However, the researcher did not proceed from the philosophical position of pragmatism, but from a research paradigm of critical realism. Critical realism recognizes the fallible character of scientific knowledge, but insists on the objective existence of natural and social realities (Elger, 2009), and accepts that research can have universal validity (Cobern & Loving, 2008). A methodological assumption of the study is that research methodology influenced by grounded theory is compatible within a critical realism paradigm, a position that has found scholarly support (C. Oliver, 2011; Volkoff, Strong, & Elmes; 2007).

Limitations

Researcher bias in qualitative research could be a potential threat to validity, but the use of triangulation of methods, using both interviews and a questionnaire, can help to minimize bias (Kitto et al., 2008). Through memo writing the researcher strived to reduce the impact of subjectivity by reflecting on and bracketing out his own bias in order to become aware of it, and transcend it as much as possible (Elliot & Lazenbatt, 2005; Luckerhoff & Guillemette, 2011). During qualitative data analysis the use of constant comparisons by the researcher provided an opportunity to examine his own bias and assumptions, and those of participants (Corbin & Strauss, 2008).

While technology directors and instructional technology specialists provide leadership for educational technology, a limitation of this study is that these positions are not the only K-12 educators in Virginia who provide leadership for integrating technology into instruction (Virginia Department of Education, 2010). School principals and other school administrators should provide visionary leadership and oversight for instructional technology. School district technology plans and the implementation of technology initiatives involve the participation of many stakeholders (Virginia Department of Education, 2010).

Theory generated from the empirical data and qualitative analysis is an example of a substantive theory, which is a theory derived from the substantive area (Corbin &

Strauss, 2008) that applies to the data while being independent of it (Urquhart et al., 2010). Substantive theory in this study was based on an investigation of the philosophical assumptions about technology of Virginia educational technology leaders. Because the research broke new ground, a limitation of the study is that as future qualitative studies are conducted in the substantive area, it may become necessary to modify the substantive theory to accommodate new data (Polit & Beck, 2008).

Delimitations

The researcher made the decision to delimit participants in the study to technology directors and instructional technology specialists working in K-12 education, employed by school districts within Virginia. Virginia has been recognized as a national leader in K-12 educational technology (Coffman, 2009; Virginia Department of Education, 2010). Coffman (2009) commended forward thinking lawmakers and educational leaders in Virginia for implementing on a statewide basis funding for ITRT positions dedicated to providing leadership for technology integration. During purposive and theoretical sampling, the researcher did make an effort to seek out participants from different geographic areas of the state, from both city and county school districts, and both men and women.

The first research question was open to broad philosophy of technology assumptions, and the interview protocol and questionnaire both began with open-ended icebreaker questions that invited participants to share philosophy of technology views in their own words. However, the researcher delimited the third research question to philosophy of technology assumptions characterized by technological determinism. This delimitation was made on the basis of the study's research problem and theoretical framework. Educational technology scholars have emphasized the importance of critically examining philosophy of technology assumptions such as technological determinism (Carr-Chellman, 2005; Fisher, 2006; Hofmann, 2006; Kanuka, 2008; Kritt & Winegar, 2010; McDonald et al., 2005; M. Oliver, 2011; Pearson & Young, 2002; Smith, 2006; Strobel & Tillberg-Webb, 2009; Selwyn, 2010b).

Ethical Assurances

Earlier in the discussion of the research method, it was articulated how grounded theory methodology seeks to reduce the impact of bias and subjectivity through the use of the memo technique, in which the researcher analyzes data, while reflecting on his or her own bias and assumptions, and those of participants (Corbin & Strauss, 2008; Elliot & Lazenbatt, 2005; Luckerhoff & Guillemette, 2011). In considering other ethical considerations as it pertains to research, and meeting the researcher's challenge of what Patton (2002) referred to as having an ethical framework, issues including the research purpose, informed consent, confidentiality, and risk assessment were all given attention. The following research strategies were employed to establish an ethical framework for research.

To prepare for the IRB application process, the researcher contacted Virginia school districts for permission to contact technology directors and technology specialists as potential research participants. Some school districts gave permission through authorization by the district superintendent, granting permission through a letter they drafted, while other districts used the researcher's School District Permission Form (Appendix C), or gave permission through email. A few of the participating districts required a formal application and review process.

No data collection was conducted before the researcher received formal approval from the Institutional Review Board (IRB) of Northcentral University. After receiving formal IRB approval, recruiting began with the researcher coordinating the informed consent process, and approaching potential participants directly, rather than through a third party, to minimize pressure from other parties that might influence the obtaining of free consent. The researcher used the Informed Consent Form (Appendix D) approved by IRB. Whether approaching potential subjects through email or by telephone, the researcher made an effort to avoid any undue pressure on the potential participants, while emphasizing that participation is voluntary. For each approach to recruitment, email or telephone, IRB approved scripts (Appendix E and Appendix F) were used that were respectful of the informed consent process.

The research purpose was summarized for potential participants during recruiting and on the informed consent form, and summarized during the interview protocol (Appendix A), and on the written questionnaire (Appendix B). In discussing integrity in research, Schram (2006) argued that a researcher should posture and present himself to participants in such a way that there is an integral balance between engaging with participants, and remaining focused on the primary aim of conducting research. Schram (2006) noted that rapport building can be part of the presentation of oneself to participants. Because the researcher is a member of professional groups and consortiums, and has attended educational technology conferences, he has a professional acquaintance with many technology leaders from other Virginia school districts. While professional collegiality may promote rapport with participants, the researcher endeavored to remain honestly focused on the primary aim of research (Schram, 2006).

The study involved minimal risk to study participants. A possible area of concern for ensuring minimal risk concerned professional reputation. Maintaining confidentiality was important, and ensuring that no identifying information became available to others (Trochim & Donnely, 2008) was a priority. In recruiting and communicating with potential participants and actual participants, confidentiality was maintained, no emails were sent to distribution lists, and study participants were not informed of the names of others participating in the study. Pseudonyms were used in data analysis and reporting of the data. In reporting the results, no personally identifiable data such as personal names, schools, or school districts were included.

The transcripts for the interviews and written questionnaires, and the MAXQDA database were kept on a password protected computer. The protocol for audio recording of interviews followed due diligence, and the digital files were stored on a passcode protected iPod or password protected computer. After data analysis was complete, the audio recordings were erased.

Summary

Scholars have conducted empirical research to examine how philosophy of technology assumptions, including assumptions characterized by technological determinism, are an important factor for the practice of technology leadership in fields such as information technology management, business management, and university management (Grant et al., 2006; Jackson & Philip, 2010; Leonardi, 2008; Leonardi & Jackson, 2004; Prakash & Sinha, 2008). Scholars have argued that questioning philosophy of technology assumptions can inform educational technology professional practice and research, but there is a gap in the literature concerning how technological determinist assumptions may influence thinking and decision making in K-12 technology leadership (Kanuka, 2008; McDonald et al., 2005; M. Oliver, 2011; Selwyn, 2010b; Strobel & Tillberg-Webb, 2009). Using Corbin and Strauss methods for qualitative data analysis, the purpose of the study was to a) examine what philosophical assumptions about technology are present in the thinking of K-12 technology leaders, b) investigate how the assumptions may influence technology decision making, and c) explore whether technological determinist assumptions are present. Researchers (Ardichvili et al., 2009; Callister et al., 2009; Fernando et al., 2009) have used qualitative methods influenced by grounded theory to examine philosophical beliefs and assumptions.

The researcher discussed ethical considerations, and described the research strategies that were employed to maintain an ethical framework for research that considered issues including the research purpose, informed consent, confidentiality, and risk assessment. IRB approval was received prior to the commencement of any data collection. The subjects for the study involved educational technology leaders, including K-12 technology directors and instructional technology specialists from Virginia school districts. Data collection initially proceeded with purposive sampling to select twenty participants who work in educational technology leadership, followed by theoretical sampling of additional subjects, until 31 subjects had participated and theoretical saturation had been reached. Data collection involved interviews with educational technology leaders using a semi-structured protocol, complemented by a written questionnaire.

After a discussion of the appropriateness of the research design, the procedures for data collection and analysis were explained, with emphasis on how theoretical sampling, constant comparative analysis, and generation of theory were managed in the study's methodology. Data analysis involved using open and axial coding. During open coding, the researcher worked to qualify the conceptual categories by defining properties and identifying dimensions. During axial coding, the researcher selected the concept that appeared to have the greatest explanatory relevance, placed it at the center of an axis, and related and connected other concepts to it (Charmaz & Henwood, 2008; Corbin & Strauss, 2008). The coding paradigm was used to analyze data for context, or the circumstances to which participants respond, and then identify important causal conditions and consequences (Corbin & Strauss; 2008). The technique of memo writing was used to engage with the data, allow emerging patterns and concepts to be transformed into theory (Lempert, 2007), and reduce the impact of bias by becoming more aware of it (Elliot & Lazenbatt, 2005; Luckerhoff & Guillemette, 2011). Strategies for using triangulation to strengthen the study's research design, validity, and credibility were described, including triangulation of data sources, methods, and theory (Kitto et al., 2008; Kuper et al., 2008). The systematic approach afforded by Corbin and Strauss methodology led to a theoretical integration that served to better explain philosophy of technology assumptions in educational technology leadership.

Chapter 4: Findings

The purpose of the qualitative study was to a) examine what philosophical assumptions about technology are present in the thinking of K-12 technology leaders, b) investigate how the assumptions may influence technology decision making, and c) explore whether technological determinist assumptions are present. Subjects involved technology directors and instructional technology specialists from Virginia school districts, and data collection involved interviews following a semi-structured protocol, and a written questionnaire with open-ended questions. The research design aligned with Corbin and Strauss qualitative data analysis, and employed constant comparative analysis, open and axial coding, use of the Corbin and Strauss coding paradigm, and theoretical saturation of categories. Three research questions, aligned with the research purpose, guided the qualitative study. Chapter 4 first presents the research findings, and then evaluates and interprets the findings in light of philosophy of technology theories from the literature, conceptual frameworks, and findings from other research studies. This chapter is organized into three sections that include Results, Evaluation of Findings, and Summary.

Results

This Results section begins with an overview of the subjects who participated, and a table listing the pseudonyms the researcher used in presenting the results. A summary of the open coding results is given that includes the number of documents imported into MAXQDA, the number of codes and codings, and a summary of the conceptual categories and their frequency. After the summary, the research findings are reported with the results organized according to the study's three research questions. The properties and dimensions for the conceptual categories are presented without discussion or interpretation, with tables showing code frequency and dimensionalized examples from the transcripts. Results pertaining to the core category that emerged from the study, *Keep up with technology (or be left behind),* are reported in the section for Research Question 2.

Overview of the subjects. Data collection continued until theoretical saturation had been reached, at which point 31 subjects had participated in the study. Participants included 15 technology directors and 16 instructional technology specialists. Among the 31 participants, there were 17 men and 14 women, from 19 school districts from different geographic areas of the state, including Central Virginia, Southside, Hampton Roads and the Virginia Peninsula, Northern Neck and Middle Peninsula, Northern Virginia, and Southwest Virginia and the foothills of the Blue Ridge Mountains. Both city and county school districts were included. Using the U.S. Census Bureau's definition of urban as a population density of 1,000 or more persons per square mile, or incorporated places with a population of 2,500 or more (Bureau of the Census, 2011), 6 of the districts are urban, and 13 are rural. A technology leader from one of the Governor's Schools in the state also participated. Table 1 lists the pseudonyms the researcher used in discussing the results.

Table 1

Educational Technology Leader Participants and Pseudonyms

Participant Pseudonym	Position	Geographic Area
TD1	Technology Director	Hampton Roads/Virginia Peninsula
TD2	Technology Director	Southwest Virginia/Foothills of Blue Ridge
TD3	Technology Director	Southside
TD4	Technology Director	Central Virginia
TD5	Technology Director	Southside
TD6	Technology Director	Central Virginia
TD7	Technology Director	Central Virginia
TD8	Technology Director	Hampton Roads/Virginia Peninsula
TD9	Technology Director	Northern Neck/Middle Peninsula
TD10	Technology Director	Northern Virginia
TD11	Technology Director	Central Virginia
TD12	Technology Director	Hampton Roads/Virginia Peninsula
TD13	Technology Director	Southwest Virginia/Foothills of Blue Ridge
TD13	Technology Director	Central Virginia
TD15	Technology Director	Northern Neck/Middle Peninsula
TS1	Technology Specialist	Northern Neck/Middle Peninsula
TS2	Technology Specialist	Southside
TS3	Technology Specialist	Central Virginia
TS4	Technology Specialist	Central Virginia
TS5	Technology Specialist	Central Virginia
TS6	Technology Specialist	Central Virginia
TS7	Technology Specialist	Central Virginia
TS8	Technology Specialist	Northern Neck/Middle Peninsula
TS9	Technology Specialist	Hampton Roads/Virginia Peninsula
TS10	Technology Specialist	Hampton Roads/Virginia Peninsula
TS11	Technology Specialist	Southside
TS12	Technology Specialist	Central Virginia
TS13	Technology Specialist	Southwest Virginia/Foothills of Blue Ridge
TS14	Technology Specialist	Central Virginia
TS15	Technology Specialist	Central Virginia
TS16	Technology Specialist	Central Virginia

Summary of the coding results. The researcher interviewed 31 participants, and written questionnaires were completed and received from all participants. Data collection resulted in a total of 31 interview transcripts and 31 written questionnaires, and these documents were imported into MAXQDA, organized into documents sets corresponding to each participant, with document sets and documents named using the pseudonyms. The documents were carefully coded and analyzed using open and axial coding (see the section Data Collection, Processing, and Analysis in Chapter 3). In coding the transcripts, the researcher used in-vivo codes in some instances, creating codes using the actual words of participants (Corbin & Strauss, 2008). In other cases, as the researcher used constant comparative analysis to compare incidents in the data to find those that were conceptually similar, he created codes for categories, properties, or dimensions to raise the data to a conceptual level (Corbin & Strauss, 2008). Properties are characteristics that describe the concepts, and dimensions are variations within properties that provide specificity (Corbin & Strauss, 2008). Coding resulted in 377 conceptual codes involving 2,109 coding instances from the transcripts. There were 19 overall conceptual categories in the code system. Table 2 displays the conceptual categories and their code frequencies.

Table 2

Conceptual Categories and Coding Frequency

Category	Coding Frequency
Technology is a tool	203
Educational goals and curriculum should drive technology	235
Technological change is inevitable	149
Keep up with technology (or be left behind)	393
Technology raises questions of human values	86
Consider ethical factors associated with technology	121
Consider philosophy of instructional technology	40
Philosophy of technology for 21st century skills is influential	10
Technology causes unintended consequences	117
Technology causes social change	58
Both technology causes social change and social factors shape technology	69
Social factors shape technology	15
Philosophy of technology influenced by philosophy of education	59
Technology is integral to our lives	23
Technological optimism	137
Technological optimism and pessimism (both present)	19
Technological pessimism	14
Optimistic about life in general	5
Make an informed decision about technology – other considerations outside of philosophy of technology	351

Two of the these categories, *Optimistic about life in general*, and *Make an informed decision about technology – other considerations outside of philosophy of technology*, encompassed coding instances from the transcripts in which participants shared information that was outside the purview of philosophy technology and the study's research questions. For example, within the category *Make an informed decision about technology – other considerations outside of philosophy of technology*, there were coding instances for properties such as *consider factors associated with implementing technology*, and *get advice from others*. These codes were useful for faithfully coding data from the transcripts. However, since these codes and coding instances do not pertain to the study's research questions, they are not reported or discussed in Chapter 4.

Results for Research Question 1. What broad philosophy of technology assumptions are present in the thinking of K-12 technology directors and instructional technology specialists?

The researcher framed the first research question broadly so that the study would be open to any philosophical assumptions about technology present in the thinking of technology leaders. The research findings include seventeen categories representing broad philosophy of technology assumptions present in the thinking of participants. Among these philosophies, five were philosophies of technology that were influential for making decisions about educational technology, including the core category for the study, *Keep up with technology (or be left behind).* The findings for these philosophies concerned with educational technology decision making are covered in the section for Research Question 2. The study found that several philosophical assumptions characterized by technological determinism were present in the technology leaders' thinking or decision making. Categories pertinent to technological determinism included *Technology causes social change*, *Both technology causes social change and social factors shape technology*, and *Technology causes unintended consequences.* The findings for these categories are presented in the section for Research Question 3.

Technology is a tool. The results show that the perspective *Technology is a tool* was a prevalent philosophy of technology. The 203 code instances for this category were distributed among 40 of the 61 documents, with coding instances from 27 of the 31 participants. Participants often described how their philosophy of technology was characterized by an instrumental view of technology as a tool. For example, in responding to the first interview question, TS7 stated, "One philosophical belief of mine, shared by many of my educator acquaintances, is that technology is nothing more than a tool." Similarly, TD4 in responding to the first interview question responded with "I look at technology as a tool to get the job done, not as an entity by itself. Technology is employed to make folks' work and lives easier."

This conceptual category of was made up of several properties, or characteristic ways of viewing technology as tool. Properties for this category included *technology is an instructional tool or tool for learning*, *technology is a productivity tool*, *technology is value neutral*, *technology is a tool or medium for communication*, *technology is a resource for information*, *philosophy of technology as a tool influences practice or decisions*, and *technology is a means to an end*. The most frequent property was *technology is an instructional tool or tool for learning* which involved 78 coding instances from 27 documents, and 21 participants. In responding to the second question on the written questionnaire, TS9 wrote, "Our goal is to meet the needs of the students and using technology as an instructional tool is crucial." The property *technology is a productivity tool* involved 36 coding instances from 16 documents and 13 participants. In responding to the opening interview question, TD10 stated, "My philosophy of technology is that it helps people be more productive."

The property *technology is value neutral* involved 24 coding instances from 9 documents and 9 participants. The instances in the data for this property were often from responses to the sixth question in the interview, which asked, "What do you think is the connection between technology and values? Does technology raise questions relating to values or ethical considerations?" An example of a coding instance is TD15 stated, "While a powerful tool, technology itself is ethically neutral." Table 3 displays the coding frequency for the category *Technology is a tool,* its properties, and dimensions with two or more coding instances.

Table 3

Technology is a Tool and Coding Frequency

Category	Property or Dimension	Coding Frequency
Technology is a tool		203
	technology is an instructional tool or tool for learning	78
	technology supports or enhances teaching or learning	19
	technology used for assessment	7
	technology in the hands of a skilled practitioner	6
	technology supports instructional or educational goals	5
	technology for observing teachers for teacher evaluations	3
	technology makes instruction smoother for teachers	3
	technology is an instructional resource	3
	assistive technology for special needs	3
	recording science data	2
	technology is a productivity tool	36
	technology is an enabler or enhancer	8
	technology makes us more efficient or organized	7
	technology reduces workload, helps make tasks easier	7
	technology is value neutral	24
	technology is a tool or medium for communication	18
	connect with people through technology or social media	10
	allows for richer communications	4
	faster communication through technology	2
	technology is a resource for information	14
	instant access to information	5
	information at your fingertips, in the palm of your hands	3
	world of information through technology	3
	philosophy of technology as a tool influences practice or decisions	8
	technology is a means to an end	5

Note. The coding frequency for the category includes its properties and dimensions. The frequency for properties includes the dimensions under them. Dimensions of properties are indented.

Table 4 displays dimensionalized examples for the category *Technology is a tool.* Coded segments from the transcripts for the category and its properties are given. Pseudonyms are used for the participants.

Table 4

Dimensionalized Examples of Technology is a Tool

Category or Property	Participant	Dimensionalized Examples
Technology is a tool	TD4	"I look at technology as a tool to get the job done, not as an entity by itself."
Technology is a tool	TS3	"Technology is very much like a tool. When I look at various tasks, if I can do it quicker, more efficiently, more accurately, I'll use technology to complete those tasks."
Technology is a tool	TS7	"One philosophical belief of mine, shared by many of my educator acquaintances, is that technology is nothing more than a tool."
Technology is a tool	TS11	"Technology is a tool for students to apply toward life and their work outside of school in day to day activities."
technology is an instructional tool or tool for learning	TD12	"I see technology mainly in a supporting role, it should be seamless, and a resource for teachers and administrators to use. We just had a discussion the other day about our iPad initiative that we recently launched in high schools. The initiative shouldn't be about the device or the thing, rather it's about using that as a tool, as a resource for instruction."
technology is an instructional tool or tool for learning	TS7	"Technology is nothing more than a tool. In the hands of a skilled practitioner (teacher!), the technology can help motivate and facilitate learning. In the hands of a not-so-skilled practitioner, it may do nothing at all."
technology is a productivity tool	TS7	"Technology is a wonderful productivity tool"
technology is a productivity tool	TS4	"Productivity tools – spreadsheets, Powerpoint presentations, desktop publishing, I encourage teachers to utilize

		these in the classroom."
technology is value neutral	TD15	"While a powerful tool, technology itself is ethically neutral."
technology is value neutral	TS3	"Technology is neutral with respect to values."
technology is a tool or medium for communication	TD11	"It's a powerful thing to connect with people who think the same way, especially if your thoughts are divergent from the community's expressed ideas. It would be much harder to be a Goth in Huntsville, Alabama! But if you have an online community it helps to support your choices."
technology is a tool or medium for communication	TS6	"The technology and social media is what students are attracted to because they want to communicate, and it's a powerful way to do that."
technology is a resource for information	TD3	"Through technology you can access more information than you could before, such as downloading books or other information instantly."
technology is a resource for information	TS1	"Technology is valuable for research, providing a world of information."
philosophy of technology as a tool influences practice or decisions	TS4	"What I've been trying to do over the years is to guide teachers in using technology as a resource, and that it must be tied to an instructional purpose."
philosophy of technology as a tool influences practice or decisions	TD15	"I would say yes, given the fact that there are a large number of people, even more prevalent in education, that have an irrational fear of technology, or possibly fear of change in general, so for me it's instructive to try to get the neutrality piece across to them, as they're afraid of change."
technology is a means to an end	TD8	"Technology is an enabler, it's a means to an end, but not the end itself."
technology is a means to an end	TD7	"The way I approach technology in any setting, is I look at the underlying business requirements of the organization you're in. I think you find means to offer a way to enable or enhance business processes in terms of efficiency or speed."

Technological change is inevitable. It was found that the philosophy of technology assumption *Technological change is inevitable* was prevalent, and present in the thinking of 30 out of the 31 participants. There were 149 coding instances for this category distributed among 36 documents. Coding instances for this category were often associated with responses to the fourth interview question. An example of a coding instance is TS2 stated, "Technological change is inevitable and we should not resist it. That is my philosophy! We've gone through more change because of technology than anything else in the last 150 years." Coding instances for the category *Technological change is inevitable* were also found elsewhere in the documents. For example, TS16 in responding to the first interview question expressed a philosophy of technology epitomized by *Technological change is inevitable*:

> My philosophy of technology would center around the ever changing world, and technology is showing us that it's always changing, there's always new versions, always something new. This is how things are going, whether it's an iPhone or other technology, it's quick, constant change and evolution.

Within this category, there were several properties including *BYOD is or seems inevitable* which involved 27 coding instances from 14 documents and 12 participants. This code involved instances when participants expressed the view that initiatives involving bring your own device (BYOD), or student owned technology, were inevitable. An example of a coding instance is TS7 stated, "We're planning for a BYOD initiative here in our district. We already have a one-to-one laptop initiative for our students and mobile carts, but BYOD is inevitable – it is already here whether you like it or not."

The property *we should not resist technological change* involved 36 coding instances from 16 documents and 13 participants. An example of a coding instance is TS14 stated, "Yea, I don't think schools can resist technological change, as much as they try to fight it you can't keep technology out of schools." The property *we should embrace technological change* involved 15 coding instances from 11 documents and 11 participants. An example of a coding instance is TD7 stated, "I'm learning to embrace technological change and go through the proper planning process to make sure things are done right." Table 5 displays the coding frequency for the category *Technological change is inevitable*, its properties, and dimensions with two or more coding instances.

Table 5

Technological Change is Inevitable and Coding Frequency

Category	Property or Dimension	Coding Frequency
Technological change is inevitable		149
	BYOD is or seems inevitable	27
	BYOD benefits students	3
	BYOD is a feather in the cap for a district	2
	students would be more engaged with BYOD	2
	we should not resist technological change	19
	we should embrace technological change	15
	online learning is or seems inevitable	7
	technological change requires an examination of policy issues	5
	electronic textbooks are inevitable	5
	textbook companies put up resistance to eBooks	2
	shift to smaller mobile devices is inevitable	4
	trend toward social media is or seems inevitable	4
	technological change does not mean constant upgrades in schools	3
	inevitable that we'll use technology to customize instruction	3
	we should resist some technological change	3
	some technological change involves inferior technology	3
	technological change will bring year round schools	2

Note. The coding frequency for the category includes its properties and dimensions. The frequency for properties includes the dimensions under them. Dimensions of properties are indented.

Table 6 displays dimensionalized examples for the category *Technological change is inevitable*. Coded segments from the transcripts for the category and its properties are given. Pseudonyms are used for the participants.

Table 6

Dimensionalized Examples of Technological Change is Inevitable

Category or Property	Participant	Dimensionalized Examples
Technological change is inevitable	TS6	"Obviously technology is inevitable – it's happening, it's uncontrollable, so on a philosophical level you have to embrace the technology and assume it's always going to be there.
Technological change is inevitable	TD15	"Technological change is inevitable, there's no doubt about that, I wholeheartedly believe that, and we should do everything in our power to prepare the kids for that change."
Technological change is inevitable	TS2	"Technological change is inevitable and we should not resist it. That is my philosophy! We've gone through more change because of technology than anything else in the last 150 years."
Technological change is inevitable	TS16	"My philosophy of technology would center around the ever changing world, and technology is showing us that it's always changing, there's always new versions, always something new. This is how things are going, whether it's an iPhone or other technology, it's quick, constant change and evolution."
BYOD is or seems inevitable	TD8	"Often we discuss the inevitable rise of BYOD."
BYOD is or seems inevitable	TD4	"Students having their devices with them in school, either their own or devices we provide to them, is inevitable."
we should not resist technological change	TS4	"Yea, I don't think schools can resist technological change, as much as they try to fight it you can't keep technology out of schools."
we should not resist	TD15	"I know that technology is rapidly

technological change		changing education and to fight against that tide is futile."
we should embrace technological change	TD13	"Should we embrace technological change, absolutely because our students are embracing it, we have to keep up with them in the technological changes."
we should embrace technological change	TS2	"There is no stopping technology, if we embrace it for what it can do for education, everybody will be happier all around."
online learning is or seems inevitable	TD3	"It's inevitable that more students will be taking online courses, the way we teach now will change, teachers will be teaching more students, some who are not physically present. Schools should not resist but should prepare for it."
online learning is or seems inevitable	TS1	"Years ago I took a class towards my Master's degree and we were given an article about a student at home getting taught by a teacher on a computer. We had to give our thoughts and just about everyone in the class said that it would never happen. We debated on the topic and most people went along with the majority arguing that there would always be teachers and students in real classrooms. Here we are today with virtual classrooms, online colleges, etc. and my son took a course online and never saw the teacher! How I wish I could have kept that article to frame it in my office. I sometimes wonder what the people in my class are thinking now and if they remember their archaic view about what may happen in the future."
technological change requires an examination of policy issues	TS6	"Many teachers are open to the idea of BYOD. We allow cell phone use during lunch time, outside the building, and in the hallway but not in the classroom. The door is open if teachers want to try something. But it does get messy, and there are policy issues that must be considered."
technological change requires	TS7	"You do need to consider the

an examination of policy issues		safeguards, compliance with CIPA, and put policies in place to manage things."
electronic textbooks are inevitable	TD7	"We discuss the inevitable rise of eBooks to replace paper textbooks, and the barriers put up by the textbook companies."
electronic textbooks are inevitable	TD6	"With the success of Amazon it seems only logical there will be a trend to electronic books, and there will be a resulting shift in the classroom."
shift to smaller mobile devices is inevitable	TD2	"The trend toward social media and small mobile devices seems inevitable, as people will even sacrifice food to have smartphones."
shift to smaller mobile devices is inevitable	TS6	"Recently schools have shifted to tablets. However, they don't work the best on carts the way laptops work well. So this is a paradigm shift. You have to have a vision for where the ball is going."
trend toward social media is or seems inevitable	TS1	"Watching television, every commercial is requesting you to like them on FaceBook, Twitter, Pinterest, Google Plus, etc. and this is not just some fad that is going to go away like wearing Jordache jeans in the 80's. People like being social and keeping in touch."
trend toward social media is or seems inevitable	TS1	"I noticed on a talk show that the host had live Twitter feeds scrolling as the show was in progress to get her viewers at home involved. This is where our society is at and we need to keep up."
technological change does not mean constant upgrades in schools	TS11	"Because technology changes, it doesn't mean you have to always upgrade and move on to the latest model."
technological change does not mean constant upgrades in schools	TS6	"I don't think because of monies it's feasible to adopt the newest technology every year. For example, with Kindles things have changed so fast with many different models."
inevitable that we'll use technology to customize instruction	TD2	"Concerning instructional technology, I believe it's inevitable that we'll use technology to customize instruction."
we should resist some	TD11	"I recently wrote something about how

technological change		we have lionized the Khan Academy as a magical thing, when one, it's not particularly new, and two, it's not particularly exciting instructionally or pedagogically or anything else. So I think there's a role for online videos that are teacher led, but it's a shade of grey among many shades of grey that can help a certain number of people. The fact that he's getting many millions of dollars and people act like he's the second coming of Gutenberg is really disturbing for me. So I think we should fight that."
some technological change involves inferior technology	TD9	"However, after the technology crash, companies brought in young kids and they started implementing Linux, which was not for the better."
technological change will bring year round schools	TD2	"I believe there will be a large volume of online coursework available, blended instruction, and year round schools."

Technological optimism. Technological *optimism* was a prevalent philosophy of technology, present in 28 out of the 31 participants, with 137 coding instances distributed among 38 documents. For example, TD15 expressed technological optimism in stating in response to the last interview question, "A favorite saying of mine is that whatever the ill might be, technology will save the world!" Within this category, there were several properties, including *technology advocacy* which involved 28 coding instances from 17 documents and 14 participants. TS10 responded in the written questionnaire with, "I try to stay optimistic and attempt to be proactive in encouraging my colleagues to use technologies." In responding to written questionnaire, TS13 also described a positive and optimistic approach to advocating for instructional technology when interacting with colleagues at school:

> I think that in my position that it is important to stand behind and be positive when discussing new technology initiatives. I feel as though it is up to me to sell the initiatives to certain teachers who may be on the fence, or totally against what is trying to be implemented.

