

# Questioning Technological Determinism through Empirical Research

Mark