Table 7 displays the coding frequency for the category *Technological optimism*, its properties, and dimensions with two or more coding instances.

Table 7

Technological Optimism and Coding Frequency

Category	Property or Dimension	Coding Frequency
Technological optimism		137
	technology advocacy	28
	change agent for technology	4
	optimistic because of advantages of online learning	12
	online learning increases opportunities for students	2
	smaller schools	2
	technology will become more a part of us	10
	augmented reality	5
	memory devices connected directly to the brain	2
	optimistic because technology will improve education	9
	electronic textbooks will improve education	2
	technology will develop or evolve to make things better	6
	transform or restructure education through technology	4
	technology costs will go down	4
	technology can bring people together	3
	technology improves quality of life	2
	ready access to information	2
	technology will help students	2

Note. The coding frequency for the category includes its properties and dimensions. The frequency for properties includes the dimensions under them. Dimensions of properties are indented.

Table 8 displays dimensionalized examples for the category *Technological optimism*. Coded segments from the transcripts for the category and its properties are given. Pseudonyms are used for the participants.

Table 8

Dimensionalized Examples of Technological Optimism

Category or Property	Participant	Dimensionalized Examples
Technological optimism	TD11	"There are just beautiful, beautiful potentials out there for instructional technology, and for technology to change how people learn and experience school."
Technological optimism	TD15	"A favorite saying of mine is that whatever the ill might be, technology will save the world!"
Technological optimism	TS9	"I think that technology is a wonderful thing that's ever changing, it's vital to have in education. It's something that impacts our daily lives, I have really embraced it throughout my career, it's a wonderful thing, and I have good feelings about technology."
Technological optimism	TS14	"I'm optimistic about what could happen with technology, and new ideas including the implementation of such things such as motion capture, sensitivity to gestures, and that opens up a whole avenue of where technology could go."
technology advocacy	TS10	"I try to stay optimistic and attempt to be proactive in encouraging my colleagues to use technologies."
technology advocacy	TS13	"I think that in my position that it is important to stand behind and be positive when discussing new technology initiatives. I feel as though it is up to me to sell the initiatives to certain teachers who may be on the fence, or totally against what is trying to be implemented."
optimistic because of advantages of online learning	TD1	"I'm in an optimist. Optimism is also my general philosophy in other areas of life. Technology provides more online opportunities for education, with education coming to you that's more asynchronous, with flexible schedules accommodating the needs of students."
optimistic because of advantages of online learning	TD6	"In terms of optimism, I think ultimately we may have a different type of classroom setting, with less students in the building, because distance learning may change things, and provide educational opportunities for students beyond brick and mortar."

technology will become more a part of us	TS6	"Things will develop where technology is more augmented into our lives and who we are. We have to be science fiction fans to develop technology more and I think our students will be able to develop that for us."
technology will become more a part of us	TD3	"I'm an optimist, there will be technology that will help us move forward, and help students. It may sound crazy but we're not too far from the possibility of having memory devices that connect directly to the brain, it's moving in that direction, with technology offering information dumps directly to the brain."
optimistic because technology will improve education	TD8	"You should be able to give kids an iPad and it will contain their entire K-12 curriculum. It will take a decade or two but I'm an optimist."
optimistic because technology will improve education	TD10	"Connectivity will change the way we do instruction and engage the youth; as technology evolves, for instructional technology it will be a positive."
technology will develop or evolve to make things better	TS8	"I believe that as we strive for more technological advances that it will be beneficial to mankind, medically, educationally, that the strides in technology will be for the better."
technology will develop or evolve to make things better	TD4	"New technology will be out there, but the new iterations will be stronger and more beneficial than the last."
transform or restructure education through technology	TD11	"I think Shawn Cornally a teacher in Iowa, he has blog, I think his ideas about how we should be structuring education are the ways we ought to be doing it. We ought to be using technology to support differentiation, and personal exploration, and individualized learning, and really do some things with people."
technology costs will go down	TS4	"I also feel optimistic about technology becoming more affordable. There's sometimes disparity with technology, but it's becoming more equitable as technology becomes more affordable."
technology can bring people together	TS6	"You do lose some of your privacy with social networks, but the tradeoff is that it brings people together. It's hard to put a dollar value on that, or with something like my Twitter feed that I use to communicate with other professionals while I'm at work. It's exciting, and because of that excitement level I am optimistic."

technology improves quality of life	TD2	"I am an optimist. Over time technology will continue to develop and make improvements in our quality of life."
ready access to information	TD6	"Wealth of knowledge at our fingertips, I'm optimistic about this. It can be valid or invalid answers, but it's there."
technology will help students	TS4	"So I feel positive and optimistic about what technology can do for our students in the classroom in the future."

Technological pessimism. While the category *Technological optimism* was associated with 28 out of the 31 participants, the contrasting view *Technological pessimism* was not as prevalent. *Technological pessimism* involved 14 coding instances from 6 documents and 6 participants. An example of *Technological pessimism* is TD12 stated in response to the last interview question:

> It would not be hard for me to envision a fairly dystopian future around a school of one type of model, where the majority of instruction is directed by computers with little human interaction, and that justification is through multiple choice types of examinations.

A notable finding is that technology leaders can assess the value of the same technological innovation in different ways, with one looking at something with optimism, and another with pessimism. In response to the last interview question concerned with imagining futuristic technology, TD3 stated:

> I'm an optimist, there will be technology that will help us move forward, and help students. It may sound crazy but we're not too far from the possibility of having memory devices that connect directly to the brain, it's moving in that direction, with technology offering information dumps directly to the brain.

In imagining futuristic technology and devices connected directly to the brain, TD3 viewed this with optimism. In contrast, TS14, in response to the same interview question, and after expressing optimism about technological innovations such as motion capture and sensitivity to human gestures, stated:

> On other hand, I am a little bit pessimistic, because if it starts going in that direction, it's going to be brain chips in our skulls whereby we're programmed to go where they want us to go, the way someone else wants it done.

Technological optimism and pessimism (both present). The category *Technological optimism and pessimism (both present)*, involved 19 coding instances, from 11 documents and 11 participants. This category included instances where participants expressed both technological optimism and technological pessimism side by side. An example of a coding instance is TD 11 stated, "I think clearly from my answers I'm going to be a combination of optimism and pessimism. I really don't know how things are going to play out, but I think the next couple of years are going to be key."

The results also show that the same technology leader can assess a technology, such as online learning, with both optimism and pessimism. For example, TD6 stated in response to the last interview question, "In terms of optimism, I think ultimately we may have a different type of classroom setting, with less students in the building, because distance learning may change things, and provide educational opportunities for students beyond brick and mortar." However, the same technology director also responded, "In terms of pessimism, I think distance learning is good, but I tend to believe that social interaction is important, and there may come a time that schools, merely to save money, or for economic reasons, pursue online learning." Table 9 and Table 10 display the coding frequency for the two categories *Technological pessimism* and *Technological optimism and pessimism (both present)*, and their properties and dimensions.

Table 9

Technological Pessimism and Coding Frequency

Category or Property	Coding Frequency
Technological pessimism	15
technological dependency or controlling our lives	4

Note. The coding frequency for the category includes its properties.

Table 10

Technological Optimism and Pessimism (Both Present) and Coding Frequency

Category or Property	Coding Frequency
Technological optimism and pessimism (both present)	19
role of teacher and nature of teaching will change	4

Note. The coding frequency for the category includes its properties.

Table 11 displays dimensionalized examples for the two categories *Technological pessimism* and *Technological optimism and pessimism (both present).* Coded segments from the transcripts for these two categories and their properties are given. Pseudonyms are used for the participants.

Table 11

Dimensionalized Examples of Technological Pessimism,

and Technological Optimism and Pessimism (Both Present)

Category or Property	Participant	Dimensionalized Examples
Technological pessimism	TD6	"In terms of pessimism, I think distance learning is good, but I tend to believe that social interaction is important, and there may come a time that schools, merely to save money, or for economic reasons, pursue online learning."

Technological pessimism	TD11	"There's a lot of things enabled by technology lined up to destroy education as we know it, which are detrimental to the process as a whole, but would definitely be much cheaper, and easier to codify."
Technological pessimism	TS14	"I am a little bit pessimistic, because if it starts going in that direction, it's going to be brain chips in our skulls whereby we're programmed to go where they want us to go, the way someone else wants it done."
Technological pessimism	TD14	"Social networking could be a great thing, but in its current form with data mining, they forget that real people are there, and it causes tons and tons of problems both in education and in society. Data mining causes problems for privacy of the end user, people expect it but don't read the end agreement."
technological dependency or controlling our lives	TS11	"The fear that I have is that we'll be so dependent on technology and using technology that we won't have to think about, we'll lose the ability to solve problems."
Technological optimism and pessimism (both present)	TD6	"Probably some combination of optimism and pessimism – time will tell how things ultimately turn out, whether good or bad."
Technological optimism and pessimism (both present)	TD5	"As much as I'd love to say optimist, it would be both. I was slow to get texting. I don't always adapt to new things right away and need to see how it helps me."
Technological optimism and pessimism (both present)	TD9	"Probably a combination of optimism and pessimism – Alvin Toffler's book *Future Shock*, I read that in the seventies. I didn't believe it then – but we do need to prepare our kids for a technological future. Students need to keep up with technology to be prepared. However, technology can be used to shape things sometimes in a mob mentality, since that's basic human nature."
Technological optimism and pessimism (both present)	TS11	"I am optimistic but a little fearful. I could see where technology could take control of our lives."
role of teacher and nature of teaching will change	TD5	"Teachers must catch up, or some are retiring, I'm not sure if that's good or bad. It takes a different type of teacher to teach with technology."

Technology raises questions of human values. The philosophy of technology view *Technology raises questions of human values* was held by a majority of the participants, 22 out of 31, with 86 coding instances distributed among 26 documents. In response to the sixth interview question, TD expressed the view that technology raises questions of values by stating, "I think it does, yes I absolutely think it does raise questions of values, what I try to do is always be mindful of those things." Similarly, in response to the same interview question, TD10 stated, "Nowadays there's a greater need to understand the ethical implications of using technology." TD10 went on to describe an opinion that the free availability of information has desensitized us to ownership of intellectual property, and stated, "That's an important ethical consideration for students and all researchers, honoring ownership of digital property."

Within this category, there were several properties, including *technology tests our values* which involved 56 coding instances from 19 documents and 17 of the 31 participants. An example of a coding instance is TD1 stated, "Technology doesn't change values, but it puts us in the position to test our values." Coding instances for *technology tests our values* included responses pertaining to challenges related to Internet safety of students. For example, TS4 stated:

> Technology has made it easier for anyone to be exposed to other things. You can get online and find anything, witchcraft, pornography, technology has made it more accessible. There are more choices, there's more to deal with in terms of moral values, parenting – there's more to monitor now.

Table 12 displays the coding frequency for the category *Technology raises questions of human values*, its properties, and dimensions with two or more coding instances.

Table 12

Technological Raises Questions of Human Values and Coding Frequency

Category	Property or Dimension	Coding Frequency
Technology raises questions of human values		86
	technology tests our values	56
	technology makes good or bad choices more likely	16
	technology changes our values or priorities	9
	practice and teach the ethical use of technology	9
	technology enhances equality	6
	technology in control	2
	must have dialogue about technology and values	2

Note. The coding frequency for the category includes its properties and dimensions. The frequency for properties includes the dimensions under them. Dimensions of properties are indented.

Table 13 displays dimensionalized examples for the category *Technology raises questions of human values*. Coded segments from the transcripts for the category and its properties are given. Pseudonyms are used for the participants.

Table 13

Dimensionalized Examples of Technology Raises Questions of Human Values

Category or Property	Participant	Dimensionalized Examples
Technology raises questions of human values	TD7	"I think it does, yes I absolutely think it does raise questions of values, what I try to do is always be mindful of those things."
Technology raises questions of human values	TD10	"Nowadays there's a greater need to understand the ethical implications of using technology."
technology tests our values	TD1	"Technology doesn't change values, but it puts us in the position to test our values."
technology tests our values	TS16	"With technology because it's not face-to-face communication or interaction, it's easier to forget our values."
technology tests our values	TS4	"Technology has made it easier for anyone to be exposed to other things. You can get online and find anything, witchcraft, pornography, technology has made it more accessible. There are more choices, there's more to deal with in terms of moral values, parenting – there's more to monitor now."
technology tests our values	TS5	"Kids are now mimicking things and learning at a younger age through media and access to technology different things that are not appropriate for them."
practice and teach the ethical use of technology	TS1	"Students need instruction in Internet safety issues, because they often do not understand issues such as privacy of personal information. Students seem surprised when they learn how easy it is to find personal information online."
practice and teach the ethical use of technology	TD3	"If you say something wrong on the web, more people hear this and it affects people in a bigger way, friends or parents may see it, so it's important to teach ethics."
practice and teach the ethical use of technology	TS6	"We need to pay more attention, I think, to behaviors and how we use tools. Technology can amplify behaviors, both good and bad. And therefore, we have an

		ethical obligation to underlay all instruction with respect for ourselves and neighbors, including with regards to digital tools."
practice and teach the ethical use of technology	TD10	"Many school divisions operate in what is commonly known as a walled garden. The walled garden has a gatekeeper to protect those inside, but what about when the students venture outside the garden and begin to interact in other spaces? We have an obligation to increase student and parental awareness of the risks and rewards of being a digital citizen."
technology enhances equality	TD9	"This should be a major focus, getting technology into the hands of kids to give them the mechanism to have equal opportunities."
technology in control	TS11	"I could see where technology could take control of our lives"
must have dialogue about technology and values	TS6	"We must have a discussion with different stakeholders about the values of why we're using these tools in our schools. If we had a cooking class but didn't give kids knives because they might cut themselves, that wouldn't work very well. We have to be of the mindset that cuts, scrapes or bruises will happen, that can't stop us from pursuing the use of the technology."

Philosophy of education influences philosophy of technology. The results from the study show that other philosophy of technology assumptions were found to be present in the thinking of leaders. The category *Philosophy of education influences philosophy of technology* had 14 properties representing different philosophical views about technology that corresponded to the philosophy of education views of participants. Twelve of these properties had coding frequencies of five or less, but the property *technology makes learning more engaging for students* involved 24 coding instances from 14 documents and 12 of the participants. For example, TD10 expressed the view that technology engages students in the learning process by stating, "By paring the technology with the social aspects of learning, we can engage students individually as well as at a group level, and maximize that social and individual engagement." Table 14 displays the coding frequency for the category *Philosophy of education influences philosophy of technology*, and its properties that involved two or more coding instances.

Table 14

Philosophy of Education Influences Philosophy of Technology, and Coding Frequency

Category or Property	Coding Frequency
Philosophy of education influences philosophy of technology	59
technology makes learning more engaging for students	24
technology to increase higher order, critical thinking skills	7
technology helps to meet different learning styles of students	4
should not emphasize memorization	4
should move away from standards based education	3
go beyond lecture method of instruction	3
show mastery of content in innovative ways	3
computer assisted instruction is not good instruction	2
technology levels the playing field	2
hands-on learning using technology	2
teacher as facilitator	2

Note. The coding frequency for the category includes its properties. Properties are indented.

Table 15 displays dimensionalized examples for the category *Philosophy of education influences philosophy of technology*. Coded segments from the transcripts for the category and its properties with two more coding instances are given. Pseudonyms are used for the participants.

Table 15

Dimensionalized Examples of Philosophy of Education Influences Philosophy of Technology

Property	Participant	Dimensionalized Examples
technology makes learning more engaging for students	TS6	"All our technology initiatives should work towards our goals of student engagement."
technology makes learning more engaging for students	TD5	"History is still history, but history becomes more engaging to many students when technology is involved."
technology makes learning more engaging for students	TS14	"A couple years ago I received a grant to purchase and incorporate iPads, and my concern for interesting students influenced my thinking and decision to write the grant. I thought students would be very engaged with something like iPads, helping connect with content."
technology makes learning more engaging for students	TD10	"By paring the technology with the social aspects of learning, we can engage students individually as well as at a group level, and maximize that social and individual engagement."
technology to increase higher order, critical thinking skills	TD11	"Technology has the potential to do a lot of interesting things to help people visualize process and make connections with information, especially information that is complex."
technology to increase higher order, critical thinking skills	TS1	"Technology takes information to a new level, and instructional tools such as Inspiration make learning more meaningful."
technology to increase higher order, critical thinking skills	TS9	"We want to use technology to both engage students and increase their higher-level thinking skills."
technology helps to meet different learning styles of students	TS5	"Learning styles or preferences are important. I got better work out of my students when they had a chance to choose their method of research or how to put together a project. Even using a graphic organizer on the computer is better than on paper, because they hate to rewrite things."

should not emphasize memorization	TS13	"I like to see the kids enjoying what they're learning; it's not just rote memory, drill, drill, drill."
should move away from standards based education	TD11	"We ought to be using technology to support differentiation, and personal exploration, and individualized learning, and really do some things with people, rather than do this hand fisted SOL, state standards, multiple choice types of progression, with this old idea that we ought to have people in grades based on age, and restricting options.
go beyond lecture method of instruction	TS13	"You can lecture, but the students don't get it, but if you show them a different way, then the light bulb comes on!"
show mastery of content in innovative ways	TS12	"This is a powerful aspect of technology in instruction, and it gives students a unique opportunity to express their mastery of content material in new and innovative ways."
computer assisted instruction is not good instruction	TD11	"I think what we see involves adaptive path learning where the computers are presenting information to kids, and the kids are not interacting in a social or sophisticated kind of way with knowledge."
technology levels the playing field	TS5	"My philosophy of technology in relation to education – I believe technology has the ability to level the playing field for a lot of students."
hands-on learning using technology	TS13	"I think it would be great to offer more technology to our students, and it helps give them a different way to learn, they need to learn hands-on."
teacher as facilitator	TD13	"One-to-one makes teachers more of a facilitator of learning, rather than just a presenter of instruction."

Technology is integral to our lives. Lastly, the view *Technology is integral to our lives* involved 23 coding instances from 10 documents and 10 participants. An example of a coding instance is TD6 stated, "It's not merely used for a specific purpose, but a lot of what we do involves using the computing instrument that's integral to our lives." Properties for this category included *technology is integral or essential to education*, *ubiquitous technology*, and *transparent technology*. An example of a coding instance for *transparent technology* is TD6 stated, "Technology is tightly interwoven into our lives, and we don't think about it anymore." Table 16 displays the coding frequency for the category *Technology is integral to our lives*, and its properties with three or more coding instances.

Table 16

Technology is Integral to Our Lives and Coding Frequency

Category or Property	Coding Frequency
Technology is integral to our lives	23
technology is integral or essential to education	8
ubiquitous technology	6
transparent technology	3

Note. The coding frequency for the category includes its properties. Properties are indented.

Table 17 displays dimensionalized examples for the category *Technology is integral to our lives*. Coded segments from the transcripts for the category and its properties with three more coding instances are given. Pseudonyms are used for the participants.

Table 17

Dimensionalized Examples of Technology is Integral to Our Lives

Category or Property	Participant	Dimensionalized Examples
Technology is integral to our lives	TS10	"I think especially with our current society that integration of technology is no longer a nice to have thing, but an integral part of what we do every day."
Technology is integral to our lives	TD6	"It's not merely used for a specific purpose, but a lot of what we do involves using the computing instrument that's integral to our lives."
Technology is integral to our lives	TS15	"Technology is an ingrained piece of who we are, you can't separate the two."
technology is integral or essential to education	TS10	"Teachers should not just present using technology, but there should be hands-on use of technology by students on a daily basis, appropriate ways to search for information with Internet safety in mind, and use of iPads with different apps that are relevant for teaching and learning."
technology is integral or essential to education	TD7	"Children today are being raised in a technological age, and technology is critically important for the way they learn and the way that instruction is delivered.
ubiquitous technology	TD6	"A tool on your bench like a wrench, you use it with a specific need in mind. Now with a computer, or electronic devices in general, everything is full of computing power, and everyone has one."
ubiquitous technology	TD10	"The devices and online tools are ubiquitous and teachers as well as learners love to use them."
transparent technology	TD5	"A quote I like is, technology is technology for those born before it. Otherwise, technology becomes part of life, and you don't think as much about it."
transparent technology	TD6	"Technology is tightly interwoven into our lives, and we don't think about it anymore."

Results for Research Question 2. How do philosophy of technology assumptions influence the decisions that leaders make about educational technology?

Questions designed to link philosophical thinking and decision making. The second research question moved from examining what philosophy of technology assumptions are present in thinking, to investigate how assumptions influence decision making about technology. To obtain data pertinent to this research question, technology leaders were asked specific questions during the interview, and also in the written questionnaire, designed to connect philosophical thinking about technology to educational technology leadership or technology decision making. Question 2 in the interview was a probing question that linked philosophy of technology with educational technology leadership, and asked, "Does what you describe as your philosophy of technology have implications for your work as an educational technology leader?" Question 3 in the interview linked thinking with technology decision making, and asked "When you think back to your leadership decisions about educational technology, what informed your thinking or influenced your decisions?"

Question 5 in the written questionnaire asked, "In your practice as a technology leader, how does your thinking influence your advocacy or decisions pertaining to technology initiatives?" Question 2 in the written questionnaire asked, "Should schools adapt to broader technological trends, or should schools shape technology to align with educational needs?" The participant responses to this question often linked philosophy of technology and decision making. Lastly, Question 1 in the written questionnaire asked, "Do you ever engage in dialogue or debate with educational colleagues about any philosophical issues pertaining to technology?" Participants in some instances responded by describing philosophy of technology views that were important to them, and by recounting how dialogue with colleagues or stakeholders on philosophical issues pertained to technology decisions.

Both the interview and written questionnaire included questions designed to be open to whether or not any ethical considerations surrounding technology influenced technology leaders in their decision making. Question 3 in the written questionnaire asked, "Are there any notable ethical considerations that in your judgment might influence your thinking in making decisions about particular technologies?" Interview question 6 asked, "What do you think is the connection between technology and values? Does technology raise questions relating to values or ethical considerations?"

Keep up with technology (or be left behind). The category *Keep up with technology (or be left behind)* emerged as a prevalent approach to educational technology decision making, with 393 coding instances from 58 of the 61 documents, and all 31 participants. This concept began to appear at the beginning of the process of data collection and analysis, and continued to grow in explanatory power as the study progressed. The concept emerged as the core category in the study, with the greatest explanatory relevance (Corbin & Strauss, 2008).

The category *Keep up with technology (or be left behind)* reappeared in-vivo in transcript narratives in various forms, often expressed in those words, or variations of them. For example, in responding to the second interview question concerned with how philosophy of technology has implications for educational technology leadership, TD5 observed, "Teachers think we're moving too fast, but technology doesn't slow down," and continued, "We need to keep up or be left behind." In responding to the last question in the written questionnaire, concerned with how thinking influences technology decisions, TD3 stated, "My goal is to get more and more technology in the hands of our staff and students." TD3 then concluded the written questionnaire by stating in the last sentence, "Technology is always changing and you must change with it or you will be left behind."

Besides being the most frequent category in the coding system (see Table 2), there are several qualitative indications from the results that *Keep up with technology (or be left behind)* is the core category. Lahman (2008) offered guidance for the researcher in identifying the core category in research, and wrote, "The researcher identifies a central phenomenon, explores occurrences, emotions, or beliefs that influence the phenomenon, and examines the results of the phenomenon" (para. 4). What follows is a summary of results showing a link between the core category and the philosophy *Technological change is inevitable*. Also provided are results showing how *Keep up with technology (or be left behind)* and its properties are the main concern for educational technology leaders as they engage in technology decision making.

In the section above for Research Question 1, it was reported that findings show the philosophy of technology perspective *Technological change is inevitable* was a prevalent philosophy of technology. In terms of explanatory relevance, *Keep up with technology (or be left behind)* emerged as an approach to technology decision making linked with the philosophy *Technological change is inevitable*. For example, in discussing his/her philosophy that *Technological change is inevitable*, TS2 responded:

> Technological change is inevitable and we should not resist it. That is my philosophy! We've gone through more change because of technology than anything else in the last 150 years. There are some roadblocks along the way, but our students have surpassed us in technology, and we need to catch up with them.

> There is no stopping technology, if we embrace it for what it can do for education, everybody will be happier all around. All the time you have to keep up with technology, it's a constant challenge.

TS4 stated, "Technological change is inevitable and we should stay abreast with technology," and then continued, "People who are unfamiliar with technology need to embrace it and keep up with it to be successful."

In discussing their perspective that technological change is inevitable, participants expressed reasons for placing priority on keeping up with technological change in their work as educational technology leaders. For example, TS9 stated, "I definitely think that we need to keep up with technological change and implement technology as it involves." TD14 responded, "We should be moving forward and doing as many trials with technology as possible," and stated, "schools should never be behind with technology." Some technology leaders expressed the goal of not only keeping up with technology, but working to keep their school districts ahead of the pace of change. For example, TD7 stated, ""Technological change is inevitable," and continued, "I embrace technological change because it's going to come, and I want to get ahead of it. I focus on getting ahead of the pace of change."

The core category had several properties. The three properties *pressure to keep up with technology*, *resistance to technological change (getting left behind)*, and *philosophy of keeping up with technology influences decisions* were associated with a majority of participants. Other properties included *prepare students for a technological future*, *prepare students to get ahead with 21st century skills*, *prepare students to get ahead through technology competency*, and *technology takes precedence over values or other norms*. Table 18 shows the coding frequency for the core category *Keep up with* *technology (or be left behind)*, its properties, and dimensions with two or more coding instances.

Table 18

Keep Up With Technology (Or Be Left Behind), and Coding Frequency

Category	Property or Dimension	Coding Frequency
Keep up with technology (or be left behind)		393
	pressure to keep up with technology	107
	keep up with technology and get ahead	16
	schools should adapt to broader technological trends	15
	pressure to keep up with technology by comparing to other districts	10
	we are behind with technology in our district	9
	pressure to keep up with technology owned by students or families	8
	pressure to keep up with technology after attending conferences	7
	pressure to keep up with students' technology skills	6
	it's not possible to keep up with technological change	4
	people show off technology	4
	predicting the next technological trend	3
	evaluate the adoption of technological trends	2
	society places pressure on schools to keep up with technology	2
	resistance to technological change (getting left behind)	76
	teachers rarely or reluctantly integrate technology	30
	teacher resistance to technology disadvantages students	14
	resistance to BYOD	7
	people who resist technology put themselves at a disadvantage	6
	philosophy of keeping up with technology influences decisions	51

empowering users to keep up and be responsible for technology	29
prepare students to get ahead with 21st century skills	45
prepare students to get ahead through technology competency	33
technology takes precedence over values or other norms	27
risks to students should not stop technological change	17
implement technology without sufficient evidence from academic research	4
rapid technological change can make it difficult to focus on educational needs	3
ethical norms changing because of technological change	3
prepare students for a technological future	13

Note. The coding frequency for the category includes its properties and dimensions. The frequency for properties includes the dimensions under them. Dimensions of properties are indented.

Table 19 displays dimensionalized examples for the core category *Keep up with technology (or get left behind)*. Coded segments from the transcripts for the core category and are given. Pseudonyms are used for the participants. Dimensionalized examples of the properties associated with the core category are provided in Table 20.

Table 19

Dimensionalized Examples of Keep Up With Technology (Or Be Left Behind)

Category	Participant	Dimensionalized Examples
Keep up with technology (or be left behind)	TD3	"Technology is always changing and you must change with it or you will be left behind."
Keep up with technology (or be left behind)	TS1	"Schools should adapt to broader technological trends because we always seem to be behind."
Keep up with technology (or be left behind)	TS1	"Adapting to broader technological trends will prepare our students for college and for working in the 21st century. Resistance to technological change will keep us behind."
Keep up with technology (or be left behind)	TS2	"All the time you have to keep up with technology, it's a constant challenge."
Keep up with technology	TS2	"The game has changed and research cannot

(or be left behind)		keep up with the changing tide, and I don't want my students left behind."
Keep up with technology (or be left behind)	TS4	"People who are unfamiliar with technology need to embrace it and keep up with it to be successful."
Keep up with technology (or be left behind)	TD5	"Teachers think we're moving too fast, but technology doesn't slow down. We need to keep up or be left behind."
Keep up with technology (or be left behind)	TS9	"Sometimes when we are ready to proceed forward, we're already behind, but we do a good job trying to keep up."
Keep up with technology (or be left behind)	TS11	"As fast as technology changes, in education we should keep up with it or be one step ahead, but we're usually one step behind."
Keep up with technology (or be left behind)	TS11	"I'm a little afraid. I'm in technology and I get to play with it. But you have to always keep up with it. If you let any time go buy you'll get behind and be lost."
Keep up with technology (or be left behind)	TD7	"I embrace technological change because it's going to come, and I want to get ahead of it."
Keep up with technology (or be left behind)	TD9	"Students need to keep up with technology to be prepared."
Keep up with technology (or be left behind)	TD12	"As we continue to pay attention to technology outside of our education bubble, we need to continue to pull those things in from the consumer market, and find ways to apply them in education and include them in lessons that our digital native students will identify with. We stand to gain from this, but if we ignore what's going on in the larger sphere our students won't be able to fully prepared for the future."
Keep up with technology (or be left behind)	TD14	"We should be moving forward and doing as many trials with technology as possible. Schools should never be behind with technology."
Keep up with technology (or be left behind)	TS13	"Schools need to keep up on technological trends."
Keep up with technology (or be left behind)	TD13	"As a leader in the state, I am a risk taker but can implement things with ease, so I have a lot of school divisions replicating what we do. My thinking is and has always been why not try it. We do not want our students to be left behind."
Keep up with technology (or be left behind)	TS16	"How do we balance technological change knowing the new things are coming out, how

do we balance with the instructional value? We often feel we're one step behind, not on the cusp of what is available, we're learning about emerging technologies after the rest of the world has learned about them."

Pressure to keep up with technology. *Pressure to keep up with technology* was the most frequent property of *Keep up with technology (or be left behind)*, with 107 coding instances from 38 documents, and 26 of the 31 participants. Technology leaders often described the pressures surrounding efforts to keep up with technological change, and the challenges that this presented for their work as educational technology leaders. The results show this property, *pressure to keep up with technology,* had a strong emotional interaction in the experience of many technology leaders.

For example, TS9 began his/her interview with a broad statement expressing technological optimism (see Table 8). TS9 in response to the second interview question, described how the implications for this perspective meant *Technology advocacy*, by stating, "It's part of my job to integrate technology into the classroom, not only to involve students but to keep our teachers abreast of using technology as an educational tool." Later in the interview, TS9 expressed the philosophy of *Keep up with technology (or be left behind)*:

> I definitely think that we need to keep up with technological change and implement technology as it involves. I also think that some kids lack the basic technology skills and this makes it tough for them to utilize technology as changes take place.

In discussing the implications of his/her philosophy of technology in working as a technology leader, TS9 described the pressures associated with keeping up with technological change, after attending technology conferences and learning what other school districts were doing with technology:

> Being a smaller school district, we don't have as many resources, and things move more slowly. Sometimes when we are ready to proceed forward, we're already behind, but we do a good job trying to keep up.

The results show that for TS9, *pressure to keep up with technology* was a matter of concern not only because of school district challenges to keep up with technology, but also because of personal pressure. In response to the last interview question, TS9 stated:

> Oh my goodness, I was going to say an optimist, but I'm a little afraid. I'm in technology and I get to play with it. But you have to always keep up with it. If you let any time go buy you'll get behind and be lost.

Technology leaders described many consequences for school districts related to *pressure to keep up with technology*. There can be pressure to keep educational technology up-to-date, and TS12 stated, "We don't always have the latest software applications, and there's some pressure to keep up with what is changing in technology." TS13 explained, "You buy laptops and computers and soon they're outdated, and in schools we have to keep things in operation for at least five years for the refresh cycle." TS12 similarly observed, "We have our one-to-one laptop initiative with our students. We have our struggles with all of the technological changes that take place, almost as soon as it's out of the box, there's something new." TS15 summarized the pressures to keep up with technology by candidly stating, "You're never going to able to keep up with technological change in education because of our numbers of students and the cost."

Some participants expressed *pressure to keep up with technology* by making comparisons with other school districts. TS3 wrote, "Since someone else (usually outside the school system) is recommending a technology because it has seen success someplace then they push certain technologies, it is hard to determine which technologies we should use." TD9 explained, "I'm not big on going to educator technology meetings, I've been going to conferences for years, but at educational technology conferences people that go to them think we've got to do this now." TS1 expressed the pressures of making comparisons with other districts by stating, "At conferences or meetings I feel so behind others who have new technology." TS1 observed, "It seems like everywhere else in other districts they seem more advanced with technology and gadgets," and said, "Those with technology like to show off."

In analyzing the data, the researcher observed that pressure to keep up with technology was not limited to rural school districts, but was present in urban districts, and districts with greater numbers of technology resources. A technology leader, TS14, from a school district known for being a pioneer in educational technology stated, in response to the first interview question, "It's a constantly changing thing, and I don't know if there will ever be a way to keep up with it because of how fast it changes." Similarly, a technology leader from another district with a reputation for educational technology stated, "We think we get it under control, and then they stop supporting the software, or something else comes out that's newer! Then we have to start from scratch all over again."

The study's data for the dimensions associated with the property *pressure to keep up with technology* describe how this philosophy of technology is of consequence for educational technology leadership. The dimension *schools should adapt to broader technology trends* was associated with 11 participants, with 15 coding instances from 11 documents. In assessing trends such as consumer technology innovations, the growth of smartphones, and the popularity of social media, some technology leaders explained that in making decisions, they were guided by a concern to adapt these broader technology trends into their classrooms. In response to the second question on the written questionnaire, TD14 wrote, "If everyone is moving to social networking for communication then educational technology needs to embrace their own form of this medium and expand upon it." In response to the same question, TD10 wrote, "With iPads and tablets being the current trend, I have had numerous students that thanked me for lessons on Jamestown, planets, oceans, and math facts simply because we are utilizing the iPads." TS6 explained, "Looking beyond our walls is important, I think, as technology becomes more omnipresent in the lives of students in the form of cheaper, inexpensive, network connected devices."

The dimension *keep up with technology and get ahead* was associated with an approach to technology leadership involving decision making efforts to get ahead with technology, in order to provide the resources necessary for students to be educated and prepared for a technological future. This dimension was associated with 8 participants, with 16 coding instances from 12 documents. TD13 explained that this philosophy meant being a risk taker, and explained:

> The one big thing is that I am willing to take risks, you have to try to be willing to be a risk taker to try new things, move forward, and through your educational leadership to advance. We were a pioneer in implementing one-to-one laptops in the state, and a pioneer with a one-to-one initiative using iPads. And we have the people to make this work.

In describing his/her philosophy of technology, TD9 stated, "We're pretty loaded in our school district. We have plasmas in every classroom, SMART Boards, there basically isn't anything that we can't do. We're pretty advanced technologically although we're a rural school district. We try to stay ahead of things."

Prepare students to get ahead. Three other properties associated with *Keep up with technology (or be left behind)* involved leaders' concerns to keep up with technology in order to have the technology resources in place to prepare and educate students. These properties includes *prepare students to get ahead through technology competency*, *prepare students to get ahead with 21st century skills*, and *prepare students for a technological future*. *Prepare students to get ahead with 21st century skills* involved 45 coding instances, from 13 documents and 11 participants. *Prepare students to get ahead through technology competency* involved 33 coding instances from 14 documents and 12 participants. *Prepare students for a technological future* involved 13 coding instances from seven documents and six participants.

Leaders expressed a sense of responsibility for exercising educational technology leadership, and making decisions about technology, that was cognizant of a need to educate students, and prepare them with skills and technology competencies to be successful in the future. TD 3 explained, "As a leader I am trying to make it better for students, so they'll have access to the resources that will prepare them for life, college, or the work force; technology is the key to that." TD5 stated, "We owe it to our kids to prepare them as good cyber citizens and develop skills to use computers." TD15 stated, "Technological change is inevitable," and said, "We should do everything in our power to prepare the kids for that change." In response to the third interview question, TD15 continued, "What informs my thinking and decisions is what can I do to the give students the tools that will be beneficial for them in facing the future."

In implementing technology resources to prepare students in facing what they perceived as a technological future, technology leaders described the importance of preparing students with not only content knowledge in academic areas, but also technology competencies and 21st century skills. TS3 observed, "The students need the skills before they leave high school. Employers are demanding the technology skills, and we can't just provide a general education anymore." TS10 stated, "What makes me happy is to keep up-to-date with current technologies so that our kids will be ready to do things in the real world with technology and to be ready for that." TS13 stated, "We live in a technological age where students need to be familiar with and competent enough to know how to use new technology."

The core category of *Keep up with technology (or be left behind)* was also associated with a concern in educational technology leadership to place emphasis on preparing students with 21st century skills. The results show this concern can affect leaders' decisions to pursue technology initiatives. For example, TD7 stated:

> I embrace technological change, this tends to guide things such as getting wireless into our schools. It's basically inevitable, because from a state perspective, and with 21st century learning skills, our kids need to be competitive in a global market.

This concern can also affect instructional technology leadership efforts as technology specialists collaborate with teachers to assist them in integrating technology into the classroom. For example, in responding to the last question in the written questionnaire, TS12 wrote, "I believe that all students can learn and deserve to be taught by high quality teachers, who design engaging 21st century lessons." TS12 concluded by stating, "Technology in schools helps students and families in difficult financial situations receive the same exposure and access to technology as those in affluent situations, helping to prepare all students for the digital future they'll face after graduating from school."

Resistance to technological change. Another property associated with the core category was *resistance to technological change*, which involved 76 coding instances, from 29 documents and 23 participants. A majority of participants described how the phenomenon of resistance to technological change was present in their school district. TD12 explained:

I think education is a very, very hard area to change, it tends to be very, very resistant to change, you've got a lot of folks who are not as comfortable with technology as the kids are, and that's a big divide there, and that holds us back.

This property emerged at the beginning of data collection and analysis. The first participant interviewed, TS1, stated, "There can be a resistance to change in schools." The results also show that from the beginning of data collection and analysis, the property *resistance to technological change* was associated with *Keep up with technology (or be left behind).* TS1 stated, "Resistance to technological change will keep us behind."

The most frequent dimension for this property was *teachers rarely or reluctantly integrate technology*, which involved 30 coding instances from 15 documents and 12 participants. This teacher resistance to integrating technology was sometimes expressed in general terms. For example, TS11 stated, "The teachers need to be more on track with being able to incorporate technology into lessons." TS1 stated, "Teachers are often wary of using technology in the classroom, and 50% of teachers do not use technology." The resistance was also expressed in more specific terms. TS15 stated, "We had a big iPad elementary school initiative recently, and this had its own challenges. Many teachers were resistant to this."

Several technology leaders described this resistance to technology as being associated with older, veteran teachers. For example, TS9 stated, "We have a lot of older teachers, many near retirement age, and many have skittish views about technology." TS10 stated, "With some of our more veteran teachers, they have done things the same way for 30 years and don't want to change." TS1 observed:

> The real problem is that students are so tech savy that some of the older teachers who are not familiar with the programs won't be able to control what they do because they are still using drill & skill and want control over the classroom.

Technology leaders described leadership strategies that they used to address resistance to technological change. In response to the first question in the written questionnaire, concerned with engaging in dialogue or debating with colleagues about philosophy of technology issues, TD10 wrote:

> We try to then go out into schools where technology use is stagnant and spark interest. Sometimes that is met with resistance and the debate ensues. Is it worth the investment of time, talent or other resources? Is it really going to deliver as promised? How will I fit this into what I am required to teach?

TD11 explained how their school district had implemented a formal process to require teachers to integrate technology and 21st century skills into instruction. TD11 explained, "We have in place a systematic process of classroom observations and interviews with teachers and students so that data is used to build 21st century learning, and force these conversations in our district."

Another dimension associated with *resistance to technological change* involved *teacher resistance to technology disadvantages students*, which involved 14 coding instances, from eight documents and six participants. TS10 stated, "Technological change is inevitable, I think that's definitely the case, and by being resistant to it as a lot of places are, we're doing a disservice to students. By keeping on top of it we're better preparing students." TD12 stated, "You've got a lot of folks who are not as comfortable with technology as the kids are, and that's a big divide there, and that holds us back." TS1 wrote that a teacher, whose students had scored the lowest on standardized reading assessments, was resistant to using a reading intervention program with students, and had said to her, "I have a real problem with allowing a machine to help my students read." TS11 stated, "Students are digital natives and ready to embrace technology, but we tend to hold them back."

Philosophy of keeping up with technology is influential. The property *philosophy of keeping up with technology is influential*, associated with *Keep up with technology (or be left behind)*, involved instances when technology leaders described how a philosophy of keeping up with technology informed professional practice and technology decision making. This property involved 51 coding instances from 18 documents and 17 participants. TD5 described this philosophy as a strategy for managing teacher resistance to technological change, by stating, "Teachers think we're moving too fast, but technology doesn't slow down. We need to keep up or be left behind." TD3 emphasized leadership efforts to implement more technology in schools, and stated, "My goal is to get more and more technology in the hands of our staff and students. Technology is always changing and you must change with it or you will be left behind." Similarly, TD14 stated, "We should be moving forward and doing as many trials with technology as possible. Schools should never be behind with technology." TD12 explained how adopting new technologies can involve willingness to accept risks, and stated, "As a leader in the state, I am a risk taker but can implement things with ease," and said, "We do not want our students to be left behind." Technology leaders also described how this philosophy was related to professional efforts to keep up with technology to benefit their schools, and keep their own skill set up-to-date. TS13 stated, "We do the best we can with staying on top of things with the new things in technology coming out. We try to update constantly what we're doing." In responding to the second interview question concerning how philosophy had implications for educational technology leadership, TS14 stated:

> It forces me to be in constant contact with what's new in technology, with what is up and coming, whether it's how a device is used or can be used, and whether it has the potential to be used in education.

Technology takes precedence over values or other norms. The property *technology takes precedence over values or other norms* associated with *Keep up with technology (or be left behind)* involved 51 coding instances, from 18 documents and 17 participants. This property involved several consequences of the philosophy *Keep up with technology (or be left behind).* Results for this property are given in the section for Research Question 3, concerned with technological determinism.

Table 20 displays dimensionalized examples for the properties associated with the core category *Keep up with technology (or get left behind).* Coded segments from the transcripts for the properties are given. Pseudonyms are used for the participants. (Dimensionalized examples for the core category itself are provided in Table 19.)

Table 20

Dimensionalized Examples of the Properties for Keep Up With Technology (Or Be Left Behind)

Property	Participant	Dimensionalized Examples
pressure to keep up with technology	TS1	"Administrators in our district got iPads, and it made some teachers angry because they did not receive iPads. There is pressure to keep up with technology. It seems like everywhere else in other districts they seem more advanced with technology and gadgets."
pressure to keep up with technology	TS12	"We don't always have the latest software applications, and there's some pressure to keep up with what is changing in technology."
pressure to keep up with technology	TD10	"Students are coming to schools equipped with more advanced technologies, often more recent and up-to-date than we can provide."
pressure to keep up with technology	TS14	"It's a constantly changing thing, and I don't know if there will ever be a way to keep up with it because of how fast it changes."
pressure to keep up with technology	TS15	"Our stated goal is to be a leader in the nation with technology. So we've had initiatives such as one-to-one, iPads, mobile carts, there's always an influx of change
resistance to technological change	TS1	"There can be a resistance to change in schools."
resistance to technological change	TS1	"Resistance to technological change will keep us behind."
resistance to technological change	TD12	"I think education is a very, very hard area to change, it tends to be very, very resistant to change, you've got a lot of folks who are not as comfortable with technology as the kids are, and that's a big divide there, and that holds us back."
resistance to technological change	TS7	"A school division may implement iPads with all schools or all students, but if you have resistance, and they don't use it, you have wasted your money."
resistance to technological change	TS10	"Especially, with some of our more veteran teachers, they have done things the same way for 30 years and don't want to change."
philosophy of keeping up with technology influences decisions	TD13	"As a leader in the state, I am a risk taker but can implement things with ease, so I have a lot of school divisions replicating what we do. My

		thinking is and has always been why not try it. We do not want our students to be left behind."
philosophy of keeping up with technology influences decisions	TD14	"We should be moving forward and doing as many trials with technology as possible. Schools should never be behind with technology."
philosophy of keeping up with technology influences decisions	TS1	"Schools should adapt to broader technological trends because we always seem to be behind."
philosophy of keeping up with technology influences decisions	TD3	"My goal is to get more and more technology in the hands of our staff and students. Technology is always changing and you must change with it or you will be left behind."
philosophy of keeping up with technology influences decisions	TD5	"21st century skills are what everyone is talking about. Teachers think we're moving too fast, but technology doesn't slow down. We need to keep up or be left behind."
prepare students to get ahead with 21st century skills	TD11	"We have in place a systematic process of classroom observations and interviews with teachers and students so that data is used to build 21st century learning, and force these conversations in our district."
prepare students to get ahead with 21st century skills	TS12	"I think that because of the power of technology, all young people should have access to technology, when they finish school, they need not just subject area content in other academic areas, but also technology skills, and the ability to use technology to do problem solving. It's about having 21st century skills, so that when they're out making sense of the world as adults, they have those needed skills."
prepare students to get ahead with 21st century skills	TS12	"I believe that all students can learn and deserve to be taught by high quality teachers, who design engaging 21st century lessons."
prepare students to get ahead with 21st century skills	TD13	"I preach this all the time, we've been in the 21st century for twelve years now, if we have not changed, we're not teaching the skills that our students need, communication, collaboration, global awareness, and critical thinking. If we're not incorporating these skills into education for our students, we have failed our students in the effort to make sure they're prepared to be successful in a global society."
prepare students to get ahead with 21st century skills	TS15	"The important thing is that students have the skills to keep up with doing research and using whatever technology tool is available, by being resourceful and using the skills and resources

		they have. Sometimes it takes doing different workarounds and using creativity, using free tools or other things to create a great project. Critical thinking skills, innovation, communication skills, these are more important that having the latest and greatest stuff."
prepare students to get ahead through technology competency	TS3	"The students need the skills before they leave high school. Employers are demanding the technology skills, and we can't just provide a general education anymore."
prepare students to get ahead through technology competency	TD5	"In order to teach our kids and for them to have a competitive advantage in the job market, they certainly need to have technology skills."
prepare students to get ahead through technology competency	TS13	"We live in a technological age where students need to be familiar with and competent enough to know how to use new technology."
prepare students to get ahead through technology competency	TD6	"Being in the business of education, we have to prepare students, and since technology is integral to our lives, we have to prepare them to use computers in the work place and their daily lives."
prepare students for a technological future	TD9	"We do need to prepare our kids for a technological future."
prepare students for a technological future	TD1	"Technology prepares students for their future which will have a technological focus."
prepare students for a technological future	TS10	"By keeping on top of it we're better preparing students. If we take the opportunity to teach them things through the inevitable technological changes they'll be better prepared once they leave school."
prepare students for a technological future	TD3	"As a leader I am trying to make it better for students, so they'll have access to the resources that will prepare them for life, college, or the work force; technology is the key to that."
prepare students for a technological future	TD15	"The hardest but most useful would be, putting it lightly, trying to divine the future. Given that it's K-12 that I work for, and that some students are walking out into the world, and others are still young, we have to consider that what we're doing with technology will be vitally important for them whenever they graduate."

Educational goals and curriculum should drive technology. In the section above for Research Question 1, it was reported that the findings show the philosophy of technology perspective *Technology is a tool* was a prevalent philosophy of technology. Concerning Research Question 2, and how this particular philosophical view influences the decisions that technology leaders make about educational technology, the category *Educational goals and curriculum should drive technology* emerged as a widespread approach to technology decision making linked with the philosophy *Technology is a tool. Educational goals and curriculum should drive technology* involved 235 coding instances from 56 documents and 30 out of 31 participants.

Early in the process of data analysis, the researcher at first treated *Educational goals and curriculum should drive technology* as a property of *Technology is a* tool. During data analysis, the researcher used the Corbin and Strauss coding paradigm to analyze data for context, or the circumstances to which participants respond, and then identify important causal conditions and consequences. The coding paradigm was useful during data analysis to link philosophical thinking about technology, with how leaders responded in terms of decision making about educational technology. Using the Corbin and Strauss coding paradigm, *Technology is a tool* merged as a macro level context, a broad philosophical perspective from which technology leaders often think and respond (Corbin & Strauss, 2008). In the case of *Educational goals and curriculum should drive technology,* this concept emerged as an approach to technology decision making linked with the philosophy *Technology is a tool.* The results showed these two categories are closely linked. For example, in the case of TD12, this technology director expressed at the beginning of the interview the philosophy that technology is a tool:

> We just had a discussion the other day about our iPad initiative that we recently launched in high schools. The initiative shouldn't be about the device or the thing, rather it's about using that as a tool, as a resource for instruction.

TD12 also explained that educational goals and curriculum should drive technology, by stating:

> The driving force for technology should be the educational needs of the school or division. Technology should be another resource to accomplish the goals for student achievement. Otherwise, technology is being implemented and then everyone has to figure out how to make it work to support division and school needs.

The results showed there were several dimensions for the property *Educational goals and curriculum should drive technology* that are of consequence for technology decision making. The most frequent property, with 114 coding instances, was *consider the intended educational goals for technology*, which was associated with 44 documents and 28 out of the 31 participants. Technology leaders often described how their philosophy of technology informed them by pursuing an approach to decision making that placed focus on considering the intended educational goals to be accomplished through the technology, rather than placing focus on technology itself. For example, TS4 responded to the written questionnaire:

> Schools should shape technology to align with educational needs. Decisions concerning use of technology must consider the objectives that must be taught. Technology use should always support learning objectives. Before considering how we might use technology as a tool, we need to examine how the tool will help deliver, review, or help the students practice curriculum objectives.

Two other properties associated with *Educational goals and curriculum should drive technology* were also concerned with an approach to decision making that placed priority on curriculum and educational goals, rather than technology. These two properties, *don't pursue technology for the sake of technology*, and *curriculum should drive technology, rather than technology drive curriculum*, were created early in data analysis as in-vivo codes from the transcripts. For example, in response to the second interview question that connected thinking and decision making, TD2 observed, "Sometimes just having money drives technology decisions and others want to purchase new technologies." TD2 then stated, "I don't believe we should purchase technology for the sake of technology." The code *curriculum should drive technology* was similarly created based on this technology director's response to the written questionnaire. TD2 asserted that the curriculum department should play an important role in planning for educational technology, and stated, "Is technology driving the bus or is teaching and learning when it comes to the use of technology?"

There were 71 coding instances for *don't pursue technology for the sake of technology*, from 36 documents and 24 participants. Technology leaders described how this philosophy of technology was of consequence in leadership and decision making. For example, in response to the first interview question, and expressing the view that technology is a tool, TD4 stated, "I'm not a fan of technology for its own sake, and as a decision maker I like to see reasons for implementing technology." Then in response to the second interview question that linked thinking and decision making, TD4 responded:

> My philosophy guides my decisions. We get hit often with we need this or we need that, and I look at things analytically and critically to analyze the technology needs presented to me. If a teacher goes to a conference and comes back and approaches me with an idea, I consider do we have something else that already does this, or is this the most cost effective solution? If the idea has merit and makes economic sense, we may proceed with it, or we might recommend something else that we already have, or which might be available.

Coding instances associated with *don't pursue technology for the sake of technology* included participants describing an approach to technology decision marked by caution in assessing whether to purchase the latest technologies, and avoiding new technologies without a clear link to educational goals. In response to the second question in the written questionnaire, TS7 wrote, "Using something just because it is a new trend is the same as using an outdated technology—ineffective." In response to the fourth interview question, TD6 stated, "Technological change for the sake of change is not always the best way to go. Others can go there first, and we can learn from their experiences or even mistakes." In responding to the first question in the written questionnaire, TD6 also observed:

> School divisions have an almost overwhelming array of choices of hardware, software, and curriculum from which to choose, and I feel that often we may tempted to try the latest and greatest without always stopping to evaluate whether the latest initiative is sound in general, or a right fit for our mission.

There were 18 coding instances for *curriculum should drive technology rather than technology drive curriculum*, from 9 documents and 6 participants. The results show that this property was of consequence for decision making by placing curriculum concerns at the center of educational technology decision making. TD2 stated this succinctly, "The focus should not be on technology, and technology is not the goal, but rather technology helps to achieve educational goals." Similarly, TD12 stated:

> You should not have the technology as the center of attention, but rather what it's able to do, and allows your students to do. So I think the instructional component needs to be the focus, and how can we use the technology to make that happen.

Other properties associated with *Educational goals and curriculum should drive technology* include *educational technology planning*, and *education market can shape technology development*. Table 21 displays the coding frequency for the category *Educational goals and curriculum should drive technology*, its properties, and dimensions with two or more coding instances.

Table 21

Educational Goals and Curriculum Should Drive Technology, and Coding Frequency

Category	Property or Dimension	Coding Frequency
Educational goals and curriculum should drive technology		235
	consider the intended educational goals for technology	114
	improve student achievement	10
	consider needs of students	10
	consider learning objectives and curriculum content to be taught	8
	improve student learning	8
	assessment of student learning	7
	technology should be transparent to the educational process	6
	accomplish school district goals or mandates	4
	consider do we already have something else that already does this	3
	provide more technology resources for students	3
	enhance efficiency and ease burdens of faculty and staff	3
	technology suited to teachers	3
	increase parental involvement	2
	improve teacher productivity	2
	help the largest number of students	2
	consider technology integration in lesson planning	2
	technology to improve security or safety	2
	assist students with disabilities	2
	don't pursue technology for the sake of technology	71
	consequences of pursuing technology for the sake of technology	21
	• placing focus on latest technology rather than education	5
	• technology sitting on the shelf or wasting of money	4
	• ignoring important issues pertaining to implementation	3
	• failure of the technology initiative	3
	• resistance to technology initiative	3
	• adapting consumer technology before	3

it's completely suitable for education	
take a cautious approach to buying into technology trends	14
technology is not a silver bullet	5
curriculum should drive technology rather than technology drive curriculum	18
educational technology planning	6
education market can shape technology development	6

Note. The coding frequency for the category includes its properties and dimensions. The frequency for properties includes the dimensions under them. Dimensions of properties are indented, and sub-dimensions are bulleted.

Table 22 displays dimensionalized examples for the category *Educational goals and curriculum should drive technology*. Coded segments from the transcripts for the category and its properties are given. Pseudonyms are used for the participants.

Table 22

Dimensionalized Examples of Educational Goals and Curriculum Should Drive Technology

Category or Property	Participant	Dimensionalized Examples
Educational goals and curriculum should drive technology	TD12	"The driving force for technology should be the educational needs of the school or division."
Educational goals and curriculum should drive technology	TD8	"There are no such things as technology initiatives! There are business of education projects designed to meet goals and objectives of student achievement through the use of technology."
Educational goals and curriculum should drive technology	TD4	"I tend to align all of our purchases with educational needs."
Educational goals and curriculum should drive technology	TD13	"Does it fit what our division is trying to do with curriculum, and student achievement?"
consider the intended educational goals for technology	TS5	"If a school system is going to purchase something, we should look at the expected outcome, and consider whether we'll be able

		to get the results."
consider the intended educational goals for technology	TS6	"All our technology initiatives should work towards our goals of student engagement, lifelong learning, and increasing community involvement in what we do. There are more specific goals, for sure, but what we do should fall under one of those three big umbrellas."
consider the intended educational goals for technology	TD10	"The one thing I always try to come back to, whether I'm working with administrators, teachers, or students, is focusing on what they're trying to accomplish, then looking at whatever technology, software, or hardware would benefit them the most."
don't pursue technology for the sake of technology	TD6	"Technological change for the sake of change is not always the best way to go. Others can go there first, and we can learn from their experiences or even mistakes."
don't pursue technology for the sake of technology	TS5	"More times than not I think some look for the silver bullet and jump for a trend when we have not adequately explored our true needs."
don't pursue technology for the sake of technology	TD4	"I'm not a fan of technology for its own sake, and as a decision maker I like to see reasons for implementing technology."
don't pursue technology for the sake of technology	TS9	"If our goal is to implement the latest and greatest technology, we'd be chasing our tails and both the teachers and students would never truly become comfortable with these technologies."
curriculum should drive technology rather than technology drive curriculum	TD13	"As a leader if your philosophy is focused on your students, your focus is then on curriculum driving your technology rather than your technology driving the curriculum."
curriculum should drive technology rather than technology drive curriculum	TD2	"The focus should not be on technology, and technology is not the goal, but rather technology helps to achieve educational goals."
curriculum should drive technology rather than technology drive curriculum	TD12	"You should not have the technology as the center of attention, but rather what it's able to do, and allows your students to do. So I think the instructional component needs to be the focus, and how can we use the technology to make that happen."
educational technology	TS2	"We have a long term Technology Plan that

planning		is updated yearly and an instructional technology plan that is produced yearly that guides our purchases. The instructional technology plan takes the principals' instructional goals and maps out what technology and training is needed in order to fulfill those goals."
educational technology planning	TD13	"You have to have a plan in place, and things will still need to be teacher directed. We still have to be on top of it, the technology can't rule the world, it still has to be teacher directed, everything has to have a plan, stakeholders have to agree, people from the community, the School Board, and the schools."
education market can shape technology development	TS12	"If a product does not exist, education can work with technology partners to come up with solutions."

Consider ethical factors associated with technology. While not as frequent as the two categories *Keep up with technology (or be left behind)* and *Educational goals and curriculum should drive technology*, the category *Consider ethical factors associated with technology* was a prevalent category that linked philosophical thinking to decision making. There were 125 coding instances for *Consider ethical factors associated with technology*, from 42 documents and 29 of the 31 participants.

Technology leaders described how ethical considerations pertaining to technology were taken into account in making decisions about technology. For example, TS10 stated, "I often make technology decisions based on ethics, especially with teaching at the elementary level." TD7 stated, "I believe as leaders we have an overall responsibility to consider ethics in our decision making." TS9 explained, "Being in education, there are many things that we consider in terms of acceptable use policy, understanding age appropriate use of technology, parental permission, and ensuring safeguards."

In terms of specific ethical considerations taken into account by the technology leaders, one property emerged from a majority of the participants, *consider Internet safety for students*, with 53 coding instances from 25 documents, and 20 participants. TS4 stated, "Protecting children's privacy is my highest priority as far as making a decision about using a particular technology." TS9 stated, "One particular ethical consideration that greatly impacts my decision making when implementing technologies is child safety." In responding to the third question in the written questionnaire, TS10 wrote:

> With teaching at the elementary level. These students are at the baseline of exposure to technology and really truly starting to understand the magnitude for which we use technology. Many of the things I do with them are influenced by terms of agreement, Internet safety.

Technology leaders described the importance of providing instruction for students in Internet safety. In responding to the opening interview question, TS1 stated, "Students need instruction in Internet safety issues, because they often do not understand issues such as privacy of personal information. Students seem surprised when they learn how easy it is to find personal information online." In responding to the written questionnaire, TS6 wrote, "We have an ethical obligation to underlay all instruction with respect for ourselves and neighbors, including with regards to digital tools."

Technology leaders also described concerns about the logistics of Internet content filtering, and monitoring student access. In response to the written questionnaire, TD12 wrote, "Monitoring at all levels is necessary in order to make sure students are not encountering things they shouldn't when they're online." Participants described implementing different age appropriate levels of Internet content filtering. For example, TD1 stated, "High school and elementary students may need different levels of access and certainly different levels of content filtering."

Another property within this category was *consider equitable access to technology – digital divide*, with 21 coding instances from 12 documents and 12 participants. Equitable access to technology by students is a concern that affected the decision making of participants. TD9 stated, "This should be a major focus, getting technology into the hands of kids to give them the mechanism to have equal opportunities." TD6 wrote, "Certainly one consideration that is always part of our decision making is equity," and then elaborated:

> We may choose for example to purchase devices at the division level and make them available within the classroom. Or perhaps we might offer a loaner program so that students who may not be able to afford an iPad, for example, could check one out from the media center as a long term loan.

Technology leaders may take into account possible disparity of access as they make decisions pertaining to technology initiatives. In response to the sixth interview question, TS13 stated:

> The county we live in is not a wealthy county, but we have worked hard with grants to make technology available. Elementary student have iPads, but we have to watch what we do in class because not every child has Internet access at home. We have to remember this and take the disparity of access into consideration because not every child could complete the assignment at home.

Similarly, TD7 stated, "Internet access for students at home may be a challenge for this initiative, so the digital divide comes into play on this."

The property *consider copyright issues and plagiarism* had 10 coding instances from 8 documents and 7 participants. In response to the third question on the written questionnaire, TS2 wrote, "In these days of cut and paste, it seems that every school needs to invest in plagiarism detection subscriptions. Students need to know before they get to college that stealing someone else's information is illegal and immoral." This ethical consideration also was a concern for leaders in their approach to collaborating with classroom teachers to encourage appropriate technology integration by students. TS12 wrote, "When I assist teachers and students in creating media projects, I am an advocate for responsible media use and respect for laws and intellectual property."

Table 23 displays coding frequencies for the category *Consider ethical factors associated with technology*, and properties under this category with 3 or more coding instances. Table 24 shows dimensionalized examples from the transcripts for the category *Consider ethical factors associated with technology.*

Table 23

Coding Frequency for Consider Ethical Factors Associated with Technology

Category or Property	Coding Frequency
Consider ethical factors associated with technology	125
consider Internet safety for students	53
consider equitable access to technology – digital divide	21
consider copyright issues and plagiarism	10
consider acceptable use policy	8
consider stewardship of public monies	4
consider parental permission	3
consider environmental sustainability	3

Note. The coding frequency for the category includes its properties.

Table 24

Dimensionalized Examples of Consider Ethical Factors Associated with Technology

Category or Property	Participant	Dimensionalized Examples
Consider ethical factors associated with technology	TD7	"I believe as leaders we have an overall responsibility to consider ethics in our decision making."
Consider ethical factors associated with technology	TS10	"Yes, I often make technology decisions based on ethics, especially with teaching at the elementary level."
Internet safety for students	TD9	"One should constantly monitor the latest fads (trends) in all areas of social communications and the use of technological advances, and always strive to always keep students and staff from hurting others or themselves. We can sometimes be proactive in this regard, rather than reactive. This is nearly a full-time job."
Internet safety for students	TS1	"Students need instruction in Internet safety issues, because they often do not understand issues such as privacy of personal information."
Internet safety for students	TS9	"One particular ethical consideration that greatly impacts my decision making when implementing technologies is child safety. I always make sure that I am aware of all the aspects that go into a project that might compromise the safety of the students."
consider equitable access to technology – digital divide	TD6	"We want to make sure that every student has equal access to whatever technology we seek to integrate into the division."
consider equitable access to technology – digital divide	TS6	"We'll likely always face some type of digital divide. But in terms of what we do, we have to provide a level playing field in terms of access to knowledge and information, software tools, and access to classes and coursework."
consider equitable access to technology – digital divide	TS6	"We may choose for example to purchase devices at the division level and make them available within the classroom. Or perhaps we might offer a loaner program so that students who may not be able to afford an iPad, for example, could check one out from the media center as a long term loan."
consider copyright issues	TS2	"In these days of cut and paste, it seems that

and plagiarism		every school needs to invest in plagiarism detection subscriptions. Students need to know before they get to college that stealing someone else's information is illegal and immoral."
consider acceptable use policy	TD9	"You can't just implement things without first considering the legal ramifications, the potential damage that might be caused. When you're dealing with kids, I remember the old joke, in the past if a fight occurred the principal would make us sit in two separate rooms for awhile and then afterward we'd get along fine. Now they practically call in the National Guard."
consider stewardship of public monies	TS6	"So in planning you have to put your values in the right place, there's the ethical factor of spending large amounts of money on gizmos and gadgets. We say kids like that stuff, it is certainly engaging. Kids prefer the computer lab rather than filling out a worksheet. But that's not the mere reason why we use technology in schools."
consider parental permission	TS9	"There are often sites that some of the students I work with cannot ethically create an account for because the Terms of Use require a particular age they do not meet. This often results in either termination of the project idea or a parental permission slip."
consider environmental sustainability	TS11	"Ethical considerations that may impact my decisions regarding technology purchases would be the sustainability and disposal of the equipment. Throwing huge computers and monitors into landfills is not something that should be occurring in our economy and environment. Smaller units, laptops, iPads, and other handhelds use less energy and require fewer disposals."
technology does not replace face-to-face communications	TD4	"I resist the way some people want to replace personal interactions with technology. Technological communications methods are impersonal and easy to misinterpret. I believe it is more ethical to sit down face-to-face when a real issue develops so all involved get a full understanding of what is going on."

Consider philosophy of instructional technology. Two other categories in the coding system that were pertinent for how philosophy of technology influenced decision making were *Consider philosophy of instructional technology*, and *Philosophy of technology for 21st century skills is influential.* Coding instances for these categories involved occurrences in the transcripts when participants described how these philosophies influenced decisions concerning technology integration. There were 40 coding instances for *Consider philosophy of instructional technology* from 25 documents and 19 participants. Within *Consider philosophy of instructional technology* the property *technology to engage or motivate students* was the most frequent, with 22 coding instances. TS6 wrote, "All our technology initiatives should work towards our goals of student engagement." TS14 wrote, "When I think of adopting a new technology initiative, I think of how engaged the students will be using it." In elaborating on this philosophy, TS14 stated in the interview:

> A couple years ago I received a grant to purchase and incorporate iPads, and my concern for interesting students influenced my thinking and decision to write the grant. I thought students would be very engaged with something like iPads, helping connect with content.

TD11 recalled that in working as a classroom teacher, "I thought about how engaged the students were when I rolled the SMART Board into my classroom." TD11 explained, "This influenced my decision to become part of technology integration because it meant so much to me to see students so involved."

Philosophy of technology for 21st century skills is influential. There were 10 coding instances for *Philosophy of technology for 21st century skills is influential* from 7 documents and 5 participants. While limited to five participants, this category also included instances when technology leaders described how this particular philosophy influenced their decisions. For example, in responding to the second interview question, TD11 stated, "It impacts what I buy, what I encourage people to buy, how we do our staff development training, and how I work with the ITRTs in my department, all of those things." Technology leaders also described how a philosophy of technology centered on 21st century skills influenced interactions and conversations with other educators. TS12 stated, "One of the things I do when coaching teachers in using technology, is I'm informed by our district's model for 21st century skills. Our philosophy and this model rely on the different components of 21st century skills." Similarly, TS16 stated:

> I have participated in many conversations around how our students learn and the importance of integrating 21st century skills (or technology) into their instruction. Teachers tend to think they must deliver all of the knowledge and that they must be the experts imparting their wisdom. However, students delve deeper and retain knowledge more when they are the discovers of information.

Table 25 displays dimensionalized examples for the categories *Consider philosophy of instructional technology*, and *Philosophy of technology for 21st century skills is influential*. Coded segments from the transcripts for the categories and properties are given. Pseudonyms are used for the participants.

Table 25

Dimensionalized Examples for Consider Philosophy of Instructional Technology, and Philosophy of Technology for 21st Century Skills is Influential

Category or Property	Participant	Dimensionalized Examples
consider philosophy of instructional technology	TS11	"There should be a good balance between face-to-face interaction and technology integration. You shouldn't go overboard with technology integration, nor have classroom instruction with no technology integration, there should be a balance."
consider philosophy of instructional technology	TS6	"A lot of debate centers around what is appropriate instruction with technology. I do not believe in drill and kill software in most instances and despite that being readily for sale by vendors, do not want to invest in it. I sometimes have to talk principals etc. out of purchasing these types of subscriptions or software."
technology to engage or motivate students	TS14	"A couple years ago I received a grant to purchase and incorporate iPads, and my concern for interesting students influenced my thinking and decision to write the grant. I thought students would be very engaged with something like iPads, helping connect with content."
technology to engage or motivate students	TD10	"By paring the technology with the social aspects of learning, we can engage students individually as well as at a group level, and maximize that social and individual engagement."
philosophy of technology for 21st century skills is influential	TS12	"One of the things I do when coaching teachers in using technology, is I'm informed by our district's model for 21st century skills. Our philosophy and this model rely on the different components of 21st century skills."
philosophy of technology for 21st century skills is influential	TS16	"I have participated in many conversations around how our students learn and the importance of integrating 21st century skills (or technology) into their instruction. Teachers tend to think they must deliver all of the knowledge and that they must be the experts imparting their wisdom. However, students delve deeper and retain knowledge more when they are the discovers of information."

Results for Research Question 3. What assumptions characterized by technological determinism may be present in leaders' thinking or decision making?

In the section for Research Question 1, results for the category *Technological change is inevitable* were reported. This was a prevalent philosophy of technology, with 149 coding instances from 36 documents and 30 out of 31 participants. See Table 6 for dimensionalized examples of *Technological change is inevitable.* These coding instances involved cases when participants described how they held the philosophical view that technology causes inevitable change in society, an assumption associated with technological determinism (Leonardi, 2008; Leonardi, 2009). An interpretation of these results follows in the section Evaluation of Findings.

Technology causes unintended consequences. There were 117 coding instances for the category *Technology causes unintended consequences*, from 37 documents and 25 participants. Coding instances for this category involved occurrences in the transcripts when participants described the viewpoint that technology can cause unintended consequences that people did not anticipate and cannot control. There were thirteen properties associated with *Technology causes unintended consequences.* Table 26 displays coding frequencies for properties associated with this category.

Table 26

Technology Causes Unintended Consequences and Coding Frequency

Category or Property	Coding Frequency
Technology causes unintended consequences	117
technology depersonalizes or removes some of the human element	27
technology amplifies or accelerates problems that we might face	22
technology accelerates or amplifies ethical issues	16
inappropriate use of technology	8
increased risk of sexual predators	7
students using technology to harm students	6
distractions from learning or off task behavior	6
inherent risks to broad access to Internet in education	5
exposing children to inappropriate content	5
cheating	4
not respecting inappropriate property	4
digital divide	4
security issues	3

Note. The coding frequency for the category includes its properties.

Table 27 displays dimensionalized examples for the category *Technology causes unintended consequences*. Coded segments from the transcripts for the category's properties are given. Pseudonyms are used for the participants.

Table 27

Dimensionalized Examples of Technology Causes Unintended Consequences

Property	Participant	Dimensionalized Examples
technology depersonalizes or removes some of the human element	TS9	"Our students have been engaging in online discussions, and especially in the beginning students would make inappropriate comments, things they would not say face-to-face."
technology depersonalizes or removes some of the human element	TD14	"When using technology, some are more likely to offend or cyber bully someone if there's no face-to-face interaction, they feel the other person isn't real, they perceive it as

		working with a machine. There's a tendency to think of the situation as not real"
technology depersonalizes or removes some of the human element	TD8	"Well, I would say that in the social arena, that when technology allows people to be anonymous, it lowers the social decorum that is normally present in non-anonymous settings."
technology depersonalizes or removes some of the human element	TD12	"Sometimes it can be disparaging things, things they wouldn't say face to face, because they may not see the negative impact. Technology takes away a certain aspect of human interaction that would be there in person."
technology amplifies or accelerates problems that we might face	TD14	"Recently there was the case of a major retailer, and a girl put information out on social media, and the company mined the data, concluding the girl was pregnant, and they sent her coupons soliciting her to buy diapers. The father saw this. The company mined the data and knew the teenage girl was pregnant before her father did."
technology amplifies or accelerates problems that we might face	TS4	"Technology doesn't cause our problems, we still make our choices, but technology makes some types of communication or accessing information possible, in secret, that we may not have done without it."
technology amplifies or accelerates problems that we might face		"We've had problems in the past before technology, but now things move faster because of it."
technology amplifies or accelerates ethical issues	TS6	"Yes, technology can amply the good and the bad – we're using Edmodo with kids, so we must have conversations about things including bullying, and being kind to peers, and we have a responsibility to address these things."
technology amplifies or accelerates ethical issues	TD11	"Then I think there are concerns like property, and ownership and theft, especially around things like music or intellectual property. Can you steal something that is infinitely capable of being replicated? We never really had to think about that before technology."
technology amplifies or accelerates ethical issues	TS5	"Kids are now mimicking things and learning at a younger age through media and access to technology different things that are not appropriate for them."

inappropriate use of technology	TD6	"When many personal devices started incorporating cameras, we had to think about the ways in which students could use their cameras inappropriately, such as in a locker room perhaps."
inappropriate use of technology	TS7	"Teachers are afraid that students will use video equipment to take inappropriate pictures and perhaps engage in sexting"
inappropriate use of technology	TD12	"We can run into issues of using applications that are non-educational and use a lot of bandwidth."
increased risk of sexual predators	TS1	"Creating videos and posting them online to the public – will someone see a student and start to stalk them? Will that be my fault? Therefore, there are some things that do influence my decisions.
increased risk of sexual predators	TS4	"Predators are kind of invisible so we have to protect children."
students using technology to harm students	TD6	"We also try to examine the ways in which students might use a given piece of technology for purposes that are decidedly non-instructional, and in some cases, could cause harm to a fellow student."
students using technology to harm students	TD9	"One should constantly monitor the latest fads (trends) in all areas of social communications and the use of technological advances, and always strive to always keep students and staff from hurting others or themselves."
distractions from learning or off task behavior	TS7	"Students may stray off topic and play video games
distractions from learning or off task behavior	TS16	"Most websites include ads and chat rooms which could distract from the educational environment."
inherent risks to broad access to Internet in education	TS5	"There are educational benefits, productivity benefits, and inherent risks, for having broacher devices and access in education."
inherent risks to broad access to Internet in education	TS7	"Teachers are often afraid that providing students with unlimited access to the Internet will enable them to circumvent filters and view porn sites and other unsuitable web content."
exposing children to inappropriate content	TD12	"For example, if a young student goes online to a news site, they could see information in headlines about more mature topics that parents may not want their children exposed

		to (such as crimes)."
exposing children to inappropriate content	TS9	"It's easier for kids to access inappropriate things on the web, or say inappropriate things online."
cheating	TS7	"Students might try to cheat by texting each other answers."
cheating	TS14	"Devices that use cellular connectivity will have the ability to connect to the web without using a school's WiFi (and filter) which means that items (photos, documents, Facebook posts, tests, etc) can be posted online during school hours (and during classes). These things can be blocked when the device connects through the school filtered WiFi, but would be hard to block if they are connecting through a cellular data plan. Connecting this way could lead to cheating, bullying, and other uses that would be considered unethical."
not respecting inappropriate property	TS8	"For example copyright, students think now if they copy and paste it is fine."
not respecting inappropriate property	TS2	"In these days of cut and paste, it seems that every school needs to invest in plagiarism detection subscriptions. Students need to know before they get to college that stealing someone else's information is illegal and immoral."
digital divide	TD9	"I read an article years ago that the technology boom would result in technology haves and have-nots and separate the planet. I'm kind of afraid of that, because it's somewhat true."
digital divide	TS6	"We'll likely always face some type of digital divide. But in terms of what we do, we have to provide a level playing field in terms of access to knowledge and information, software tools, and access to classes and coursework."
security issues	TD2	"Hackers create viruses that wreak havoc."
security issues	TD9	"The main difference between education and the corporate world is that education tends to blindly view what is new without regard for system security."

Both technology causes social change and social factors shape technology. While not as frequent as the two categories *Technological change is inevitable*, or *Technology causes unintended consequences*, the category *Both technology causes social change and social factors shape technology* involved coding instances from a majority of participants. There were 69 coding instances for this category, from 22 documents and 20 participants. Coding instances for this category involved occurrences in the transcripts when participants held the perspective that technology drives social change, but this occurs alongside an interaction with social factors, with social factors in turn shaping technology.

Many of these coding instances were in response to the fifth question in the interview. TS15 responded, "When there's a need it will feed technology, and when the technology exists, it will feed change as well." TD11 responded:

> Societal wants, needs, or proclivities drive the development and application of technology, but at the same time, the possibilities inherent in technology sometimes cause shifts and changes in society and culture.It's kind of a chicken and egg conversation, all of it mixes together.

TS16 asserted, "I really think it starts out with technology causing social change, and then it shifts to social factors shaping the technology." TD16, then continued:

> As social networking has developed, our needs and wants are now driving the products that are being developed and coming to us. Before we just didn't know what technology could do, but now we have an understanding of what technology can do, so we begin to ask for things, and the developers begin to change things.

Table 28 displays coding frequencies for the category *Both technology causes social change and social factors shape technology*, and its properties. Table 29 shows dimensionalized examples from the transcripts for the category *Both technology causes* *social change and social factors shape technology*, and properties with three or more coding instances.

Table 28

Coding Frequency for Both Technology Causes Social Change and Social Factors Shape Technology

Category or Property	Coding Frequency
Both technology causes social change and social factors shape technology	69
students are digital natives	13
technology amplifies social movements	3
learning as social interaction through technology	2

Note. The coding frequency for the category includes its properties.

Table 29

Dimensionalized Examples of Both Technology Causes Social Change and Social Factors Shape Technology

Category or Property	Participant	Dimensionalized Examples
Both technology causes social change and social factors shape technology	TD14	"That's a complex question, it's a little of both. Technology affects social factors and social factors affect technology, and they bounce and it's almost an infinite loop."
Both technology causes social change and social factors shape technology	TS11	"Societal wants, needs, or proclivities drive the development and application of technology, but at the same time, the possibilities inherent in technology sometimes cause shifts and changes in society and culture. It's kind of a chicken and egg conversation, all of it mixes together."
Both technology causes social change and social factors shape technology	TS16	"I really think it starts out with technology causing social change, and then it shifts to social factors shaping the technology."
Both technology causes social change and social factors shape technology	TS6	"The technology does change our habits. But we still have our interests, so we can shape our tools."
students are digital natives	TS5	"I think that students learn differently today than when I was young."

students are digital natives	TS5	"The idea of going to an encyclopedia, they were not interested in that. But in terms of electronic databases, they were all over that."
technology amplifies social movements	TS6	"With something such as Second Life, you can change your persona. In the past, people may have wanted to go to a masked ball or live a secret life, and now that life is available, Second Life provides an avenue for social tendencies that people had in the past."

Technology causes social change. The category *Technology causes social change* involved 58 coding instances from 17 documents and 17 participants. Coding instances for this category involved occurrences in the transcripts when participants held the perspective that technology is the main cause of social change. Many of these coding instances were in response to the fifth question in the interview. TS 9 stated, "I think that once technology is in place, it causes social change, we're texting or emailing or Facebooking instead of communicating face-to-face." TD3 sated, "Society has changed because of technology," and then continued, "Fewer kids are playing outside, they're inside playing games on tech devices, playing by themselves more, and social skills don't develop as quickly." TD9 observed, "Technology drives change. Education doesn't change technology."

Properties associated with *Technology causes social change* included, *causing people to avoid face-to-face interactions*, *technology accelerates social change*, *social networking or social media causes social change*, and *more isolation because of technology*. Table 28 displays coding frequencies for the category *Technology causes social change*, and its properties. Table 29 shows dimensionalized examples from the transcripts for the category *Technology causes social change*, and properties with four or more coding instances.

Table 30

Coding Frequency for Technology Causes Social Change

Category or Property	Coding Frequency
Technology causes social change	58
causing people to avoid face-to-face interactions	10
technology accelerates social change	8
social networking/social media causes social change	8
more isolation because of technology	4

Note. The coding frequency for the category includes its properties.

Table 31

Dimensionalized Examples of Technology Causes Social Change

Category or Property	Participant	Dimensionalized Examples
Technology causes social change	TS9	"I think that once technology is in place, it causes social change, we're texting or emailing or Facebooking instead of communicating face-to-face."
Technology causes social change	TD3	"Society has changed because of technology. Fewer kids are playing outside, they're inside playing games on tech devices, playing by themselves more, and social skills don't develop as quickly."
Technology causes social change	TD9	"So technology drives change. Education doesn't change technology."
causing people to avoid face-to-face interactions	TD3	"Students may be texting instead of going to talk in person with a friend who is close by.
causing people to avoid face-to-face interactions	TD4	"I know for instance around here email is a necessity, but it has replaced face to face meetings, and has made it easier to make decisions without facing others."
causing people to avoid face-to-face interactions	TS11	"People are interviewing for jobs and they don't know how to carry on a conversation or ask questions."

technology accelerates social change	TS10	"If you look at the opportunities technology provide to us, even when I was younger, I would never have even thought about the ways that we network with others through social media. There are problems socially that we've never had to deal with before that are affecting us how."
technology accelerates social change	TD1	"Technological change allows for social change to take place more rapidly. Previously with print, change would take longer, but with electronic communications and social media, change takes place more rapidly."
technology accelerates social change	TD15	"With the abilities of modern information technology in particular, the speed of its ability to change social interaction is accelerating this process of social change."
more isolation because of technology	TD3	"If you've been brought up with technology, there can be more isolation than what would otherwise have been normal."
more isolation because of technology	TD12	"However, technology has already changed society, we're more connected, but there's less face- to-face and more computer interaction, we're a little more isolated."

Technology takes precedence over values or other norms. The property of *technology takes precedence over values or other norms* was a consequence associated with the category *Keep up with technology (or be left behind).* There were 27 coding instances for this property, from 16 documents and 13 participants. Coding frequency for this property and its dimensions are provided above in Table 18. A discussion and interpretation of the findings associated with *technology takes precedence over values or other norms* is provided in the section Evaluation of Findings. Table 32 provides dimensionalized examples for *technology takes precedence over values or other norms.*

Table 32

Dimensionalized Examples of Technology Takes Precedence Over Values or Other Norms

Property	Participant	Dimensionalized Examples
risks to students should not stop technological change in schools	TD7	"I embrace technological change because it's going to come, and I want to get ahead of it. I focus on getting ahead of the pace of change. It also means loosening controls on Internet access."
risks to students should not stop technological change in schools	TS6	"If we had a cooking class but didn't give kids knives because they might cut themselves, that wouldn't work very well. We have to be of the mindset that cuts, scrapes or bruises will happen, that can't stop us from pursuing the use of the technology."
risks to students should not stop technological change in schools	TS5	"Resisting change is futile, but as far as the school goes we should use optimistic caution, we should realize some of the risks and try to minimize the negative aspects."
implement technology without sufficient evidence from academic research	TS2	"I would like to say that it is solid research that influences me, but I don't need research to see students get excited using response systems, iPads, and interactive whiteboards. The game has changed and research cannot keep up with the changing tide, and I don't want my students left behind."
implement technology without sufficient evidence from academic research	TS16	"I have experienced technology initiatives that are driven by money or appearance of support rather than data of how well it supported students."
rapid technological change can make it difficult to focus on educational needs	TS11	"As educational professionals we try to always remain focused on what is in the best interest of our students. With the rapid changes in technology, it is often difficult to make those determinations."
rapid technological change can make it difficult to focus on educational needs	TS5	"More times than not I think some look for the silver bullet and jump for a trend when we have not adequately explored our true needs. Trends sometimes pass quickly or repeat themselves, which to me means that it didn't really work. Without

		really evaluating at what is needed how can we know what to use?"
ethical norms changing because of technological change	TD13	"We tell the students about this all the time, some of the things like plagiarism may not be considered plagiarism in the future."
ethical norms changing because of technological change	TD12	"As technology changes, the definitions of ownership, copyright, and plagiarism are likely to change."

Evaluation of Findings

The Evaluation of Findings section will interpret the results in light of the literature, including theories and conceptual frameworks pertaining to philosophy of technology. The evaluation will compare and contrast the findings of this study to findings from other studies. This section presents a substantive theory pertaining to philosophy of technology in K-12 educational technology leadership, surrounding the core category that emerged from the study, *Keep up with technology (or be left behind).*

Instrumental view of technology. In the section detailing the findings for Research Question 1, it was reported that the perspective *Technology is a tool* was a prevalent philosophy of technology. Participants often described how their philosophy of technology was characterized by viewing technology as a tool. This perspective *Technology is a tool* aligns with the instrumental view of technology, a popular and widely held philosophy of technology (Franssen et al., 2009; Jackson, 2010). The instrumental view of technology considers technology as a tool, as means put to use by users for their purposeful ends (Berger, 2011; Feenberg, 1991; Heidegger, 2009).

The instrumental view of technology employs a means and ends reasoning that starts with emphasizing the purposeful ends that one wishes to realize through a technological solution, and then proceeds toward identifying possible means of achieving those ends (Kroes et al., 2009). Under means and ends reasoning, the normal and appropriate role for educational technology would be the means to achieve the educational ends intended for it (Kanuka, 2008), shaping technology to suit educational needs and requirements (Jones & Czerniewicz, 2010). It is evident from the results that the instrumental perspective of seeing technology as a means to achieve educational ends was prevalent among the participants. In the section for Research Question 2, it was reported *Educational goals and curriculum should drive technology* emerged as a widespread approach to technology decision making linked with the philosophy *Technology is a tool.* Within this category the property *consider the intended educational goals for technology* involved coding instances from 28 participants.

The instrumental view of technology considers technology as a means to an end, not an end itself (Berger, 2011; Russo, 1998), and such a view was present in the findings in two properties associated with the category *Educational goals and curriculum should drive technology.* The property *don't pursue technology for the sake of technology* was associated with 24 participants. For example, TD4 stated, "I'm not a fan of technology for its own sake, and as a decision maker I like to see reasons for implementing technology." A similar property, *curriculum should drive technology, rather than technology drive curriculum*, also emerged from the data. For example, TD13 stated, "As a leader if your philosophy is focused on your students, your focus is then on curriculum driving your technology rather than your technology driving the curriculum." This perspective is in alignment with a respected textbook example of what constitutes appropriate technology integration, characterized by curriculum driving technology integration, rather than technology driving curriculum (Shelly et al., 2008).

In interpreting these results, the instrumental view of technology, as evidenced by *Technology is a tool*, is an overarching philosophical view, that when considered from the lens of the Corbin and Strauss (2008) coding paradigm, shows itself to be a macro level context, a broad philosophical perspective from which individuals think and respond. In the Results section for Research Question 2, findings were reported showing the linkage between the category *Technology is a tool* and the category *Educational goals and curriculum should drive technology.* The data supports the interpretation that the approach to decision making *Educational goals and technology should drive technology* is a consequence of holding the instrumental view of technology. Figure 2 depicts the instrumental view of technology as an overarching philosophy of technology, and its relationship to the decision making practice *Educational goals and curriculum should drive technology.*

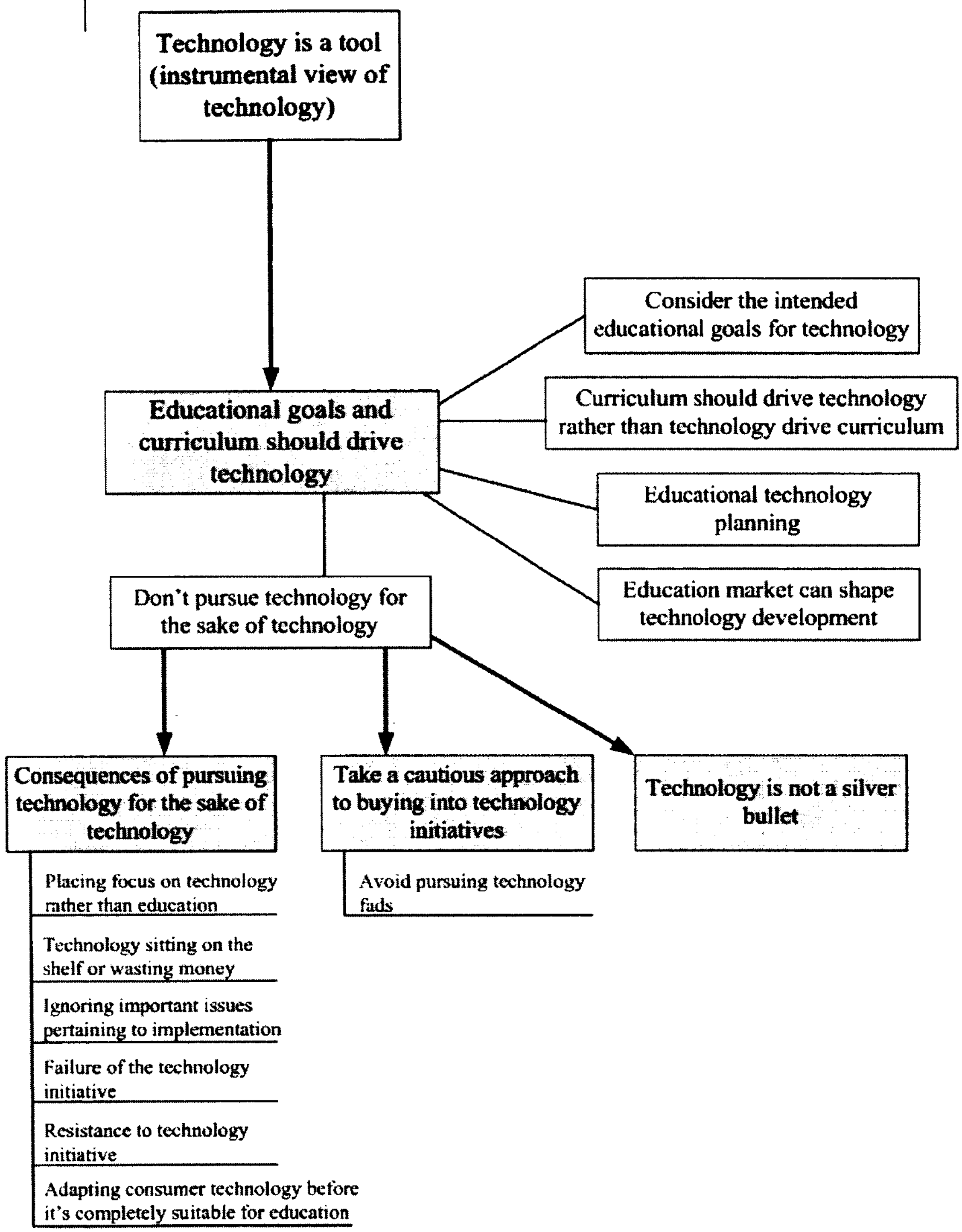

Figure 2. Instrumental view of technology, and its relationship to the decision making practice Educational goals and curriculum should drive technology.

Technology and values. The property *technology is value neutral*, within the category *Technology is a tool*, matches up well with a philosophical position connected with the instrumental view of technology, called the neutrality thesis (see Chapter 2 discussion of the instrumental view of technology). The neutrality thesis considers technology as neutral with regard to values, and assumes there are no inherent moral implications in using technology (Vermaas, 2011). Examples in the transcripts included TS3, who stated, "Technology is neutral with respect to values," and TD15, who stated, "While a powerful tool, technology itself is ethically neutral." However, while the instrumental view of technology was prevalent among the participants, its property *technology is value neutral* was not widespread, and only involved eight participants.

Hofmann (2006) proposed the theory technology is value laden, which contrasts with the neutrality thesis. The results showed the category *Technology raises questions of human values* was associated with 22 of the 31 participants. The philosophical view represented by this category aligns with Hofmann's theory that technology is value laden. The position that technology is value laden, rather than value neutral, does not mean differentiating between good technology and bad technology (Hofmann, 2006). The emphasis rather is that technology raises questions of human values, either through promoting particular values, or because the employment of technology has ethical consequences, whether intended or unintended (Hofmann, 2006).

In arguing that educational technology is value laden, Amiel and Reeves (2008) asserted that often people have a limited view of educational technology focused on specific technological devices, rather than a broader representation of technology as a process and value laden system. Amiel and Reeves held that neither education nor technology are value neutral, but rather educational technologies are interconnected with agendas, economics, and social needs and consequences. The philosopher Feenberg (1991), who critiqued the instrumental view of technology, argued, "Modern technology is no more neutral than medieval cathedrals or The Great Wall of China" because technologies embody, like those constructions, the values of the civilizations that built them (p. 3).

The findings show the instrumental view as a whole was a prevalent philosophy of technology, but its normal property, technology is value neutral, was only associated with eight participants. This surprising finding might be interpreted as a possible case of cognitive dissonance between *technology is value neutral*, and *Technology raises questions of human values*. Festinger's theory of cognitive dissonance posits that persons experience discomfort or unease when they encounter new information that contradicts their previously held assumptions or beliefs (Sullivan, 2009). Cognitive dissonance can result in defense mechanisms such as dismissing new information, ignoring the conflict, or resolving the differences in an incomplete way (Sullivan, 2009). When a person considers two views that are inconsistent with each other, cognitive dissonance posits that the person weighs the importance of the cognitions, and may add or subtract from the alternatives to reduce the inconsistency (Harmon-Jones, 2009). Figure 3 displays the relationship between the contrasting philosophical perspectives *Technology is value neutral* and *Technology raises questions of human values*, and the greater weight given to the latter.

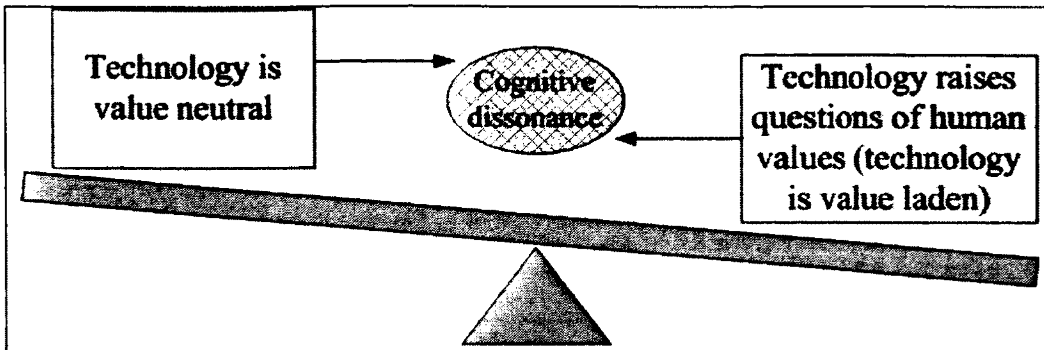

Figure 3. Technology is value neutral vs. Technology raises questions of human values.

Consider ethical factors associated with technology. *Consider ethical factors associated with technology* involved coding instances from 29 participants. The philosophical perspective associated with this category aligns with the approach to technology and values taken in the national framework for K-12 educational technology leadership (Consortium for School Networking, 2011). This framework addresses ethical considerations that are integral to responsible technology leadership, including Internet safety for students, computer security, equitable access to technology, copyright compliance, personal privacy, and environmental protection and energy saving practices. The ethical considerations in the national framework were represented in the participants' responses, including Internet safety, personal privacy, equitable access to technology, copyright compliance, and environmental sustainability.

Keep up with technology (or be left behind). The Finding sections presented the results that show *Keep up with Technology (or be left behind)* emerged as the core category in the study, the central phenomenon that often concerns technology leaders. Corbin and Strauss (2008) explained that during data analysis, the core category should continue to grow in explanatory relevance. While other categories and philosophical perspectives were also prevalent, *Keep up with technology (or be left behind)* came forward at the beginning of the process of data collection and analysis. As axial coding progressed, *Keep up with technology (or be left behind)* emerged as the core phenomenon that linked other important categories, with its properties and dimensions (see Table 19) involving instances from all 31 participants.

Strobel and Tillberg-Webb (2009) discussed how within education, there can be the idea, associated with technological determinism, that students and educators "have to keep up with the technologies or be left behind" (p. 78). It is important to note, that while the researcher had seen this usage from Strobel and Tillberg-Webb, *Keep up with technology (or be left behind)* reappeared in-vivo in transcript narratives in various forms, often expressed in those words, or variations of them (see Table 19). Strobel and Tillberg-Webb (2009) also discussed the idea of catching up with technological innovations, as did Kritt and Winegar (2010). Instances in the transcripts also used the language of catching up with technology.

The philosophy of technology assumption *Technological change is inevitable* was prevalent, present in the thinking of 30 participants. Discourse about the inevitability of technological change was a consistent theme in the study. Similarly, Leonardi (2008) found from a study of technology managers in the private sector that a "discourse of inevitability" created an ideological orientation toward technological change (p. 975). Leonardi and Jackson (2004) found that managers presented organizational change as being inevitable because technological change was perceived as inevitable.

A similar phenomenon of an ideological orientation toward technological change appears to be present in this study of educational technology leaders. The results presented for Research Question 2 show that philosophical thinking surrounding *Technological change being inevitable* links with the response to technology decision making *Keep up with technology (or be left behind)*. For example, TS2 stated, "Technological change is inevitable and we should not resist it. That is my philosophy!" TS2 then continued

> Our students have surpassed us in technology, and we need to catch up with them. There is no stopping technology, if we embrace it for what it can do for education, everybody will be happier all around. All the time you have to keep up with technology, it's a constant challenge.

This can be interpreted as an ideological orientation to technological change, similar to what Leonardi (2008) found in a study of technology managers in the private sector. The data showed that in deliberating on technology decisions, participants can be influenced by their belief that technological change is inevitable. In their thinking and decision making, participants had an ideological orientation to perceived inevitable technological change, lived out by the approach *Keep up with Technology (or be left behind)*. For example, TS11 stated, "As fast as technology changes, in education we should keep up with it or be one step ahead, but we're usually one step behind."

***Technological imperative*.** The core category that emerged from the data, *Keep up with technology (or be left behind),* can be interpreted as a manifestation of a perspective called the technological imperative, described by some scholars as associated with technological determinism (Chandler, 1995; Cukier et al., 2009; Hofmann, 2006). The technological imperative involves rhetoric and underlying assumptions that technology has a controlling influence (Hofmann, 2006) that is inevitable and unstoppable (Chandler, 1995; Cukier et al., 2009; Leonardi, 2008) and creates an imperative to keep up with technological developments or be left behind (Strobel &

Tillberg-Webb, 2009). The category *Keep up with technology (or be left behind)* was closely linked in the data with viewing technological change as inevitable, and the perceived imperative within schools to keep up with this technological change. TS8 stated, "My philosophy is that technology is imperative for today's schools and for other sectors, it's growing in leaps and bounds. Not all technology is good, but it's an unstoppable force, and it has to be used and harnessed properly."

Hofmann (2006) discussed that under the technological imperative, technology appears to determine our choices, and emphasized that the technological imperative views technology as in control. While the findings showed a strong link with viewing technological change as inevitable, and an imperative to keep up with this change, the data showed only week linkage with viewing technology as in control. An exception involved TS6, who stated in the interview, "Obviously technology is inevitable, it's happening, it's uncontrollable, so on a philosophical level you have to embrace the technology and assume it's always going to be there." In their interest to *Keep up with technology (or be left behind)*, rather than being motivated by a view that technology is in control, the data showed that most participants expressed concern for keeping up with technology in order to benefit students. The perceived imperative *Keep up with technology (or be left behind)* encompassed the properties *prepare students for a technological future, prepare students to get ahead through technology competency*, and *prepare students to get ahead through 21st century skills.*

The core phenomenon *Keep up technology (or be left behind)* had two main properties, *pressure to keep up with technology*, and *resistance to technological change.* Based on the instances from the transcripts, there is evidence that *pressure to keep up* *with technology* has an emotional influence on leaders and other users of technology. Kritt and Winegar (2010) discussed how technological change places pressure on schools to play a game of catch up. Selwyn (2010b) discussed how the rapid pace of technological change places pressure on educational technologists to keep abreast of technological innovation. Pressure on educators to keep pace with evolving technology can leave less time for considered judgment and contemplative leadership (Canole, 2007; Selwyn, 2010b).

We can interpret from the data that the two categories *pressure to keep up with technology*, and *resistance to technological change*, are competing perspectives in tension with each other. Participants often described how teachers in schools are resistant to implementing new technological innovations. For example, TD12 stated:

> I think education is a very, very hard area to change, it tends to be very, very resistant to change, you've got a lot of folks who are not as comfortable with technology as the kids are, and that's a big divide there, and that holds us back.

The study's results, showing pressure to implement technology occurring alongside resistance, appears to lend support to Rogers' model of technological innovation. This model theorizes that technological innovation proceeds alongside resistance from users in varying degrees (Friesen, 2008). The theme of resistance to technological change emerging from this study is similar to the resistance to change theme found by Cukier et al. (2009) in their qualitative study that used critical analysis to examine media discourse surrounding a technology initiative at a Canadian university.

Figure 4 depicts *Keep up with technology (or be left behind)* and its properties, as a technological imperative following from the philosophy of technology assumption *Technological change is inevitable*. It shows the tension between *pressure to keep up* *with technology* and *resistance to technological change.* Weighted priority is placed by educational technology leaders on *pressure to keep up with technology*, as they struggle with resistance to technological change in their organizations.

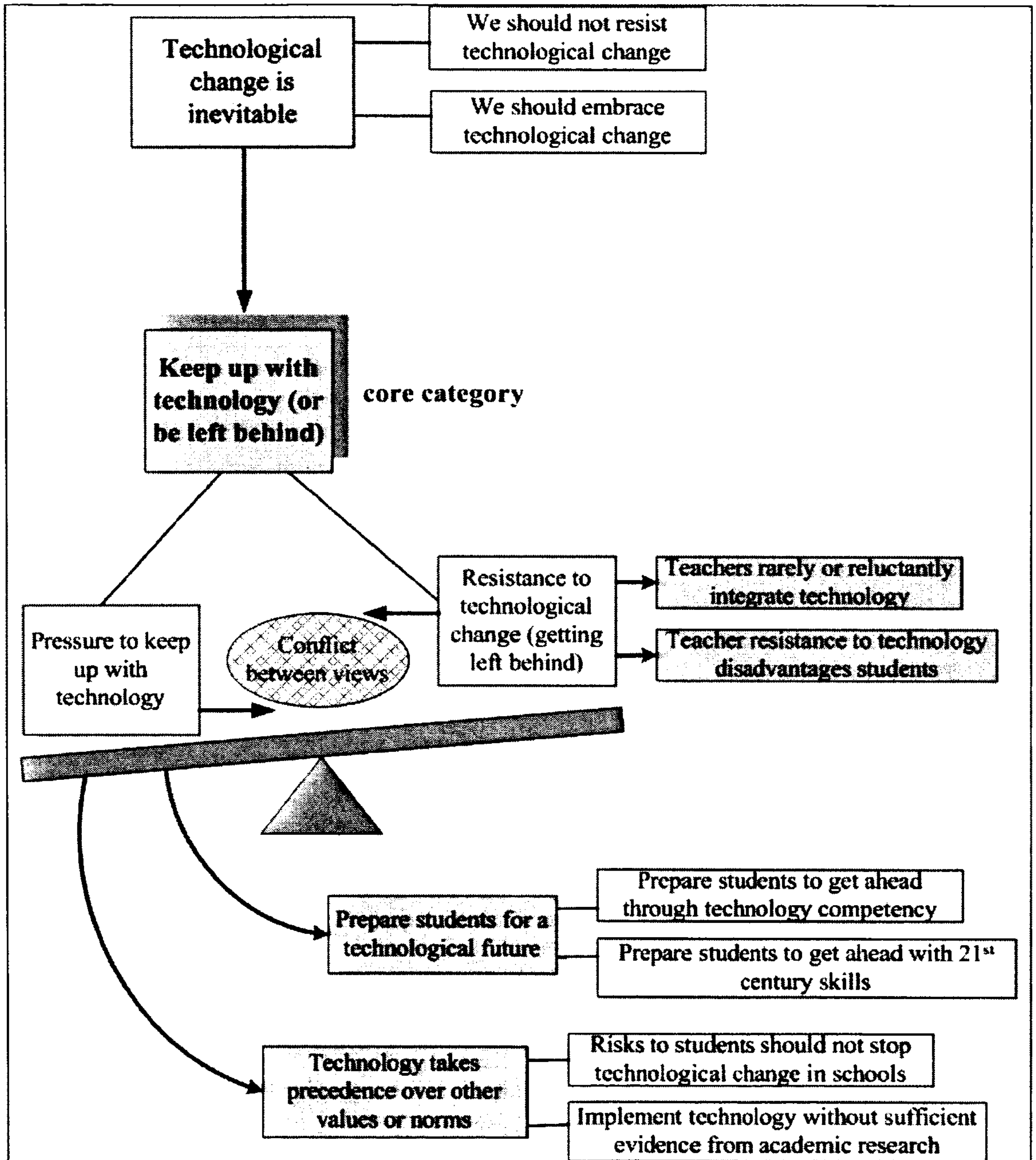

Figure 4. The imperative Keep up with technology (or be left behind) and its properties, following from the assumption Technological change is inevitable.

Bimber's conceptual framework for technological determinism. Bimber proposed three possible accounts of technological determinism including nomological, normative, and unintended consequences. Results of the study show that different categories or properties in the data align with these three accounts of technological determinism in Bimber's conceptual framework (see Chapter 2).

Normative technological determinism. Normative technological determinism posits that if the norms of practice or attitudes of those who employ technology become disconnected from broader ethical criteria, accountability to society, or consideration of means and ends, technology can be understood to have a dominance or autonomy over society (Bimber, 1994; Wyatt, 2008). The property *technology takes precedence over other values or norms* aligns with the normative account of technological determinism. Dimensions of this property included *risks to students should not stop technological change in schools*, *implement technology without sufficient evidence from academic research*, *rapid technological change can make it difficult to focus on educational needs*, and *ethical norms changing because of technological change.*

Meeting curriculum goals for Internet safety of students is a state law in Virginia, and mandated Internet content filtering in schools is a federal law under CIPA. The dimension *risks to students should not stop technological change in schools* involved instances when participants stated that technological change takes priority over normal practices arising from Internet safety of students and CIPA. Minimizing Internet safety and loosening of Internet content filtering appears to be a consequence of *Keep up with technology (or be left behind).* We can interpret this as an example of normative technological determinism, because the norms of practice and attitudes become detached from ethical criteria or accountability to society, in this case as it pertains to the safety of children in using the Internet. The dimension *ethical norms changing because of technological change* involved coding instances in which participants stated that technological change takes priority over ethical norms concerning copyright and plagiarism, that will change because of technological change.

Nomological technological determinism. The category *Technology causes social change,* associated with 17 participants, aligns with the nomological account in Bimber's conceptual framework for technological determinism. The nomological variant of technological determinism sees technology acting as the primary cause of social change, and exercising causal influence with one development leading inevitably to another (Bimber, 1994; Vermaas, 2011; Wyatt, 2008). The nomological account sees technology causing social change apart from the social context (Vermaas, 2011). Table 30 above in the Results section reported instances when participants described how technology causes social change.

Unintended consequences. The category *Technology causes unintended consequences*, associated with 25 participants, aligns with the unintended consequences account in Bimber's conceptual framework for technological determinism. This account asserts that technology is partially autonomous, because even when human decision makers willfully approach technology in deliberate and responsible ways, technology can cause unintended consequences that we did not anticipate and cannot control (Bimber, 1994; Jonas, 2009; Vermaas, 2011). Table 27 above in the Results section reported instances when participants described how technology causes unintended consequences. The results from this empirical study lend support to the scholarly work done by Nworie and Haughton (2008), who analyzed the unintended consequences of technology in teaching and learning.

Strobel and Tillberg-Webb humanizing framework for educational technology. The humanizing framework for educational technology proposed by Strobel and Tillberg-Webb (2009) guided this study. Strobel and Tillberg-Webb (2009) argued that educators should critically question their philosophical assumptions and ideological perspectives about technology, because beliefs and ways of thinking about technology influence professional discourse, and affect the actions of decision makers. This framework emphasizes the importance of questioning assumptions about technology, which can correspond to ideological perspectives associated with technological determinism and social determinism (Kanuka, 2008; Strobel & Tillberg-Webb, 2009).

Hard technological determinism and soft technological determinism. The conceptual framework of hard technological determinism and soft technological determinism described by Marx and Smith (1994) is an alternate theory of technological determinism. Hard technological determinism is largely equivalent to Bimber's nomological variant, and attributes agency to technology to the extent that technology has a dominant or determined autonomy of its own to cause social change, independent of social constraints (Marx & Smith, 1994; Smith, 1994; Strobel & Tillberg-Webb, 2009). We can interpret that the category *Technology causes social* change aligns with both nomological technological determinism and hard technological determinism.

Soft technological determinism asserts that technology drives social change, but sees technology as an influence among others, occurring alongside a complex interaction of social, economic, political, and cultural factors (Marx & Smith, 1994; Smith, 1994;

Strobel & Tillberg-Webb, 2009). The category *Both technology causes social change and social factors shape technology*, with coding instances from 20 participants, aligns with the philosophical position of soft technological determinism. Using this interpretation, soft technological determinism was more frequent in the data than hard technological determinism.

Social determinism. In contrast to technological determinism, social determinism assumes that social processes shape the development and evolution of technologies, with the technologies fundamentally embedded in social systems (Kanuka, 2008; Lievrouw, 2006; Strobel & Tillberg-Webb, 2009). The category *Social factors shape technology*, associated with three participants, aligns with the philosophy of technology position of social determinism. This view was not widespread in the results.

Technological utopianism and dystopianism. While the contrast between technological determinism and social determinism is concerned with what causes change, the contrast between utopianism and dystopianism is concerned with valuing the results of technological change (Strobel & Tillberg-Webb, 2009). The humanizing framework for educational technology proposed by Strobel and Tillberg-Webb (2009) also emphasizes the importance of critically analyzing assumptions corresponding to utopianism and dystopianism as it pertains to educational technology. Technological utopianism embraces the promise of technology, and is an optimistic position that presents technological innovation as something for the better (Kritt &Winegar, 2010; Strobel & Tillberg-Webb, 2009; Vermaas et al., 2011). Technological dystopianism (or Luddism) is a pessimistic position generally not open to technological innovation, and resists technological change (Kritt &Winegar, 2010; Strobel & Tillberg-Webb, 2009; Vermaas et al., 2011).

The category *Technological optimism*, associated with 28 participants, is aligned with the perspective of *technological utopianism.* The category *Technological pessimism,* associated with six participants, is aligned with *technological dystopianism.* The category *Technological optimism and pessimism (both present)*, involving 11 participants, included instances when participants expressed how their valuing of technological change was characterized by both optimism and pessimism. The presence of this mixed category in the data lends support to the scholarly work of Kritt and Winegar (2010) and Strobel and Tillberg-Webb (2009) who argued that the dichotomy between technological utopianism and dystopianism does not adequately capture different views about technology. Strobel and Tillberg-Webb (2009) held that moderate positions are possible between the two extremes, and argued that the reductionist nature of the dichotomy calls for the critical examination of philosophical assumptions about technology.

Overview of evaluation of findings. This study found that educational technology leaders were influenced by two main philosophical approaches to technology decision making, represented by the categories *Educational goals and curriculum should drive technology*, and *Keep up with Technology (or be left behind).* The former approach was linked to a philosophy that technology is a tool, interpreted to be in alignment with the instrumental view of technology, a popular and widely held philosophy of technology (Franssen et al., 2009; Jackson, 2010). *Keep up with technology (or be left behind)* emerged as the core category, and main concern of educational technology leaders as they engage in technology decision making. Educational technology leaders are influenced by an ideological orientation to technological change, similar to what Leonardi (2008) found in a study of technology managers in the private sector.

The core category had two main properties that are in conflict with each other, *pressure to keep up with technology*, and the *resistance to technological change* they encounter in schools. The study's results, showing pressure to implement technology occurring alongside resistance, appears to lend support to Rogers' model of technological innovation, which theorizes that technological innovation proceeds alongside resistance from users in varying degrees (Friesen, 2008). The theme of resistance to technological change is similar to the resistance to change theme found by Cukier et al. (2009) in their qualitative study that examined a technology initiative at a Canadian university.

Summary

Chapter 4 presented the research findings, and then evaluated and interpreted the findings in light of philosophy of technology theories from the literature, conceptual frameworks, and findings from other research studies. Chapter 4 began with an overview of the subjects, and a table listing the pseudonyms for the educational technology leaders utilized for reporting the results. A summary of the coding results was given that listed all the conceptual categories that emerged from data analysis, and their frequency.

The research findings were organized and presented according to the study's three research questions. For Research Question 1 concerned with the broad philosophy of technology assumptions present in thinking, three categories were prevalent, including *Technology is a tool*, *Technological change is inevitable*, and *Technological optimism*.

The category *Technology raises questions of human values* was associated with a majority of participants.

The results section for Research Question 2 began by describing the questions in the interview and written questionnaire designed to move from examining what philosophy of technology assumptions were present in thinking, to investigate how assumptions influence decision making about technology. There were five philosophies of technology pertinent for making decisions about educational technology. Three categories related to technology decision making were prevalent, including *Keep up with technology (or be left behind)*, *Educational goals and curriculum drive technology*, and *Consider ethical factors associated with technology*. The category pertaining to technology decision making *Educational goals and curriculum should drive technology* had two major properties, *consider the intended educational goals for technology*, and *don't pursue technology for the sake of technology*.

The core category that emerged from the study, *Keep up with technology (or be left behind)*, had two major properties, *pressure to keep up with technology*, and *resistance to technological change*. There were also three properties under the core category that were closely related, *prepare students for a technological future*, *prepare students to get ahead through technology competency*, and *prepare students to get ahead with 21st century skills*.

The results for Research Question 3 described philosophical assumptions characterized by technological determinism. The categories *Technological change is inevitable* and *Technology causes unintended consequences* were both prevalent. The categories *Technology causes social change*, and *Both technology causes social change* *and social factors shape technology* involved a majority of participants. Another category pertaining to technological determinism was *Technology takes precedence over values or other norms.*

The Evaluation of Findings section interpreted the findings in light of philosophy of technology theories from the literature, conceptual frameworks, and findings from other research studies. The category *Technology is a tool* was interpreted as aligning with the widely held philosophy of technology known as the instrumental view of technology. It was interpreted that this philosophy is an overarching philosophical view, that when considered from the lens of the Corbin and Strauss (2008) coding paradigm, shows itself to be a macro level context, a broad philosophical perspective from which individuals think and respond. The data supports the interpretation that the approach to decision making *Educational goals and technology should drive technology* is a consequence of holding the instrumental view of technology.

The property *technology is value neutral*, within the category *Technology is a tool*, aligns with a philosophical position connected with the instrumental view of technology, called the neutrality thesis. Although the instrumental view of technology was prevalent, its normal property, technology is value neutral, was only associated with eight participants. It was interpreted that this surprising finding might be a case of cognitive dissonance between *technology is value neutral*, and the category *Technology raises questions of human values*, which aligns with Hofmann's theory of technology as value laden. The category *Consider ethical factors associated with technology* was understood as being in close alignment with the national framework for K-12 educational technology leadership from the Consortium for School Networking (Consortium for

School Networking, 2011). This framework includes ethical considerations that are integral to responsible technology leadership.

The two main properties associated with *Keep with technology (or be left behind)* were *pressure to keep up with technology*, and *resistance to technological change*, which are in conflict with each other. The study's results, showing pressure to implement technology occurring alongside resistance, appears to lend support to Rogers' model of technological innovation. This model theorizes that technological innovation proceeds alongside resistance from users in varying degrees (Friesen, 2008). The theme of resistance to technological change was interpreted as being similar to the resistance to change theme found by Cukier et al. (2009) in their qualitative study that researched a technology initiative at a Canadian university.

The core category *Keep up with technology (or be left behind)* was compared with the literature, and it was interpreted that this core category is effectively an ideological orientation to technological change, similar to what Leonardi (2008) found in a study of technology managers in the private sector. The core category *Keep up with Technology (or be left behind)* was also interpreted as a manifestation of a perspective called the technological imperative, associated with technological determinism (Chandler, 1995; Cukier et al., 2009; Hofmann, 2006). *Keep up with technology (or be left behind)* was construed as a technological imperative following from the philosophy of technology assumption *Technological change is inevitable*, and oriented toward helping prepare students for a technological future.

In interpreting the results pertaining to Research Question 3, the researcher compared the findings with Bimber's conceptual framework for technological determinism. The property *technology takes precedence over other values or norms* was found to be in alignment with the normative account of technological determinism. The category *Technology causes social change* was in alignment with Bimber's nomological account of technological determinism. The category Technology *causes unintended consequences* was in alignment with Bimber's unintended consequences account of technological determinism.

The humanizing framework for educational technology proposed by Strobel and Tillberg-Webb (2009) guided this study. This framework emphasizes the importance of questioning assumptions about technology, which can correspond to ideological perspectives associated with technological determinism and social determinism. Strobel and Tillberg-Webb (2009) used a conceptual framework for technological determinism based on hard and soft technological determinism. The category *Technology causes social change* was interpreted as aligning with hard technological determinism. The category *Both technology causes social change and social factors shape technology* was in alignment with the philosophical position of soft technological determinism. The category *Social factors shape technology* was in alignment with the philosophy of technology position of social determinism.

The humanizing framework for educational technology proposed by Strobel and Tillberg-Webb (2009) also emphasizes the importance of critically analyzing assumptions corresponding to utopianism and dystopianism as it pertains to educational technology. The category *Technological optimism* was equated with the perspective of technological utopianism. The category *Technological pessimism* was equated with technological dystopianism.

Chapter 5: Implications, Recommendations, and Conclusions

An important theme in the literature concerns the importance for educational technology of critically examining philosophy of technology assumptions such as technological determinism (Carr-Chellman, 2005; Fisher, 2006; Hofmann, 2006; Kanuka, 2008; Kritt & Winegar, 2010; McDonald et al., 2005; M. Oliver, 2011; Pearson & Young, 2002; Smith, 2006; Strobel & Tillberg-Webb, 2009; Selwyn, 2010b). Research in fields outside of K-12 education found assumptions characterized by technological determinism were an important factor that influenced technology leadership (Grant et al., 2006; Jackson & Philip, 2010; Leonardi, 2008; Leonardi & Jackson, 2004; Prakash & Sinha, 2008). However, educational technology scholars have argued that research is needed within the field to critically questions technological determinist assumptions, and considers alternate ways of thinking about technology and learning that emphasizes the agency of human actors, and better recognizes the social factors involved with using technology in education (M. Oliver, 2011; Selwyn, 2010b). Such research can better inform professional practice and contribute to what Kanuka (2008) called philosophy in practice pertaining to technology.

The purpose of the qualitative study was to a) examine what philosophical assumptions about technology are present in the thinking of K-12 technology leaders, b) investigate how the assumptions may influence technology decision making, and c) explore whether technological determinist assumptions are present. The research design aligned with Corbin and Strauss qualitative data analysis, and employed constant comparative analysis, theoretical sampling, and theoretical saturation of categories. Subjects involved 31 technology directors and instructional technology specialists from

Virginia school districts, and data collection involved interviews following a semi-structured protocol, and a written questionnaire with open-ended questions.

The substantive area of inquiry for the qualitative study involved the philosophy of technology assumptions that may influence thinking and decision making pertaining to educational technology. The participants in the study were delimited to technology directors and instructional technology specialists from rural, suburban, and urban school districts in Virginia. While technology directors and instructional technology specialists provide leadership for educational technology, these positions are not the only K-12 educators in Virginia who provide leadership for integrating technology into instruction (Virginia Department of Education, 2010). Because the research broke new ground, a limitation of the study is that as future qualitative studies are conducted in the substantive area, it may become necessary to modify the substantive theory to accommodate new data (Polit & Beck, 2008).

No data collection was conducted before the researcher received formal approval from the Institutional Review Board (IRB) of Northcentral University. After receiving formal IRB approval, recruiting began with the researcher coordinating the informed consent process, and approaching potential participants directly, rather than through a third party, to minimize pressure from other parties that might influence the obtaining of free consent. Pseudonyms were used in reporting the data, with no personally identifiable data such as personal names, schools, or school districts being reported.

Chapter 5 discusses the study's implications organized according to the three research questions. Potential limitations of the study's methodology that may have affected interpreting the results are described. The researcher presents recommendations for practical application of the study, and recommendations for future research. Chapter 5 closes with a summary of the qualitative study's conclusions.

Implications

Research Question 1. Research Question 1 sought to examine what broad philosophy of technology assumptions are present in the thinking of K-12 technology directors and instructional technology specialists. The research design aligned with Corbin and Strauss qualitative data analysis, and employed constant comparative analysis and theoretical saturation of categories. Among the categories that emerged were three that represented broad philosophy of technology assumptions that were widespread, including *Technology is a tool*, *Technological change is inevitable*, and *Technological optimism*. Philosophy of technology assumptions corresponding to technological determinism are discussed in the implications for Research Question 3.

The category *Technology is a tool* represents a philosophical perspective found widely among the participants in the study (see Table 3 for coding frequency and Table 4 for dimensionalized examples). The philosophy *Technology is a tool* aligns with the instrumental view of technology. The instrumental view of technology considers technology as a tool, as means put to use by users for their purposeful ends (Berger, 2011; Feenberg, 1991; Heidegger, 2009). The implication is that this overarching philosophical viewpoint of the participants is in alignment with what scholars and philosophers have argued is a popular and widely held philosophy of technology (Franssen et al., 2009; Jackson, 2010). The German philosopher Martin Heidegger, who many scholars have held to be the most influential in the philosophy of technology (Kaplan, 2009b; Lewin, 2010), began his important work *The Question Concerning*

Technology by critiquing the instrumental view of technology (Heidegger, 2009), admitting is strengths, but pointing out its weaknesses (see Chapter 2). The category *Technology is a tool* was found to be directly linked to the category *Educational goals and curriculum should drive technology* (explained below in the implications for Research Question 2).

A surprising finding of the study was that while the instrumental view of technology was prevalent, a philosophical position normally associated with the instrumental view, the neutrality thesis, was only associated with eight participants. The neutrality thesis considers technology as neutral with regard to values, and assumes there are no inherent moral implications in using technology (Vermaas, 2011). On the other hand, the category *Technology raises questions of human values* was associated with 22 of the 31 participants. The researcher interpreted the philosophical view represented by this category to be in alignment with Hofmann's theory that technology is value laden, raises questions of values, and has ethical consequences (Hofmann, 2006).

The researcher concludes that the surprising finding in the study involving educational technology leaders can be explained as a possible case of cognitive dissonance between *technology is value neutral*, and *Technology raises questions of human values*. Festinger's theory of cognitive dissonance posits that persons experience discomfort or unease when they encounter new information that contradicts their previously held assumptions or beliefs (Sullivan, 2009). When a person considers two views that are inconsistent with each other, cognitive dissonance posits that the person weighs the importance of the cognitions, and may add or subtract from the alternatives to reduce the inconsistency (Harmon-Jones, 2009). Figure 3 in Chapter 4 depicted the relationship between the contrasting philosophical perspectives *Technology is value neutral* and *Technology raises questions of human values*, with the greater weight given by participants to the latter.

Discourse about the inevitability of technological change was a consistent theme in this study, and the category *Technological change is inevitable* was linked with 30 participants (see Table 5 for coding frequency, and Table 6 for dimensionalized examples). Leonardi (2008) found from a study of technology managers that a "discourse of inevitability" created an ideological orientation toward technological change (p. 975). The same phenomenon of an ideological orientation toward technological change is evident in this study of educational technology leaders. The implications section for Research Question 2 explains that this ideological orientation toward technological change links with the philosophical response to technology decision making *Keep up with technology (or be left behind)*. The philosophical view that technology causes inevitable change in society is an assumption associated with technological determinism (Leonardi, 2008; Leonardi, 2009). Conclusions pertaining to technological determinism are presented in the implications for Research Question 3.

A third broad philosophy of technology was represented by *Technological optimism* (see Table 7 for coding frequency, and Table 8 for dimensionalized examples). This prevalent category included the widespread property *technology advocacy*. This study was guided by the humanizing framework for educational technology proposed by Strobel and Tillberg-Webb (2009), which emphasizes critically analyzing whether assumptions about educational technology correspond to utopianism or dystopianism, which are concerned with valuing the results of technological change. The category

Technological optimism is in alignment with the perspective of technological utopianism, which embraces the promise of technology with optimism, and presents technological innovation as something for the better (Kritt &Winegar, 2010; Strobel & Tillberg-Webb, 2009; Vermaas et al., 2011). The data showed that 11 of the participants expressed simultaneously both optimism and pessimism with regard to technological change (see Table 11 for dimensionalized examples).

Research Question 2. The second research question moved from examining what philosophy of technology assumptions are present in thinking, to investigate how assumptions influence decision making about technology. Both the interview and the written questionnaire included questions designed to connect philosophical thinking about technology to educational technology leadership or decision making. Two dominant philosophical approaches were found to be important for educational technology leadership and decision making, *Educational goals and curriculum should drive technology*, and *Keep up with technology (or be left behind).*

Educational goals and curriculum should drive technology. *Educational goals and curriculum should drive technology* was a prevalent category (see Table 21 for coding frequency and Table 22 for dimensionalized examples). The data showed *Educational goals and curriculum should drive technology* was found to link directly with the category *Technology is a tool.* The implication is the instrumental view of technology leads to a corresponding approach to decision making that logically follows from the parent philosophy (see Figure 2).

The philosophy represented by *Educational goals and curriculum should drive technology* is similar to what some scholars have argued is the appropriate role for educational technology. The instrumental view of technology considers technology as a tool, as means put to use by users for their purposeful ends (Berger, 2011; Feenberg, 1991; Heidegger, 2009). Under means and ends reasoning, the normal and appropriate role for educational technology would be the means to achieve the educational ends intended for it (Kanuka, 2008). Jones and Czerniewicz (2010) asserted that leaders should shape technology to suit educational needs and requirements.

Many participants articulated the principle that technology should not be pursued for the sake of technology, and the property *don't pursue technology for the sake of technology* was strong. A related property was *curriculum should drive technology, rather than technology drive curriculum.* This perspective is in alignment with a respected textbook example of what constitutes appropriate technology integration, characterized by curriculum driving technology integration, rather than technology driving curriculum (Shelly et al., 2008).

Core category. The most frequent philosophy of technology category in the study, and the dominant approach to technology decision making was *Keep up with technology (or be left behind). Keep up with Technology (or be left behind)* emerged as the core category, the central phenomenon that often concerns educational technology leaders. This category emerged early in data analysis, continued to grow in explanatory relevance, and reappeared in-vivo in transcript narratives in various forms, often expressed in those words, or variations of them (see Table 19). The core category with its properties and dimensions involved coding instances from all 31 participants (see Table 18 for coding frequency and Tables 19 and 20 for dimensionalized examples).

The data showed that *Keep up with technology (or be left behind)* emerged as an approach to technology decision making linked with the philosophy *Technological change is inevitable*. In the implications section above for Research Question 1, it was explained that participants in the study had an ideological orientation to technological change, similar to what Leonardi (2008) found in a study of technology managers in the private sector. The data from this study showed that in deliberating on technology decisions, educational technology leaders are often influenced by the belief that technological change is inevitable. An ideological orientation to technological change is lived out by participants in their approach to technology decision making *Keep up with Technology (or be left behind).*

The researcher makes the argument that the core category is a manifestation of a philosophical perspective called the technological imperative, described by some scholars as associated with technological determinism (Chandler, 1995; Cukier et al., 2009; Hofmann, 2006). The technological imperative involves rhetoric and underlying assumptions that technology has a controlling influence (Hofmann, 2006) that is inevitable and unstoppable (Chandler, 1995; Cukier et al., 2009; Leonardi, 2008) and creates an imperative to keep up with technological developments or be left behind (Strobel & Tillberg-Webb, 2009). However, an implication of this conclusion, following from the data, is participants' concerns surrounding an imperative to keep up with technology were not motivated by a perception that technology was in control. Rather, the data showed that most participants expressed concern for keeping up with technology in order to benefit students (see Table 20). Leading technological change within schools to better prepare students to compete in a global economy with 21st century skills has been an important focus in recent education reform efforts (Schrum & Levin, 2008).

The two main properties of the core category were *pressure to keep up with technology*, and *resistance to technological change*. The data shows schools are under pressure to keep up with the latest technology, and this pressure to keep up with technology has an emotional influence on technology leaders and other users of technology. The study provides support for the assertions of scholars such as Kritt and Winegar (2010), who discussed how technological change places pressure on schools to play a game of catch up, and Selwyn (2010b) who discussed how the rapid pace of technological change places pressure on educational technologists to keep abreast of technological innovation. This can be of consequence, as pressure on educators to keep pace with evolving technology can leave less time for considered judgment and contemplative leadership (Canole, 2007; Selwyn, 2010b).

The theme of resistance to technological change was echoed from a majority of participants, and the most frequent dimension was *teachers rarely or reluctantly integrate technology*. The theme of resistance to technology emerging from this study is similar to the resistance to change theme found by Cukier et al. (2009) in their qualitative study that examined a technology initiative at a Canadian university. A consequence of resistance to technological change in the present study was *teacher resistance to technological change disadvantages students*. The study's results, showing pressure to implement technology occurring alongside resistance, appears to lend support to Rogers' model of technological innovation. This model theorizes that technological innovation proceeds alongside resistance from users in varying degrees (Friesen, 2008).

A limitation of this study as it relates to resistance to technological change, and other concepts, is that while technology directors and instructional technology specialists provide leadership for educational technology, these positions are not the only K-12 educators in Virginia who provide leadership for integrating technology into instruction (Virginia Department of Education, 2010). Other educators including principals and teachers provide leadership for education or educational technology, and research involving those groups may paint a different picture surrounding concerns such as resistance to technological change.

Introduction to Substantive theory. As explained above, the instrumental view of technology (*Technology is a tool*), viewing technology as a means to an end, but not an end in itself, is an overarching philosophy of technology widespread among participants. The data show that the approach to decision making *Educational goals and curriculum should drive technology*, connected with the instrumental view of technology, was a prevalent philosophy of technology. The property under this category *Consider the intended educational goals for technology*, was also prevalent.

However, it is evident from the data that schools are under pressure to keep up with the latest technology. Technology leaders may feel pressure to keep up with technology by making technology comparisons with other school districts, or comparisons with technology owned by students or families (see Table 18, 19, and 20). This pressure to keep up with technology can result in procuring and implementing technology without aligning technology with clear educational goals. For example, the category *Educational goals and curriculum should drive technology* included the property *don't pursue technology for the sake of technology*, which included the dimension *consequences for pursuing technology for the sake of technology.* TD12 observed that when technology is adopted for its own sake, "Everyone has to figure out how to make it work to support division and school needs. In most cases, this leads to resistance from teachers and usually dooms the technology to failure." TS15 observed, "It seems like in the ever-evolving technology world, folks are fast to jump on the bandwagon for the latest and greatest gadget or piece of software without first considering its instructional impact."

An historic example of this quickness to adoption is that many schools invested heavily in Palm Pilots, seeing in them the promise for affordable one-to-one computing, expecting them to become ubiquitous (Johnson, 2005; Schrum & Levin, 2008), when they were headed for obsolescence. Besides the monetary consequences, another consequence of pressures to keep up with technology leading to quick adoptions is not waiting for educational research to make an informed decision. TS2 wrote:

> I would like to say that it is solid research that influences me, but I don't need research to see students get excited using response systems, iPads, and interactive whiteboards. The game has changed and research cannot keep up with the changing tide, and I don't want my students left behind.

Schrum and Levin (2008) advised that educators should wait for research demonstrating educational benefits before pursuing extensive technology investments.

Under the instrumental view of technology, technology is employed as a means to an end, not an end itself, and not for its own sake. In contrast, when viewed from the perspective of inevitable technology, participants described how we should not resist, but should embrace technological change, and there can be a quickness to adopt technology for the sake of technology. In interpreting such results, it appears there is cognitive dissonance between the instrumental view of technology, and the philosophical perspective that technological change is inevitable (see discussion of theory of cognitive dissonance on p. 237). For example, TS16 expressed:

> I feel – and this a struggle – how do we balance this change knowing the new things are coming out, how do we balance with the instructional value? We often feel we're one step behind, not on the cusp of what is available, we're learning about emerging technologies after the rest of the world has learned about them.

Often the same participants who expressed the instrumental view of technology would express an urgency to keep up with technological change. Figure 5 depicts a code matrix showing the same participants holding different philosophy of technology views in cognitive dissonance.

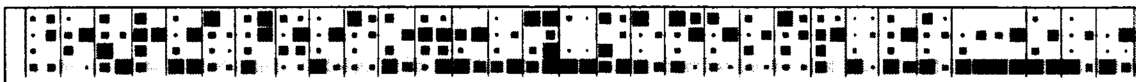

Figure 5. Code matrix showing the same participants holding different philosophy of technology views in cognitive dissonance.
The code matrix includes the categories (in order) Technology is a tool, Educational goals and curriculum should drive technology, Technological change is inevitable, and Keep up with technology (or be left behind), with the core category highlighted in the fourth row. Each of the vertical increments represents one of the 62 documents, with a pair (interview and written questionnaire) for each of the 31 participants, separated by a dark line. The relative size of the box reflects the number of coding instances in a particular document for a code.

Keep up with technology (or be left behind) is given the greatest weight in technology decision making. In seeking to understand this surprising result, we may interpret that there is philosophical tension and cognitive dissonance between the philosophy of technology perspectives *Technology is a tool* and *Technological change is inevitable*. Figure 6 depicts a substantive theory surrounding *Keep up with Technology (or be left behind)*.

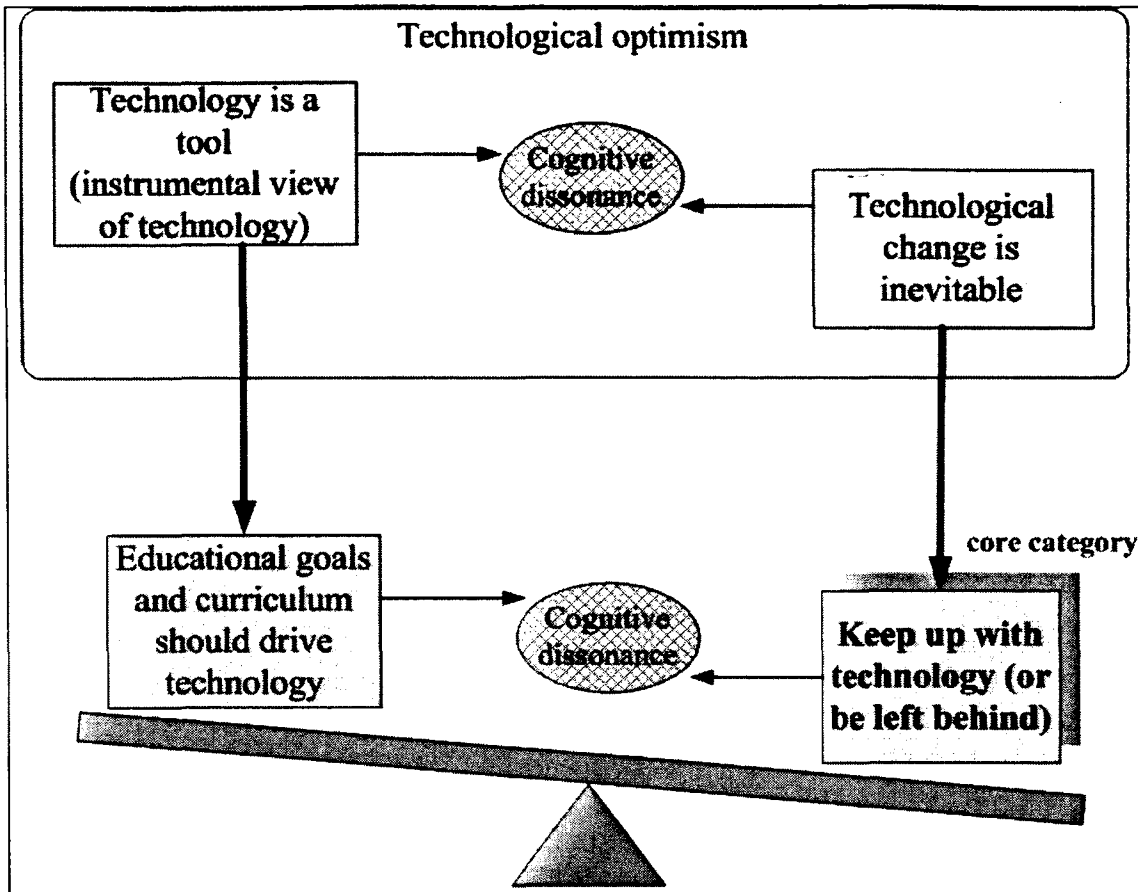

Figure 6. Keep up with technology (or be left behind) is given the greatest weight in technology decision making.
The figure depicts two broad philosophy of technology perspectives, Technology is a tool (instrumental view of technology, and Technological change is inevitable, in cognitive dissonance with each other, and situated within Technological optimism. Two approaches to educational technology decision making are shown in cognitive dissonance with each other, and linked with their respective parent philosophy. The core category Keep up with technology (or be left behind shows) emerges as the primary concern of leaders as they deal with their perceived experience of the inevitability of technological change. The core category is depicted as holding a greater relative weight.

The figure depicts the two broad philosophy of technology perspectives in cognitive dissonance with each other, and situated within *Technological optimism*. The two approaches to educational technology decision making, *Educational goals and curriculum should drive technology*, and *Keep up with technology (or be left behind)*, are shown in cognitive dissonance with each other, and linked with their respective parent philosophy. The core category *Keep up with technology (or be left behind)* emerges as the primary concern of leaders as they deal with their perceived experience of the inevitability of technological change. While technology leaders emphasized that educational goals and curriculum drive technology decision making, it is evident the core category *Keep up with technology (or be left behind)* influences technology leaders in a powerful way. The researcher concludes based on the results of the qualitative study that among the participants in this study, the core category carries the greater philosophical weight in technology decision making.

The core phenomonon is also affected by the viewpoint of technological optimism, which is a philosophical (Vermaas et al., 2011) and ideological (Strobel & Tillberg-Webb, 2009) perspective through which leaders respond emotionally to technological change in a positive way, through a response of advocacy for technological change, with new technology being given the benefit of the doubt. Employing the Corbin and Strauss (2008) paradigm, Technological optimism shows itself to be influential as a condition of interaction and emotion, as technology leaders approach technology as a solution for education with an optimistic attitude. This optimism affects their emotional response to dealing with the pressures of keeping up with technology, and dealing with resistance to technological change in their organizations. Because the research broke new ground, a limitation of the study is that as future qualitative studies are conducted in the substantive area, it may become necessary to modify the substantive theory to accommodate new data (Polit & Beck, 2008).

Consider ethical factors associated with technology. Another prevalent approach to technology decision making that was inspired by philosophical views was *Consider ethical factors associated with technology.* The researcher concludes that this category aligns with the approach to technology and values taken in the national framework for K-12 educational technology leadership (Consortium for School Networking, 2011). This framework addresses ethical considerations that are integral to responsible technology leadership. The ethical considerations in the national framework were represented in the participants' responses, including Internet safety, personal privacy, equitable access to technology, copyright compliance, and environmental sustainability.

Research Question 3. The third research question was concerned with examining what assumptions characterized by technological determinism were present in leaders' thinking or decision making. As explained in the implications for Research Question 1 the perspective *Technological change is inevitable* was a widespread philosophy of technology perspective. The viewpoint that technology causes inevitable change in society is an assumption associated with technological determinism (Leonardi, 2008; Leonardi, 2009).

Data from the study showed that the core category *Keep up with technology (or be left behind)* was linked with *Technological change is inevitable.* As explained in the implications for Research Question 2, the researcher argues that *Keep up with technology (or be left behind)* is a manifestation of the technological imperative, a philosophical assumption associated with technological determinism (Chandler, 1995, Cukier et al., 2009; Hofmann, 2006). The technological imperative assumes that once technological development is inevitably underway, users should learn to cope with it (Chandler, 1995) because they cannot help but use technology (Leonardi, 2008) and must keep up with it (Strobel & Tillberg-Webb, 2009).

The phenomenon of the core category, *Keep up with technology (or be left behind)*, as a manifestation of the technological imperative, is similar to what was found in a qualitative study conducted by Cukier et al. (2009). Using critical hermeneutic analysis and content analysis techniques, Cukier et al. (2009) examined media discourse surrounding an instructional technology initiative at Acadia University in Canada. Cukier et al. (2009) found that a technological determinist viewpoint was present in both academic and non-academic literature, with rhetoric of the technological imperative a dominant metaphor surrounding the technology initiative. Discourse characterized by the technological imperative and the inevitability of technology can be employed to persuade others, with the rhetoric creating an ideological orientation in a culture toward technological change (Cukier et al., 2009; Leonardi, 2008).

This study was guided by the work of Strobel and Tillberg-Webb (2009) who proposed a framework for educational technology that emphasizes a critical and humanistic approach to technology integration (see Theoretical Framework in Chapter 1). The starting point for their framework underscores that educators should question whether technological determinist assumptions influence thinking about technology (Strobel & Tillberg-Webb, 2009). The core category that emerged from the study, *Keep up with technology (or be left behind),* has been shown to be influenced by technological determinism assumptions, particularly as it relates to perceiving technological change as inevitable. The fact that this emerged as the core category supports the Strobel and

Tillberg-Webb framework's concern for critically analyzing technological determinist assumptions in educational technology.

However, the model for technological determinism selected by Strobel and Tillberg-Webb appears to have limitations in terms of explaining some phenomena. They used the model of hard and soft technological determinism (Strobel & Tillberg-Webb, 2009), described by Marx and Smith (1994). On the one hand, some of the data in this study lined up with this particular model. For example, in Chapter 4, it was interpreted that the category *Technology causes social change* aligns with hard technological determinism. The category *Both technology causes social change and social factors shape technology* was interpreted as aligning with soft technological determinism. However, other notable data from this study did not fit the relatively simplistic model based on hard and soft technological determinism.

An implication of this study is that Bimber's conceptual framework for technological determinism was more adequate for understanding some of the data. Most notably, the category *Technology causes unintended consequences* was widespread among participants, and as explained in Chapter 4, this category aligns with Bimber's unintended consequences account of technological determinism. See Table 27 in Chapter 4 for dimensionalized examples of *Technology causes unintended consequences*.

The property *technology takes precedence over other values or norms*, under the core category, aligns with Bimber's normative account of technological determinism. Normative technological determinism posits that if the norms of practice or attitudes of those who employ technology become disconnected from broader ethical criteria, accountability to society, or consideration of means and ends, technology can be understood to have a dominance or autonomy over society (Bimber, 1994; Wyatt, 2008). Dimensions of this property included *risks to students should not stop technological change in schools*, *implement technology without sufficient evidence from academic research*, *rapid technological change can make it difficult to focus on educational needs*, and *ethical norms changing because of technological change*.

Recommendations

While technology directors and instructional technology specialists provide leadership for educational technology, a limitation of this study is that these positions are not the only K-12 educators in Virginia who provide leadership for integrating technology into instruction (Virginia Department of Education, 2010). School principals and other school administrators should provide visionary leadership and oversight for instructional technology. School district technology plans and the implementation of technology initiatives involve the participation of many stakeholders (Virginia Department of Education, 2010). It is recommended that similar qualitative studies be conducted involving other groups of educators within Virginia. It is also recommended that similar qualitative study be conducted involving educational technology leaders or other groups of educators outside of Virginia. Because this qualitative study broke new ground, a limitation of the study is that as future qualitative studies are conducted in the substantive area, it may become necessary to modify the substantive theory to accommodate new data (Polit & Beck, 2008).

It is also recommended that data from this, or similar qualitative studies, be used to develop and validate a quantitative instrument to measure philosophy of technology assumptions, for use in quantitative research. Within her discussion of qualitative research in the context of leadership, Ospina (2004) wrote that a key reason to use qualitative research is to explore a phenomenon that has not been previously investigated, and which may be examined subsequently through quantitative research. Quantitative instruments have been developed to measure other types of philosophical assumptions. For example, the Ross-Barger Philosophic Inventory is a validated quantitative instrument used for examining philosophic worldviews, and has been used in studies of computer professionals (Barger, 2008).

The Strobel and Tillberg-Webb (2009) framework for educational technology includes a recommendation to critically analyze whether assumptions about educational technology correspond to utopianism or dystopianism, which are concerned with valuing the results of technological change. While this study did involve examining assumptions of technological optimism or pessimism, it was not a major area of inquiry, so questions were limited. Because the category Technological optimism emerged as a prevalent category, the researcher recommends that future studies be conducted to investigate this further.

Conclusions

Strobel and Tillberg-Webb (2009) argued that educators should critically question their philosophical assumptions and ideological perspectives about technology, because beliefs and ways of thinking about technology influence professional discourse, and affect the actions of decision makers. The results and conclusions from this qualitative study lend support for the importance of examining philosophy of technology assumptions in education. The study showed that philosophy of technology assumptions matter, the assumptions shape educational technology leaders' approaches to technology decision making, and these philosophical approaches to decision making have consequences.

The study found that three broad philosophy of technology views were widely held by participants, including an instrumental view of technology, technological optimism, and a technological determinist perspective that sees technological change as inevitable. The category *Technology is a tool* represented the instrumental view of technology. The researcher concludes this overarching philosophical viewpoint of the participants is in alignment with what scholars and philosophers have argued is a popular and widely held philosophy of technology (Franssen et al., 2009; Jackson, 2010).

A surprising finding of the study was that while the instrumental view of technology was prevalent, a philosophical position normally associated with the instrumental view, the neutrality thesis, was only associated with eight participants. This contrasted with the category *Technology raises questions of human values* that was associated with 22 participants. Despite the prevalence of the instrumental view of technology as a whole, we can conclude that the philosophy of technology views of most participants did not align with the neutrality thesis, but with Hofmann's theory that technology is value laden, raises questions of values, and has ethical consequences (Hofmann, 2006). The researcher proposes that the surprising result may be explained as a possible case of cognitive dissonance between *technology is value neutral*, and *Technology raises questions of human values*, with greater weight given to the latter (see Figure 3). When a person considers two views that are inconsistent with each other, cognitive dissonance posits that the person weighs the importance of the cognitions, and may add or subtract from the alternatives to reduce the inconsistency (Harmon-Jones, 2009).

The category *Consider ethical factors associated with technology* was prevalent, and the researcher concluded that this category is an approach to technology decision making arising out of a philosophical viewpoint similar to Hofmann's theory that technology is value laden, and involves ethical considerations (Hofmann, 2006). The researcher also concluded that the philosophical perspective associated with *Consider ethical factors associated with technology* aligns with the approach to technology and ethical considerations in the national framework for K-12 educational technology leadership (Consortium for School Networking, 2011). This framework addresses ethical considerations that are integral to responsible technology leadership. The ethical considerations in the framework were represented in the participants' responses concerning matters such as Internet safety, personal privacy, equitable access to technology, copyright compliance, and environmental sustainability (see Table 24).

The instrumental view of technology connected with the approach to technology decision making *Educational goals and Curriculum should drive technology*. Implications for leadership and decision making were reflected in the category's five main properties, with the most frequent consequence being that technology leaders *consider the intended educational goals for technology*. This focus on technology being the means to achieve the educational ends intended for it aligns with what some educators have held is the normal and appropriate role for educational technology (Kanuka, 2008). Under the category *Educational goals and Curriculum should drive technology*, the related properties *don't pursue technology for the sake of technology*, and *curriculum* *should drive technology, rather than technology drive curriculum*, both describe technology decision making practices that place focus on educational ends, with technology considered as the means. This perspective is in alignment with a respected textbook example of what constitutes appropriate technology integration, characterized by curriculum driving technology integration, rather than technology driving curriculum (Shelly et al., 2008).

Core category. The core category and central phenomenon that emerged from the qualitative study was that technology leaders approach technology leadership through a practice of *Keep up with technology (or be left behind)*. This core category and its properties included coding instances from 30 of 31 participants. The core category emerged early in data analysis, continued to grow in explanatory relevance, and reappeared in-vivo in transcript narratives in various forms, often expressed in those words, or variations of them (see Table 19). Data analysis showed the core category was linked with the broad philosophy of technology perspective *Technological change is inevitable*. The researcher concludes that participants in this study had an ideological orientation to technological change, similar to what Leonardi (2008) found in a study of technology managers in the private sector.

The researcher makes the argument that the core category is a manifestation of a philosophical perspective called the technological imperative, described by some scholars as associated with technological determinism (Chandler, 1995; Cukier et al., 2009; Hofmann, 2006). An implication of this conclusion, following from the data, is that participants' concerns surrounding an imperative to keep up with technological change were not connected to a perception that technology was in control. Rather, the data showed that most participants expressed concern for keeping up with technology in order to benefit students (see Table 20).

The two main properties of the core category were *pressure to keep up with technology*, and *resistance to technological change.* The theme of resistance to technology emerging from this study is similar to the resistance to change theme found by Cukier et al. (2009) in their qualitative study that examined a technology initiative at a Canadian university. The study's results, showing pressure to implement technology occurring alongside resistance, appears to lend support to Rogers' model of technological innovation. This model theorizes that technological innovation proceeds alongside resistance from users in varying degrees (Friesen, 2008).

Substantive theory. Under the approach to technology decision making *Educational goals and curriculum should drive technology*, technology is not pursued for the sake of technology. However, under pressures to keep up with technological change, and influenced by an ideological orientation toward technological change, educational technology leaders can place priority on embracing technological change, sometimes adopting it for its own sake. The researcher proposes a theoretical interpretation that presents the two approaches to technology decision making, *Educational goals and curriculum should drive technology*, and *Keep up with Technology (or be left behind)*, in competition and cognitive dissonance with each other. The core category *Keep up with technology (or be left behind)* is given the greater weight in technology decision making (see Figure 6). *Keep up with technology (or be left behind)* emerges as the principal approach to technology decision making, as leaders deal with their perceived experience of the inevitability of technological change, and their concern for preparing students for a technological future.

Conceptual frameworks for technological determinism. The starting point for the Strobel and Tillberg-Webb framework underscores that educators should question whether technological determinist assumptions influence thinking about technology (Strobel & Tillberg-Webb, 2009). The core category that emerged from the study, *Keep up with technology (or be left behind),* has been shown to be influenced by the assumption that technological change is inevitable. The fact that this emerged as the core category supports the framework's concern for critically analyzing technological determinist assumptions in educational technology.

However, Strobel and Tillberg-Webb (2009) used the model of hard and soft technological determinism described by Marx and Smith (1994), and the researcher concludes that this model appears to have limitations in terms of explaining some phenomena. Bimber's conceptual framework for technological determinism was more adequate for understanding some of the data pertaining to technological determinism. For example, the prevalent category *Technology causes unintended consequences* was interpreted as aligning with Bimber's unintended consequences account of technological determinism. The property *technology takes precedence over other values or norms*, under the core category, was interpreted as aligning with Bimber's normative account of technological determinism.

Philosophy of technology, praxis, and informed decision making. The overall characteristics of the Strobel and Tillberg-Webb humanizing framework for educational technology served as a good compass for this qualitative study. Strobel and Tillberg-

Webb (2009) argued that educators should critically question their philosophical assumptions and ideological perspectives about technology, because beliefs and ways of thinking about technology influence professional discourse, and affect the actions of decision makers. Based on this study involving 31 Virginia educational technology leaders, and analyzing 62 transcripts to examine what concepts emerged, the data support the conclusion that philosophy of technology assumptions do influence the actions of technology decision makers.

Praxis can be defined as applying theoretical knowledge and critical reflection to professional life (Strobel &Tillberg-Webb, 2009). In presenting a final conclusion, it should be admitted that engaging in this qualitative study was a humbling experience for the researcher. During his tenth year of working as a school district technology director, he bracketed out his own assumptions, and proceeded to venture forward to examine philosophy of technology in educational technology leadership. He learned so much from asking questions, listening, and reflecting on the participants' insights pertaining to philosophy of technology in leadership. It was humbling to listen to the collective voice of so many experienced educational technology leaders. The researcher hopes that this empirical study can better inform professional practice and contribute to what Kanuka (2008) called philosophy in practice pertaining to technology. The researcher concludes that there is evidence that by questioning philosophy of technology assumptions, practitioners are better able to make purposeful and informed decisions (Kanuka, 2008).

References

Adair, J. (2005). *How to grow leaders: The seven key principles of effective leadership development*. London, United Kingdom: Kogan Page Limited.

Adomavicius, G., Bockstedt, J. C., Gupta, A. & Kauffman, R. J. (2008). Making sense of technology trends in the information technology landscape: A design science approach. *MIS Quarterly*, *32*(4), 779-809.

Aibar, E. (2010). A critical analysis of information society conceptualizations from an STS point of view. *tripleC - Cognition, Communication, Co-operation*, *8*(2), 177-182. Retrieved from http://www.triple-c.at

Amiel, T., & Reeves, T. C. (2008). Design-based research and educational technology: Rethinking technology and the research agenda. *Educational Technology & Society*, *11*(4), 29-40.

Ardichvili, A., Mitchell, J. A., & Jondle, D. (2009). Characteristics of ethical business cultures. *Journal of Business Ethics*, *85*, 445–451. doi:10.1007/s10551-008-9782-4

Arneson, P. (2009a). Axiology. In S. W. Littlejohn & K. A. Foss (Eds), *Encyclopedia of communication theory*. Retrieved from www.sage-ereference.com/.

Arneson, P. (2009b). Ontology. In S. W. Littlejohn & K. A. Foss (Eds), *Encyclopedia of communication theory*. Retrieved from www.sage-ereference.com/.

Ayres, L. (2008). Semi-structured interview. In L. M. Given (Ed.), *The Sage encyclopedia of qualitative research methods* (pp. 811-813). Thousand Oaks, CA: Sage Publications.

Barger, R. (2008). *Computer ethics: A case-based approach*. New York, NY: Cambridge University Press.

Battistella, C., & De Toni, A. F. (2011). A methodology of technological foresight: A proposal and field study. *Technological Forecasting and Social Change*, *78*(6), 1029-1048.

Bebell, D., & Kay, R. (2010). One to one computing: A summary of the quantitative results from the Berkshire Wireless Learning Initiative. *Journal of Technology, Learning, and Assessment*, *9*(2), 1-59.

Bebell, D., & O'Dwyer, L. M. (2010). Educational outcomes and research from 1:1 computing settings. *The Journal of Technology, Learning, and Assessment*. *9*(1), 1-15.

Bell, J. (2010). *Doing your research project.* Berkshire, UK: Open University Press.

Bennett, S., & Maton, K. (2010). Beyond the 'digital natives' debate: Towards a more nuanced understanding of students' technology experiences. *Journal of Computer Assisted Learning, 26*(5), 321-331. doi:10.1111/j.1365-2729.2010.00360.x

Bennett, S., Maton, K., & Kervin, L. (2008). The 'digital natives' debate: A critical review of the evidence. *British Journal of Educational Technology, 39*(5), 775-786. doi:10.1111/j.1467-8535.2007.00793.x

Berger, J. (2011). Perceived neutrality of technology and its potential impact: Recontextualizing technology into adult learning settings using a cultural studies approach. In V. Wang (Ed.), *Encyclopedia of information communication technologies and adult education integration* (pp. 810-823). Hershey, PA: IGI Global.

Best, K. (2009). When mobiles go media: Relational affordances and present-to-hand digital devices. *Canadian Journal of Communication, 34*(3), 397-414.

Beyer, C. (2011). Edmund Husserl. In E. N. Zalta (Ed.), *The Stanford encyclopedia of philosophy (Summer 2011 Edition).* Retrieved from http://plato.stanford.edu/archives/sum2011/entries/husserl

Biddle, L., Donovan, J., Hawton, K., Kapur, N., & Gunnell, D. (2008). Suicide and the Internet. *BMJ,* 336, 800-802. doi:10.1136/bmj.39525.442674.AD

Bimber, B. (1990). Karl Marx and the three faces of technological determinism. *Social Studies of Science,* 20, 333-351. doi:10.1177/030631290020002006

Bimber, B. (1994). Three faces of technological determinism. In M. R. Smith & L. Marx (Eds.), *Does technology drive history? The dilemma of technological determinism* (pp. 79-100). Cambridge MA: MIT Press.

Borden, S. (2004). *Outstanding Christian thinkers: Edith Stein.* London, Great Britain: Continuum International Publishing.

Borgmann, A. (2009). Focal things and practices. In D. M. Kaplan (Ed.), *Readings in the philosophy of technology* (pp. 56-75). Plymouth, UK: Rowman and Littlefield.

Boucher, P. (2011). What next after determinism in the ontology of technology? Distributing responsibility in the biofuel debate. *Science and Engineering Ethics, 17*(3), 525-538.

Braman, S. (2004). Technology. In J. Downing, D. McQuail, P. Schlesinger, & E. Wartella (Eds.), *The Sage handbook of media studies.* Retrieved from http://www.sage-ereference.com/hdbk_mediastudy/Article_n7.html

Breckenridge, J., & Jones, D. (2009). Demystifying theoretical sampling in grounded theory research. *The Grounded Theory Review, 8*(2), 113-126.

Brey, P. (2010). Values in technology and disclosive computer ethics. In L. Floridi (Ed.), *The Cambridge handbook of information and computer ethics* (pp. 41-58). New York: Cambridge University Press.

Brogan, W. A. (2007). In D. A. Hyland & J. P. Manoussakis (Eds.), *Heidegger and the Greeks: Interpretive essays* (pp. 43-56). Bloomington, IN: Indiana University Press.

Bromley, H. (1997). The social chicken and the technological egg: Educational computing and the technology/society divide. *Educational Theory, 47*(1), 51-65.

Brown, C., & Czerniewicz, L. (2010). Debunking the 'digital native': beyond digital apartheid, towards digital democracy. *Journal of Computer Assisted Learning, 26*(5), 357-369. doi:10.1111/j.1365-2729.2010.00369.x

Brownlee, J., Nailon, D., & Tickle, E. (2010). Constructing leadership in child care: Epistemological beliefs and transformation leadership. *Australasian Journal of Early Childhood, 35*(3), 95-104.

Buckingham, D. (2006). Children and new media. In L. Lievrouw & S. Livingstone (Eds.), *The handbook of new media* (2006 student ed.). Retrieved from http://www.sage-ereference.com/hdbk_newmedia/Article_n5.html

Buffington, M. L. (2008). What is Web 2.0 and how can it further art education? *Art Education, 61*(3), 36-41.

Bureau of the Census (2011). Urban area criteria for the 2010 census. *Federal Register*, 76(164), 53030-53043.

Burls, A., Caron, L., Cleret de Langavant, G., Dondorp, W., Harstall, C., Pathak-Sen, P., Hofmann, B. (2011). Tackling ethical issues in health technology assessment: A proposed framework. *International Journal of Technology Assessment in Health Care, 27*, 230-237. doi:10.1017/S0266462311000250

Burnett, J., Senker, P., & Walker, K. (2009). Introduction. In J. Burnett, P. Senker, & K. Walker (Eds.), *The myths of technology: Innovation and inequality* (pp. 1-22). New York: Peter Lang Publishing.

Buss, S. (2011). Personal autonomy. In E. N. Zalta (Ed.), *The Stanford Encyclopedia of Philosophy (Fall 2011 Edition)*. Retrieved from http://plato.stanford.edu/archives/fall2011/entries/personal-autonomy/

Callister, L. C., Luthy, K. E., Thompson, P., & Memmott, R. J. (2009). Ethical reasoning in baccalaureate nursing students. *Nursing Ethics, 16*(4), 499-510. doi:10.1177/0969733009104612

Campbell, C. C. (2011). A broader but shallower social network. *St. Louis Post-Dispatch*. Retrieved from http://www.stltoday.com/

Canole, G. (2007). An international comparison of the relationship between policy and practice in e-learning. In R. Andrews & C. Haythornwaite (Eds.), *The Sage handbook of e-learning research*. Retrieved from http://www.sage-ereference.com.proxy1.ncu.edu/hdbk_elearningrsch/

Carr-Chellman, A. (2005). *Global perspectives on e-learning: Rhetoric and reality*. Thousand Oaks, CA: Sage Publications.

Carr-Chellman, A. (2006). Desperate technologists: Critical issues in e-learning and implications for higher education. *Journal of Thought, 41*(10), 95-115,119.

Chai, C. S. (2010). Teachers' epistemic beliefs and their pedagogical beliefs: A qualitative case study among Singaporean teachers in the context of ICT-supported reforms. *The Turkish Online Journal of Educational Technology, 9*(4), 128-139.

Chandler, D. (1995). *Technological or media determinism*. Aberystwyth, UK: MCS. Retrieved from http://www.aber.ac.uk/media/Documents/tecdet/tecdet.html

Chang, C. (2010). Internet safety survey: Who will protect the children? *Berkeley Technology Law Journal, 25*, 501-527. Retrieved from http://www.btlj.org

ChanLin, L. (2007). Perceived importance and manageability of teachers toward the factors of integrating computer technology into classrooms. *Innovations in Education and Teaching International, 44*(1), 45–55. doi:10.1080/14703290601090390

Charmaz, K., & Henwood, K. (2008). Grounded theory. In C. Willig & W. Stainton-Rogers (Eds.), *The Sage handbook of qualitative research in psychology* (pp. 240-259). Retrieved from http://srmo.sagepub.com/

Clegg, S., Hudson, A., & Steel, J. (2003). The emperor's new clothes: Globalisation and e-learning in higher education. *British Journal of Sociology of Education, 24*(1), 39-53.

Cobern, W. W., & Loving, C. C. (2008). An essay for educators: Epistemological realism really is common sense. *Science & Education, 17*(4), 425-447. doi:10.1007/s11191-007-9095-5

Coffman, T. (2009). Getting to the heart of technology integration: Virginia's instructional technology resource teacher program. *Learning & Leading with Technology, 36*(7), 20-23.

Collarbone, P. (2009). *Creating tomorrow : Planning, developing and sustaining change in education and other public services*. London, England: Continuum International Publishing.

Collier, A. (1994). *Critical realism: an introduction to the philosophy of Roy Bhaskar.* London, UK: Verso.

Consortium for School Networking (2009). *Framework of essential skills of the K-12 CTO.* Washington, DC: Consortium for School Networking.

Consortium for School Networking (2011). *Framework of essential skills of the K-12 CTO.* Washington, DC: Consortium for School Networking.

Cope, J. (2005). Researching entrepreneurship through phenomenological inquiry: Philosophical and methodological issues. *International Small Business Journal,* 23(2), 163-189.

Corbin, J., & Strauss, A. (2008). *Basics of qualitative research: Techniques and procedures for developing grounded theory.* Thousand Oaks, CA: Sage Publications.

Cozby, P. C. (2009). *Methods in behavioral research.* New York, NY: McCraw-Hill.

Crawford, K., & Wright, J. (2010, July). *Reflections on the application of critical realism to researching higher education.* Paper presented at the Fifth Higher Education Close-Up Conference, Lancaster University, UK. Retrieved from http://eprints.lincoln.ac.uk

Creswell, J. W. (2008). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research.* Upper Saddle River, NJ: Pearson Prentice Hall.

Cukier, W., Ngwenyama, O., Bauer, R., & Middleton, C. (2009). A critical analysis of media discourse on information technology: Preliminary results of a proposed method for critical discourse analysis. *Information Systems Journal, 19*(2), 175-196.

Day, A. (2010). Stories in the making: Myth, technology, and the future. *Science as culture. 19*(2), 259-263.

DeFranco, J. F. (2011). Teaching internet security, safety in our classrooms. *Teaching internet security, safety in our classrooms. Techniques*, 86(5), 52-55.

De Vaney, A. (1998). Will educators ever unmask that determiner, technology? *Educational Policy*, 12(5), 568-585.

Devaney, L. (2010). FTC: Virtual worlds pose real risks to minors. *eSchool News*, *13*(2), 14.

Dreyfus, H. (2009). Heidegger on gaining a free relation to technology. In D. M. Kaplan (Ed.), *Readings in the philosophy of technology* (pp. 25-33). Plymouth, UK: Rowman and Littlefield.

Dumciene, A., Daukilas, S., & Sipaviciene, S. (2008, June). Axiological logic in the means of e-teaching product interactivity. *Proceedings of the ITI 2008 30th International Conference on Information Technology Interfaces*, Cavtat, Croatia. Retrieved from http://hnk.ffzg.hr/bibl/iti2008/

Edward, T. (2010). Technophilia's big tent: What technology wants. *Issues in Science & Technology*, *27*(1), 92-94.

Elger, T. (2009). Critical realism. In A. J. Mills, G. Durepos, E. Wiebe (Eds.), *Encyclopedia of case study research*. Retrieved from http://sage-ereference.com

Elliot, N., & Lazenbatt, A. (2005). How to recognize a quality grounded theory research study. *Australian Journal of Advanced Nursing*, *22*(3), 48-52.

Ellul, J. (2010). The autonomy of technology. In C. Hanks (Ed.), *Technology and values: Essential readings* (pp. 67-75). West Sussex, UK: Wiley-Blackwell.

Erkunt, J. (2010). Emergence of epistemic agency in college level educational technology course for pre-service teachers engaged in CSCL. *The Turkish Online Journal of Educational Technology*, *9*(3), 38-51.

Ermer, G. E. (2009). Guiding technological development: An analysis of Borgmann's device paradigm. In *Proceedings from 2009 Christian Engineering Education Conference* (44-56). Waco, Texas: Calvin College. Retrieved from http://www.calvin.edu/academic/engineering/ces/ceec/2009/CEEC2009proceedings.pdf

Fallman, D. (2010). A different way of seeing: Albert Borgmann's philosophy of technology and human–computer interaction. *AI & Society*, *25*(1), 53-60. doi:10.1007/s00146-009-0234-1

Fallman, D. (2011). The new good: Exploring the potential of philosophy of technology to contribute to human-computer interaction. *Proceedings of CHI 2011, Conference on Human Factors in Computing Systems*, Vancouver, BC. Retrieved from http://daniel.fallman.org/resources/papers/chi2011-thenewgood.pdf

Feenberg, A. (1991). *Critical theory of technology*. New York, NY: Oxford University Press.

Feenberg, A. (2010). Democratic rationalization: Technology, power, and freedom. In D. M. Kaplan (Ed.), *Readings in the philosophy of technology* (pp. 139-155). Plymouth, UK: Rowman and Littlefield.

Fernando, M., Beale, F., Geroy, G. D. (2009). The spiritual dimension in leadership at Dilmah Tea. *Leadership & Organization Development Journal, 30*(6), 522-539.

Fidalgo, A. (2009). Heidegger's cell phone – ubiquitous communication and existential distance. *MATRIZes, 3*(1), 1-20.

Finlay, L. (2009). Debating phenomenological research methods. *Phenomenology & Practice, 3*(1), 6-25.

Fisher, T. (2006). Educational transformation: Is it, like 'beauty', in the eye of the beholder, or will we know it when we see it? *Education and Information Technologies, 11*, 293–303. doi: 10.1007/s10639-006-9009-1

Flyverbom, M. (2005). Beyond the black box. *Social Epistemology, 19*(2/3), 225-229. doi:10.1080/02691720500145423

Franssen, M., Lokhorst, G., & van de Poel, I. (2009). Philosophy of technology. In E. N. Zalta (Ed.), *The Stanford encyclopedia of philosophy (Spring 2010 Edition)*. Retrieved from http://plato.stanford.edu/archives/spr2010/entries/technology/

Friedman, T. (2009). Tweeting the dialectic of technological determinism. *FLOW, 10*(2).

Friesen, N. (2008). Critical theory: Ideology critique and the myths of e-learning. *Ubiquity, 2008*(6). doi: 10.1145/1386858.1386860

Frith, J., Morain, M., Cummings, C., & Berube, D. (2011). The shallows: What the Internet is doing to our brains. You are not a gadget: A manifesto. *Journal of Communication, 61*(1), E9-E12. doi: 10.1111/j.1460-2466.2010.01535.x

Fuchs, C. (2009). The role of income inequality in a multivariate cross-national analysis of the digital divide. *Social Science Computer Review, 27*(1), 41-58.

Fullan, M., & Scott, G. (2009). *Turnaround leadership for higher education*. San Francisco, CA: Jossey-Bass.

Funk, W. (2010). Will IT matter and how? In D. Kritt and L. Winegar (Eds.), *Education and technology: Critical perspectives, possible futures* (pp. 237-255). Lanham, MD: Lexington Books.

Gabberty, J. W., & Vambery, R. G. (2008). How technological determinism shapes international marketing. *International Business & Economics Research Journal, 7*(1), 19-28.

Glaser, B. G. (2009). Jargonizing: The use of the grounded theory vocabulary. *The Grounded Theory Review, 8*(1), 1-15.

Glaser, B. G. (2007a). All is data. *The Grounded Theory Review, 6*(2), 1-22.

Glaser, B. G. (2007b). Doing formal theory. In A. Bryant & K. Charmaz (Eds.), *The Sage handbook of grounded theory* (pp. 96-111). Retrieved from http://srmo.sagepub.com/

Glaser, B. G., & Strauss, A. L. (1967). *The discovery of grounded theory: Strategies for qualitative research.* Hawthorne, NY: Aldine de Gruyter.

Gorski, P. C. (2009). Insisting on digital equity: Reframing the dominant discourse on multicultural education and technology. *Urban Education, 44*(3), 348-363. doi: 10.1177/0042085908318712

Grant, D., Hall, R., Wailes, N., & Wright, C. (2006). The false promise of technological determinism: The case of enterprise resource planning systems. *New Technology, Work and Employment, 21*(1), 2-15.

Greenhow, C., Robelia, B., & Hughes, J. E. (2009). Learning, teaching, and scholarship in a digital age: Web 2.0 and classroom research. *Educational Researcher, 38*(4), 246-259. doi:10.3102/0013189X09336671

Gregg, B. (2011). The Rapid-Rater: What happened to teaching machines? *TechTrends, 55*(2), 24.

Grounded Theory Institute (2009). *What is grounded theory?* Retrieved from http://www.groundedtheory.com/what-is-gt.aspx

Halverson, R. R. (2002). *Representing phronesis: Supporting instructional leadership practice in schools* (Doctoral dissertation). Available from ProQuest Dissertations and Theses database. (UMI No.3050529)

Hanks, C. (2010). General introduction. In C. Hanks (Ed.), *Technology and values: Essential readings* (pp. 1-6). West Sussex, UK: Wiley-Blackwell.

Harmon-Jones, E. (2009). Cognitive dissonance theory. In S. Littlejohn, & K. Foss (Eds.), *Encyclopedia of communication theory.* (pp. 110-112). Thousand Oaks, CA: Sage Publications, Inc. doi: 10.4135/9781412959384.n43

Harrell, M. C., & Bradley, M. A. (2009). *Data collection methods: Semi-structured interviews and focus groups*. Santa Monica, CA: RAND National Defense Research Institute.

Hazari, S., North, A., & Moreland, D (2009). Investigating pedagogical value of wiki technology. *Journal of Information Systems Education, 20*(2), 187-198.

Heidegger, M. (2009). The Question Concerning Technology. In D. M. Kaplan (Ed.), *Readings in the philosophy of technology* (pp. 9-24). Plymouth, UK: Rowman and Littlefield.

Herrington, J., Reeves, T., & Oliver, R. (2007). Immersive learning technologies: Realism and online authentic learning. *Journal of Computing in Higher Education, 19*(1), 80-99.

Hlynka, D. & Jacobsen, M. (2009). What is educational technology, anyway? A commentary on the new AECT definition of the field. *Canadian Journal of Learning and Technology, 35*(2). Retrieved from http://www.cjlt.ca/index.php/cjlt

Hodgkinson-Williams, C. (2006, March). *Revisiting the concept of ICTs as 'tools': Exploring the epistemological and ontological underpinnings of a conceptual framework.* Paper presented at ITFORUM, University of Georgia. Retrieved from http://it.coe.uga.edu/itforum/paper88/Hodgkinson-Williams-2006.pdf

Hofmann, B. (2006). When means become ends: Technology producing values. *Seminar.net: Media, Technology, & Lifelong Learning, 2*(2), 1-12.

Holton, J. A. (2007). The coding process and its challenges. In A. Bryant & K. Charmaz (Eds.), *The Sage handbook of grounded theory* (pp. 265-289). Retrieved from http://srmo.sagepub.com/

Hood, J. C. (2007). Orthodoxy vs. power: The defining traits of grounded theory. In A. Bryant & K. Charmaz (Eds.), *The Sage handbook of grounded theory* (pp. 151-164). Retrieved from http://srmo.sagepub.com/

How, T. T. (2010, June). *Some questions on technological and social determinism.* Paper presented at 19th Annual Conference of the Asian Media Information and Communication Centre, Singapore. Retrieved from http://www.spp.nus.edu.sg

Huang, W., & Yoo, S. (2010). How do Web 2.0 technologies motivate learners? A regression analysis based on the motivation, volition, and performance theory. In J. Sanchez & K. Zhang (Eds.), *Proceedings of World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education 2010* (pp. 1811-1819). Chesapeake, VA: Association for the Advancement of Computing in Education.

Hughes, J., Kroes, P., & Zwart, S. (2007). A semantics for means-end relations. *Synthese, 158*, 207–231. doi: 10.1007/s11229-006-9036-x

Husserl, E. (1965a). Philosophy as rigorous science. In Q. Lauer (Trans.), *Phenomenology and the crisis of philosophy* (pp. 71-147). New York, NY: Harper and Row.

Husserl, E. (1965b). Philosophy and the crisis of European man. In Q. Lauer (Trans.), *Phenomenology and the crisis of philosophy* (pp. 149-192). New York, NY: Harper and Row.

Interactive Educational Systems Design, (2011). *Digital districts: Web 2.0 and collaborative technologies in U.S. schools*. New York, NY: Interactive Educational Systems Design.

Instone, L. (2004). The educational possibilities of dis-comfort. In R. Atkinson, C. McBeath, D. Jonas-Dwyer & R. Phillips (Eds.), *Beyond the comfort zone: Proceedings of the 21st ASCILITE Conference* (pp. 437-443). Retrieved from http://www.ascilite.org.au/conferences/perth04/procs/instone.html

International Society for Technology in Education, (2007). *National educational technology standards for students*. Eugene, OR: International Society for Technology in Education.

Introna, L. (2011). Phenomenological approaches to ethics and information technology. In E. N. Zalta (Ed.), *The Stanford encyclopedia of philosophy (Winter 2008 Edition)*. Retrieved from http://plato.stanford.edu/archives/win2008/entries/ethics-it-phenomenology/

Jackson, V. E. (2010). *Critical theory and science fiction: A lens into technology in education*. Minneapolis, MN: Mill City Press.

Jackson, S. & Philip, G. (2010). A techno-cultural emergence perspective on the management of techno-change. *International Journal of Information Management, 30*, 445–456. doi:10.1016/j.ijinfomgt.2010.01.008

Jackson, L. A., Zhao, Y., Witt, E. A., Fitzgerald, H. E., & von Eye, A. (2009). Gender, race, and morality in the virtual world and its relationship to morality in the real world. *Sex Roles, 60*(11-12), 859-869. doi:10.1007/s11199-009-9589-5

Jahnke, J. (2010). Student perceptions of the impact of online discussion forum participation on learning outcomes. *Journal of Learning Design, 3*(2), 27-34.

Januszewski, A. & Molenda, M. (2008). *Educational technology: A definition with commentary*. New York, NY: Lawrence Erlbaum.

Jennings, S., Sutherlin, M., & Counts, A. (2010). Enhancing online courses with Web 2.0 technology. In J. Sanchez & K. Zhang (Eds.), *Proceedings of World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education 2010* (pp. 160-164). Chesapeake, VA: Association for the Advancement of Computing in Education.

Johnson, D. G. (2005). Handheld computers: No Child Left Behind's digital divide equalizers? *Journal of the Research Center for Educational Technology, 1*(2), 39-66.

Jonas, H. (2009). Technology and responsibility. In D. M. Kaplan (Ed.), *Readings in the philosophy of technology* (pp. 173-184). Plymouth, UK: Rowman and Littlefield.

Jonas, H. (2010). Toward a philosophy of technology. In C. Hanks (Ed.), *Technology and values: Essential readings* (pp. 11-25). West Sussex, UK: Wiley-Blackwell.

Jones, C., & Czerniewicz, L. (2010). Describing or debunking? The net generation and digital natives. *Journal of Computer Assisted Learning, 26*(5) 317-320. doi:10.1111/j.1365-2729.2010.00379.x

Jones, C., & Healing, G. (2010). Net generation students: Agency and choice and the new technologies. *Journal of Computer Assisted Learning, 26*(5), 344-356. doi:10.1111/j.1365-2729.2010.00370.x

Jonsen, K., & Jehn, K. A. (2009). Using triangulation to validate themes in qualitative studies. *Qualitative Research in Organizations and Management: An International Journal, 4*(2), 123-150. doi:10.1108/17465640910978391

Jordan, T. (2009). Hacking and power: Social and technological determinism in the digital age. *First Monday, 14*(7). Retrieved from http://firstmonday.org

Kakutani, M. (2007, June 29). The cult of the amateur. *The New York Times*. Retrieved from http://www.nytimes.com

Kakutani, M. (2010, March 17). Texts without context. *The New York Times*. Retrieved from http://www.nytimes.com

Kanuka, H. (2008). Understanding e-learning technologies-in-practice through philosophies-in-practice. In T. Anderson (Ed.), *The theory and practice of online learning* (pp. 91-120). Athabasca University, Canada: AU Press. Retrieved from http://www.aupress.ca/index.php/books/120146

Kaplan, D. M. (2009a). Introduction. In D. M. Kaplan (Ed.), *Readings in the philosophy of technology* (xii-xviii). Plymouth, UK: Rowman and Littlefield.

Kaplan, D. M. (2009b). Philosophical perspectives. In D. M. Kaplan (Ed.), *Readings in the philosophy of technology* (pp. 1-8). Plymouth, UK: Rowman and Littlefield.

Kaplan, D. M. (2009c). Technology and ethics. In D. M. Kaplan (Ed.), *Readings in the philosophy of technology* (pp. 169-172). Plymouth, UK: Rowman and Littlefield.

Kelle, U. (2005). Emergence vs. forcing of empirical data?: A crucial problem of grounded theory reconsidered. *Forum: Qualitative Social Research, 6*(2). Retrieved from http://www.qualitative-research.net/index.php/fqs/article/view/467/1001

Kelle, U. (2007). The development of categories: Different approaches in grounded theory. In A. Bryant & K. Charmaz (Eds.), *The Sage handbook of grounded theory* (pp. 191-212). Retrieved from http://srmo.sagepub.com/

Keen, A. (2008, February). *Jimmy Wales and Andrew Keen debate Web 2.0* [Video]. Retrieved from http://fora.tv

Kenealy, G. J. J., & Cartright, S. (2007). The temporal sensitivity accelerated work pace. A grounded theory building approach. *The Grounded Theory Review, 6*(2), 117-145.

Kitto, S. C., Chesters, J., & Grbich, C. (2008). Quality in qualitative research. *MJA, 188*(4).

Ko, C., Cheong, D., Park, T., Kang, Y. & Park, J. (2011). The correlations between addicted cell phone use of adolescents and mental health: The case of middle school students in Korea. *Communications in Computer and Information Science, 261*, 392-397. doi:10.1007/978-3-642-27180-9_48

Kraus, S. E. (2005). Research paradigms and meaning making: A primer. *The Qualitative Report, 10*(4), 758-770.

Kritt, D., & Winegar, L. (2010). Technological determinism and human agency. In D. Kritt and L. Winegar (Eds.), *Education and technology: Critical perspectives, possible futures* (pp. 3-30). Lanham, MD: Lexington Books.

Kroes, P., Franssen, M., & Bucciarelli, L. (2009). Rationality in design. In D. M. Gabbay, A. Meijers, P. Thagard, & J. Woods (Eds.), *Philosophy of technology and engineering sciences* (pp. 565-600). Burlington, MA: North Holland.

Kuper, A., Lingard, L., & Levinson, W. (2008). Critically appraising qualitative research. *BMJ, 337*, 687-692. doi:10.1136/bmj.a1035

Lacina, J. (2008). Palm Pilots: An assessment tool. *Childhood Education, 85*(2), 134-135.

Lahman, M. K. E, & Geist, M. R. (2008). Qualitative methodologies. In F. T. L. Leong, E. M. Altmaier, & B. D. Johnson (Eds.), *Encyclopedia of counseling* (pp. 360-364). Thousand Oaks, CA: Sage Publications.

Lally, V., Sharples, M., Bertram, N., Masters, S., Norton, B., & Tracy, F. (2010). *Mobile, ubiquitous and immersive technology enhanced learning: An ethical perspective.* London, UK: London Knowledge Lab, Institute of Education, University of London. Retrieved from http://www.esrc.ac.uk/

Leidlmair, K. (1999). From the philosophy of technology to a theory of media. *Philosophy & Technology*, *4*(3), 13-21.

Lempert, L. B. (2007). Asking questions of the data: Memo writing in the grounded theory tradition. In A. Bryant & K. Charmaz (Eds.), *The Sage handbook of grounded theory* (pp. 245-264). London: Sage Publications. Retrieved from http://srmo.sagepub.com/

Leonardi, P. M., & Jackson, M. H. (2004). Technological determinism and discursive closure in organizational mergers. *Journal of Organizational Change Management*, *17*(6), 615-631. doi:10.1108/09534810410564587

Leonardi, P. M. (2008). Indeterminacy and the discourse of inevitability in international technology management. *Academy of Management Review*, *33*(4), 975-984.

Leonardi, P. M. (2009). Crossing the implementation line: The mutual constitution of technology and organizing across development and use activities. *Communication Theory*, *19*, 278–310. doi:10.1111/j.1468-2885.2009.01344.x

Lewin, D. (2010). They know not what they do: The spiritual meaning of technological progress. *Journal of Contemporary Religion*, *25*(3), 347-362.

Lievrouw, L. (2006). New media design and development: Diffusion of innovations v. social shaping of technology. In L. Lievrouw & S. Livingstone (Eds.), *The handbook of new media* (2006 student ed.). Retrieved from http://www.sage-ereference.com/hdbk_newmedia/Article_n14.html

Lillehammer University College (Producer). (2006). *When means become ends: Technology producing values* [Video]. Retrieved from http://seminar.net/

Livingstone, S., & Haddon, L. (2009). *EU kids online: Final report.* London, UK: London School of Economics and Political Science.

Lowrance, W. W. (2010). The relation of science and technology to human values. In C. Hanks (Ed.), *Technology and values: Essential readings* (pp. 38-48). West Sussex, UK: Wiley-Blackwell.

Luckerhoff, J., & Guillemette, F. (2011). The Conflicts between grounded theory requirements and institutional requirements for scientific research. *The Qualitative Report*, *16*(2), 396-414.

MacKeogh, K., & Fox, S. (2009). Strategies for embedding e-Learning in traditional universities: Drivers and barriers. *Electronic Journal of eLearning 7*, 147-153.

MacLeod, M. C., & Rubenstein, E. M. (2005). Universals. In J. Fieser & B. Dowden (Eds.), *Internet encyclopedia of philosophy*. Retrieved from http://www.iep.utm.edu/universa/

Marcel, G. (2001). *The mystery of being, v. 1: Reflection and mystery* (G. S. Fraser, Trans.). South Bend, IN: St. Augustine's Press.

Martin, K. E. (2008). Internet technologies in China: Insights on the morally important influence of managers. *Journal of Business Ethics*, *83*(3), 489–501. doi: 10.1007/s10551-007-9633-8

Marx, L., & Smith, M. R. (1994). Introduction. In M. R. Smith & L. Marx (Eds.) *Does technology drive history? The dilemma of technological determinism* (p. ix-xv). Cambridge MA: MIT Press.

Mason, R., & Rennie, F. (2010). Evolving technologies. In K. E. Rudestam & J. Schoenholtz-Read (Eds.), *Handbook of online learning* (pp. 91-128). Thousand Oaks, CA: Sage Publications.

McCain, T., & Jukes, I. (2001). *Windows on the future: Education in the age of technology*. Thousand Oaks, CA: Corwin.

McDonald, J., Yanchar, S., & Osguthorpe, R. (2005). Learning from programmed instruction: Examining implications for modern instructional technology. *Educational Technology Research & Development*, *53*(2), 84-98.

Mello, J., & Flint, D. J. (2009). A refined view of grounded theory and its application to logistics research. *Journal of Business Logistics*, 30(1), 107-125.

Meyers, E. M. (2009). Virtual worlds, real learning. *School Library Monthly*, *26*(3), 50-52.

Michelfelder, D. P. (2010). Philosophy, privacy, and pervasive computing. *AI & Society*, *25*, 61-70. doi:10.1007/s00146-009-0233-2

Miller, K. D., & Tsang, E. W. K. (2011). Testing management theories: Critical realist philosophy and research methods. *Strategic Management Journal*, *32*(2), 139-158.

Misa, T. J. (2009). History of technology. In J. K. B. Olsen, S. A. Pedersen, and V. F. Hendricks (Eds.), *A companion to the philosophy of technology* (pp. 7-17). Wiley-Blackwell, Oxford, UK.

Molenda, M. (2008). The programmed instruction era: When effectiveness mattered. *TechTrends*, *52*(2), 52-58.

Morozov, E. (2009). Testing toward Utopia: Does the Internet spread democracy? *Boston Review*, 34(2), 19-21.

Morse, J. M. (2007). Sampling in grounded theory. In A. Bryant & K. Charmaz (Eds.), *The Sage handbook of grounded theory* (pp. 229-244). Retrieved from http://srmo.sagepub.com/

Motiwalla, L. F. (2007). Mobile learning: A framework and evaluation. *Computers & Education*, *49*, 581-596.

Murray, O. T., & Olcese, N. R. (2011). Teaching and learning with iPads, ready or not? *TechTrends*, *55*(6), 42-48.

Noonoo, S. (2012, January). Mobile technology changes the game. *THE Journal*, *39*(1), 46.

Norris, C., & Soloway, E. (2011, May). From banning to BYOD. *District Administration*. Retrieved from http://www.districtadministration.com/

Nworie, J., & Haughton, N. (2008). The unintended consequences of the application of technology in teaching and learning environments. *TechTrends*, *52*(5), 52-58.

Oliver, C. (2011). Critical realist grounded theory: A new approach for social work research. *British Journal of Social Work.* doi:10.1093/bjsw/bcr064

Oliver, M. (2011). Technological determinism in educational technology research: Some alternative ways of thinking about the relationship between learning and technology. *Journal of Computer Assisted Instruction*, 27(5), 373-384. doi:10.1111/j.1365-2729.2011.00406.x

Orlikowski, W. J., & Scott, S. V. (2008). Sociomateriality: Challenging the separation of technology, work and organization. *The Academy of Management Annals*, *2*(1), 433-474.

Ospina, S. (2004). Qualitative research. In G. Goethals, G. Sorenson, & J. M. Burns (Eds.), *Encyclopedia of leadership* (pp. 1279-1284). Thousand Oaks, CA: Sage Publications.

Patton, M. Q. (2002). *Qualitative research and evaluation methods.* Thousand Oaks, CA: Sage Publications.

Peach, A., Bell, S., & Spatariu, A. (2012). Internet safety: Proactively protecting young children from Internet threats. In S. Blake, D. Winsor, & L. Allen (Eds.), *Child development and the use of technology: Perspectives, applications and experiences* (pp. 289-314). Hershey, PA: Information Science Reference. doi:10.4018/978-1-61350-317-1.ch014

Pearson, G., & Young, A. T. (Eds.). (2002). *Technically speaking: Why all Americans need to know more about technology.* Washington, D.C.: National Academy Press.

Pedersen, J. (2001). Technological determinism and the school. *Journal of Educational Enquiry, 2*(1), 61-65).

Persaud, N. (2010). Interviewing. In N. J. Salkind (Ed.), *Encyclopedia of research design* (pp. 633-637). Thousand Oaks, CA: Sage Publications.

Phillippi, J. C., & Wyatt, T. H. (2011). Smartphones in nursing education. *CIN: Computers, Informatics, Nursing, 29*(8), 449-454.

Polit, D. F., & Beck, C. T. (2008). *Nursing research: Generating and assessing evidence for nursing practice.* Philadelphia, PA: Lippincott Williams & Wilkins.

Pollock, J. (2010, October 24). Wired co-founder Kevin Kelly on what technology wants. *7x7.* Retrieved from http://www.7x7.com/arts/wired-co-founder-kevin-kelly-what-technology-wants

Poser, H. (2009). Technology and necessity. *The Monist, 92*(3), 441-451.

Prakash, R. S. & Sinha, D. K. (2008). Technological change: Random shock or conscious choice? *Journal of High Technology Management Research, 19,* 1-10. doi:10.1016/j.hitech.2008.06.004

Purcell, M. (2011). The power of podcasting. *Library Media Connection, 29*(5), 48-49.

Race, R. (2008). Qualitative research in education. In L. M. Given (Ed.), *The Sage encyclopedia of qualitative research methods* (pp. 241-245). Thousand Oaks, CA: Sage Publications.

Reichertz, J. (2007). Abduction: The logic of discovery of grounded theory. In A. Bryant & K. Charmaz (Eds.), *The Sage handbook of grounded theory.* doi:10.4135/9781848607941

Robinson, C., & McKnight, D. (2007). Technologized democracy: A critique of technology's place in social studies education. *THEN: Technology, Humanities, Education, & Narrative, 4*, 9-35.

Rohr, C. (2008, September). *Organizations revisited: Human and technological agency in networks within organizational theory.* Paper presented at the Eleventh Annual Conference of the Irish Academy of Management, Dublin, Ireland. Retrieved from: http://arrow.dit.ie/

Russo, J. P. (1998). The humanities in a technological society. *Humanitas, 11*(1), 14-41.

Sabatino, C. J. (2007). A Heideggerian reflection on the prospects of technology. *Janus Head, 10*(1), 63-76.

Saettler, P. (1968). *A history of instructional technology.* New York, NY: McGraw-Hill.

Salazar, M. (2005). *Social and policy studies of technology: A review.* Vancouver, BC: Centre for Policy Research on Science and Technology, Simon Fraser University.

Schachter, R. (2012, April). Creating a robust and safe BYOD program: Plan to upgrade your district's infrastructure for increased capacity and security. *District Administration, 48*(4), 28.

Schram, T. H. (2006). *Conceptualizing and proposing qualitative research.* Upper Saddle River, NJ: Pearson Merrill Prentice Hall.

Schrum, L., & Levin, B. B. (2009). *Leading 21st century schools: Harnessing technology for engagement and achievement.* Thousand Oaks, CA: Corwin.

Scott, G., Coates, H., & Anderson, M. (2008). *Learning leaders in times of change: Academic leadership capabilities for Australian higher education.* Sydney, Australia: Australian Learning and Teaching Council. Retrieved from http://www.altc.edu.au

Selwyn, N., Gorard, S., & Furlong, J. (2006). *Adult learning in the digital age. Information technology and the learning society.* London: Routledge.

Selwyn, N. (2010a). Plus ca change, plus c'est la meme chose – Considering the probable futures of educational technology. In D. Kritt and L. Winegar (Eds.), *Education and technology: Critical perspectives, possible futures* (pp. 31-46). Lanham, MD: Lexington Books.

Selwyn, N. (2010b). Looking beyond learning: Notes towards the critical study of educational technology. *Journal of Computer Assisted Instruction*, 26, 65-73. doi:10.1111/j.1365-2729.2009.00338.x

Selwyn, N. (2011). In praise of pessimism—the need for negativity in educational technology. *British Journal of Educational Technology, 42*(5), 713-718.

Shannak, R. O., & Aldhmour, F. M. (2009). Grounded theory as a methodology for theory generation in information systems research. *European Journal of Economics, Finance and Administrative Sciences, 15*, 32-50. Retrieved from http://www.eurojournals.com/EJEFAS.htm

Shelly, G., Cashman, T., Gunter, R., & Gunter, G. (2008). *Teachers discovering computers: Integrating technology and digital media in the classroom.* Boston, MA: Thomson Course Technology.

Sieff, K. (2011, March 24). Va. Board of Education urges policy on social networks as teaching tools. *The Washington Post.* Retrieved from http://www.washingtonpost.com

Slack, J., & Wise, J. (2006). Cultural studies and communication technology. In L. Lievrouw & S. Livingstone (Eds.), *The handbook of new media* (2006 student ed.). Retrieved from http://www.sage-ereference.com/hdbk_newmedia/Article_n9.html

Smith, M. L. (2006). Overcoming theory-practice inconsistencies: Critical realism and information systems research. *Information and Organization, 16*, 191-211.

Smith, M. L., & Madon, S. (2007). Structure, agency, and causality: Three central assumptions in ITD research. In *Proceedings of the 9th International Conference on Social Implications of Computers in Developing Countries.* São Paulo, Brazil: International Federation for Information Processing. Retrieved from http://www.ifipwg94.org.br/ifip94fullpapers.htm

Smith, M. R. (1994). Technological determinism in American culture. In M. R. Smith & L. Marx (Eds.) *Does technology drive history? The dilemma of technological determinism* (pp. 1-35). Cambridge MA: MIT Press.

Solomon, J. D. (2006, June). Education in hand: One-to-one computing at the elementary level in Texas. *District Administration.* Retrieved from http://www.districtadministration.com

Starks, H., & Trinidad, S. B. (2007). Choose your method: A comparison of phenomenology, discourse analysis, and grounded theory. *Qualitative Health Research, 17*(10), 1372-1380. doi:10.1177/1049732307307031

Stern, P. N. (2007). On solid ground: Essential properties for growing grounded theory. In A. Bryant & K. Charmaz (Eds.), *The Sage handbook of grounded theory* (pp. 114-126). Retrieved from http://srmo.sagepub.com/

Straub, E. T. (2009). Understanding technology adoption: Theory and future directions for informal learning. *Review of Educational Research, 79*(2), 625–649. doi:10.3102/0034654308325896

Strauss, A., & Corbin, J. (1990). *Basics of qualitative research: Grounded theory procedures and techniques*. Thousand Oaks, CA: Sage Publications.

Striano, M. (2009). Managing educational transformation in the globalized world. A Deweyan perspective. *Educational Theory, 59*(4), 379-393.

Strobel, J., & Tillberg-Webb, H. (2009). Applying a critical and humanizing framework of instructional technologies to educational practice. In L. Moller, J. B. Huett &, D. M. Harvey (Eds.), *Learning and instructional technologies for the 21st century: Visions of the future* (pp. 75-93), New York, NY: Springer. doi:10.1007/978-0-387-09667-4_5

Suddaby, R. (2006). From the editors: What grounded theory is not. *Academy of Management Journal, 49*(4), 633–642.

Sullivan, L. (2009). Cognitive dissonance (communication). In L. Sullivan (Ed.), *The SAGE glossary of the social and behavioral sciences* (p. 83). Thousand Oaks, CA: Sage Publications, Inc. doi: 10.4135/9781412972024.n412

Suter, W. N. (2012). *Introduction to educational research*. Thousand Oaks, CA: Sage Publications.

Tamim, R. M., & Bernard, R. M., & Borokhovski, E., Abrami, P. C., & Schmid, R. F. (2011). What forty years of research says about the impact of technology on learning: A second-order meta-analysis and validation study. *Review of Educational Research, 81*(4), 4-28. doi:10.3102/0034654310393361

Treanor, B. (2010). Gabriel Marcel. In E. N. Zalta (Ed.), *The Stanford encyclopedia of philosophy* (Fall 2010 Edition). Retrieved from http://plato.stanford.edu/archives/fall2010/entries/marcel/

Trochim, W. M. K. & Donnelly, J. P. (2008). *The research methods knowledge base*. Mason, OH: Cengage Learning.

Troquard, N., Trypuz, R., & Vieu, L. (2006). Towards an ontology of agency and action: From STIT to OntoSTIT+. In B. Bennett & C. Fellbaum (Eds.), *Formal Ontology in Information Systems: Proceedings of the Fourth International Conference* (pp. 179-190). Amsterdam, Netherlands: IOS Press.

Tunstall, D. A. (2009). Struggling against the specter of dehumanization: The experiential origins of Marcel's reflective method. *Philosophy Today, 53*(2), 147-160).

Turner, D. W. (2010). Qualitative interview design: A practical guide for novice investigators. *The Qualitative Report, 15*(3), 754-760.

Turner, P., & Turner, S. (2009). Triangulation in practice. *Virtual Reality, 13*, 171-181. doi:10.1007/s10055-009-0117-2

Uckelman, S. L. (2009a). *Modalities in medieval logic* (Doctoral dissertation, University of Amsterdam). Retrieved from http://www.illc.uva.nl/Publications/Dissertations/DS-2009-04.text.pdf

Uckelman, S. L. (2009b). Anselm's logic of agency. *Logical Analysis and History of Philosophy, 12*, 248-268.

Urquhart, C., Lehmann, H., & Myers, & M. D. (2010). Putting the 'theory' back into grounded theory: Guidelines for grounded theory studies in information systems. *Information Systems Journal, 20*(4), 357-381. doi:10.1111/j.1365-2575.2009.00328.x

Vermaas, P., Kroes, P., van de Poel, I., Franssen, M., & Houkes, W. (2011). *A philosophy of technology: From technical artefacts to sociotechnical systems*. San Rafael, CA: Morgan & Claypool Publishers.

Virginia Department of Education (2007). *Ideas for integrating Internet safety into the curriculum*. Richmond, VA: Virginia Department of Education. Retrieved from http://www.doe.virginia.gov

Virginia Department of Education (2008a). *Educational technology guidelines: Designing and maintaining instructional technology systems*. Richmond, VA: Virginia Board of Education.

Virginia Department of Education (2008b). *Instructional technology resource teacher: Guidelines for teachers and administrators*. Richmond, VA: Virginia Board of Education.

Virginia Department of Education (2010). *Educational technology plan for Virginia: 2010-15*. Richmond, VA: Virginia Board of Education.

Virginia Society for Technology in Education (2009). *Pioneers shaping the future*. Conference program for 2009 VSTE Annual Technology in Education Conference, Roanoke, VA.

Volkoff, O., Strong, D. M., & Elmes, M. B. (2007). Technological embeddedness and organizational change. *Organizational Science, 18*(5), 832-848.

Wang, S., & Hsua, H. (2008). Reflections on using blogs to expand in-class discussion. *TechTrends 52*(3), 81-85.

Warschauer, M. (2007). The paradoxical future of digital learning. *Learning Inquiry, 1*(1), 41-49. doi:10.1007/s11519-007-0001-5

Weber, M. (2009). The neo-Schumpeterian element in the sociological analysis of innovation. In H. Hanusch & A. Pyka (Eds.), *Elgar companion to neo-Schumpeterian economics* (pp. 107-129). Cheltenham Glos, UK: Edward Elgar Publishing.

Wedell, M. (2009). *Planning for educational change: Putting people and their contexts firsts*. London, England: Continuum International Publishing.

Westera, W. (2004). On strategies of educational innovation: Between substitution and transformation. *Higher Education, 47*, 501-517.

Williams, R., & Edge, D. (1996). The social shaping of technology, *Research Policy, 25*, 865-899.

Willig, C. (2008). *Introducing qualitative research in psychology*. Berkshire, UK. McGraw-Hill Education.

Witt, D. (2012). Digital knowing: How young children's ease with technology is changing expectations. . . Implications for educating gifted students. *Gifted Education Press Quarterly, 26*(1), 8-11.

Woo, Y., Herrington, J., Agostinho, S., & and Reeves, T. C. (2007). Implementing authentic tasks in web-based learning environments. *EDUCAUSE Quarterly, 30*(3). Retrieved from http://www.educause.edu/eq/archives

Wuisman, J. (2005). The logic of scientific discovery in critical realist social scientific research. *Journal of Critical Realism, 4*, 366-394.

Wyatt, S. (2008). Technological determinism is dead: Long live technological determinism. In E. J. Hackett, O. Amsterdamska, M. Lynch, & J. Wajcman (Eds.), *The handbook of science and technology studies* (pp. 165-180), Cambridge, MA: The MIT Press.

Yang, G. (2009). The Internet as a cultural form: Technology and the human condition in China. *Knowledge, Technology & Policy, 22*, 100-115. doi:10.1007/s12130-009-9074-z

Zucker, A. A. (2009). Transforming schools with technology. *Independent School, 68*(2), 22-30.

Appendixes

Appendix A:

Interview Questions and Protocol

Philosophy of Technology Assumptions in Educational Technology Leadership: Questioning Technological Determinism

Date: ______________________________

Participant Name: ______________________________________

School or district: ______________________________________

Job Title: ______________________________________

Interviewer Name: ______________________________________

Introductory Protocol

To assist with my data collection and interview note taking, I would like to audio record your interview. I am the only person who will listen to the recording, and the audio file will be kept safeguarded on a password protected device. After completing my note taking and data analysis the recording will be deleted.

You had previously signed a release form that meets the human subject requirements for Northcentral University. There is no intent to inflict harm, and the research does not involve more than minimal risk to participants. In reporting the results of my study, no personally identifiable data such as name, school, or district will be reported that might connect the data to a participant. Your participation in this study is voluntary and you can opt to withdraw from the study at any time. You may choose not to answer any question during the interview.

My dissertation research focuses on examining philosophy of technology assumptions in educational technology leadership, and how these assumptions influence decision making and leadership. Participants for this study include educational technology leaders such as yourself from Virginia school districts, including technology directors and instructional technology specialists. The interview will include a series of open-ended questions, and the interview is expected to take approximately 30 minutes. Thank you for agreeing to participate in this research study.

Interview Questions

1. Ice-breaker question: How would you describe your philosophy of technology?
2. (follow-up probing question) Does what you describe as your philosophy of technology have implications for your work as an educational technology leader?
3. When you think back to your leadership decisions about educational technology, what informed your thinking or influenced your decisions?
4. Do you have any thoughts on the idea that technological change is inevitable, and that schools should not resist such change?
5. What do you think, does technology cause social change, or do social factors shape technology? Please explain.
6. What do you think is the connection between technology and values? Does technology raise questions relating to values or ethical considerations?
7. If you imagine futuristic technology and its potential impact on society or schools perhaps in twenty years, are you inclined to be an optimist, a pessimist, neither, or some combination of the two? Please explain.

Conclusion of Interview

Thank you so much for taking the time to share with me your responses to the interview questions. I would be happy to answer any question you may have about the study, so please feel free to contact me. When my dissertation research is complete, I will be happy to provide you with information about its findings.

Appendix B:

Written Questionnaire

Philosophy of Technology Assumptions in Educational Technology Leadership:

Questioning Technological Determinism

Date: ______________________________

Participant Name: ______________________________________

School or district: ______________________________________

Job Title: ______________________________________

You had previously signed a release form that meets the human subject requirements for Northcentral University. There is no intent to inflict harm, and the research does not involve more than minimal risk to participants. In reporting the results of my study, no personally identifiable data such as name, school, or district will be reported that might connect the data to a participant. Your participation in this study is voluntary and you can opt to withdraw from the study at any time. You may choose not to answer any question in this questionnaire.

My dissertation research focuses on examining philosophy of technology assumptions in educational technology leadership, and how these assumptions influence decision making and leadership. The questionnaire is expected to take approximately 30 minutes. The data from the questionnaire will supplement the data from the interview, in order to enhance the validity of the study. Thank you for agreeing to participate in this research study.

---

1. Do you ever engage in dialogue or debate with educational colleagues about any philosophical issues pertaining to technology? If so, please explain.
2. Should schools adapt to broader technological trends, or should schools shape technology to align with educational needs? Please explain.
3. Are there any notable ethical considerations that in your judgment might influence your thinking in making decisions about particular technologies? If so, please describe them.
4. In your practice as a technology leader, what influences your thinking about adopting technology initiatives?
5. In your practice as a technology leader, how does your thinking influence your advocacy or decisions pertaining to technology initiatives?

Thank you so much for taking the time to share with me your responses to this questionnaire. I would be happy to answer any question you may have about the study, so please feel free to contact me. When my dissertation research is complete, I will be happy to provide you with information about its findings.

Appendix C:

School District Permission Form

School District Permission to Contact Employees and Pursue Research

Researcher: Mark Webster, Doctoral Candidate at Northcentral University
(804) 873-7419 (cell) | (804) 524-3400 ext. 22 (work) | mark_webster@colonialhts.net
I am working under the supervision of my Chair, Dr. Alexandru Spatariu: aspatariu@my.ncu.edu

I am employed as Director of Technology for Colonial Heights Public Schools.

Title of Dissertation Research: Philosophy of Technology Assumptions in Educational Technology Leadership: Questioning Technological Determinism

SUMMARY OF DISSERTATION RESEARCH

The purpose of the qualitative study will be to examine what philosophical assumptions about technology are present in the thinking of K-12 technology leaders, and investigate how assumptions may influence technology decision making. ***Participants in this study will include technology directors and instructional technology resource teachers from Virginia school divisions.*** Data collection will include an interview and written questionnaire. The interview and written questionnaire are expected to take approximately 30 minutes each. In reporting and publishing the results of the study, no personally identifiable data such as names, schools, or school districts will be published that might connect the data to a participant in the study. Participation is voluntary and participants can withdraw from the study at any time.

This approval letter will be included in the researcher's IRB application packet to Northcentral University. Research will not begin until after IRB approval.

SCHOOL DISTRICT PERMISSION

____
Name of Virginia school division

Our school division grants permission for Mark Webster to contact our director of technology and instructional technology resource teachers to seek their possible participation for a dissertation research study involving philosophy of technology assumptions in educational technology leadership. If the employee agrees to participate as a volunteer and gives informed consent, we permit the qualitative study that will utilize an interview and a written questionnaire.

____ ________________
Signature of person granting permission Date

____
Printed name

____
Title

Appendix D:

Informed Consent Form

Northcentral University

Informed Consent Form
Philosophy of Technology Assumptions in Educational Technology Leadership

Purpose. You are invited to participate in a research study being conducted for a doctoral dissertation at Northcentral University in Prescott, Arizona. The purpose of the qualitative study will be to examine what philosophical assumptions about technology are present in the thinking of K-12 technology leaders, and investigate how assumptions may influence technology decision making. I am interested in your thinking and reflections on this issue, and hope the research study and its findings can better inform educational technology professional practice.

Participation Requirements. You are asked to participate in a semi-structured interview about philosophy of technology assumptions, conducted over the telephone or in person. To assist with data collection and transcription, the researcher asks your permission to audio record the interview using a password protected iPod. The researcher is the only person who will listen to the recording. After completing data transcription and analysis, the recording will be deleted. The interviews will be followed by a written questionnaire about philosophy of technology assumptions. The interview is expected to take approximately 30 minutes, and the written questionnaire approximately 15 minutes.

Researcher. The researcher is a Northcentral University doctoral candidate. I would be happy to answer any question you may have about the study.

Mark Webster, (804) 873-7419 (cell) | (804) 524-3400 ext. 22 (work)
mark_webster@colonialhts.net

I am working under the supervision of my Chair, Dr. Alexandru Spatariu: aspatariu@my.ncu.edu
My research proposal has been reviewed by the Northcentral University IRB: irb@ncu.edu

Potential Risk. There are no known risks to participating in this study. Philosophical assumptions about technology may be unrecognized and outside of everyday awareness, so reflecting on the topic may be unfamiliar to some participants. You may choose not to answer any question that you feel uncomfortable in answering, and can withdraw from the study at any time.

Potential Benefit. There are no direct benefits for participation in the study, and no incentives offered. However, philosophical reflection on educational technology may provide insights that are beneficial for technology leadership. It is expected that the findings will have theoretical and practical interest that can better inform educational technology practice and research.

Confidentiality. The data collected in this study will be kept confidential to the extent allowed by law, and data items will be coded such that your real name is not associated with them. In reporting and publishing the results of the study, no personally identifiable data such as names, schools, or school districts will be published that might connect the data to a participant in the study.

Voluntary Participation/Right to Withdraw. Your participation is voluntary and you can opt to withdraw from the study without penalty at any time. You may choose not to answer any interview question that you feel uncomfortable in answering, and you can omit questions on the written questionnaire if you do not want to answer them.

Signatures. Your signature indicates that you have read and understand the information pertaining to participating as a volunteer in this research study, and you agree to participate as a volunteer.

Participant's Name: ________________________

Agreement to participate in study – Participant's Signature: ________________________

Researcher's Name: ________________________

Researcher's Signature: ________________________ Date: ____________________

OPTIONAL - Agreement for interview to be audio recorded to aid the researcher in transcribing the interview (recordings will be destroyed after data analysis)

Participant's Signature: ________________________

Date: ____________________

Appendix E:

Letter of Introduction – Email

From: "Mark Webster" <Mark_Webster@colonialhts.net>
To: emailaddress@schooldistrict.domain
Date: 11/14/2012 09:43 PM
Subject: Educational Technology Leadership Research

Dear "Name of educational technology leader," Title

Please allow me to introduce myself, my name is Mark Webster, a Director of Technology for Colonial Heights Public Schools, and PhD candidate in Education (specializing in Education Technology Management) through Northcentral University. I would like to invite you to consider participating in my research study. Participants in this study will include technology directors and ITRTs from Virginia school districts. The purpose of the qualitative study will be to examine philosophy of technology in K-12 educational technology leadership, and investigate how the assumptions may influence technology decision making. I am interested in your thinking and reflections on this issue, and hope the research study and its findings can better inform educational technology professional practice.

The study's data collection methods involve a 30 minute interview about philosophy of technology assumptions, conducted over the telephone or in person. The interview would be followed by a brief written questionnaire about philosophy of technology assumptions, which will take approximately 15 minutes. Participation in the study is voluntary, and you could opt to withdraw from the study at any time. The study's data will be published with names and school districts anonymous.

If you are interested in participating, please reply via email or call me at your convenience. The first step would involve getting your informed consent, and we could then arrange a time that is convenient with you for the interview. Thank you for considering this research study.

Sincerely yours,

Mark

Mark Webster, Director of Technology and Learning

Colonial Heights Public Schools
512 Blvd., Colonial Heights, VA 23834
http://www.colonialhts.net
(804) 524-3400 ext. 22 (voice)
(804) 526-4524 (fax)
Sent by WorldClient

Attachments:

File: ATT00002.txt	Size: 2k	Content Type: text/plain
File: ATT00003.html (Shown Inline)	Size: 3k	Content Type: text/html

Appendix F:

Introductory Script – Telephone

Hello, my name is Mark Webster, and I serve as Director of Technology for Colonial Heights City Schools. I am also a PhD candidate in Education with Northcentral University, specializing in Education Technology Management. The reason for my call, is that I am conducting doctoral research, and my study's participants will include technology directors and ITRTs. The purpose of the qualitative study will be to examine philosophy of technology in K-12 educational technology leadership, and investigate how assumptions may influence technology decision making. It is hoped that the research study and its findings can better inform educational technology professional practice.

I am seeking volunteers to participate in a 30 minute interview about philosophy of technology assumptions, followed by a brief 15 minute written questionnaire. I am interested in your thinking and reflections on this issue, and I would like to invite you to consider participating in this study as a volunteer. Participation is of course voluntary, and you could opt to withdraw from the study at any time.

Would you consider participating as a volunteer?

- (If there is interest in participating. . .)

That's great to hear, thank you so much. I will email you the informed consent form that represents the first step. If you're willing to participate, you can complete and email this back to me, and we could then arrange a time that is convenient with you for the 30 minute interview. The interview can be conducted over the telephone or in person.

Thank you for considering this research study, I really appreciate it. I will email you the informed consent form.

- (If there is not interest in participating. . .)

That is fine, I understand. Best wishes for a great school year in "name of school district."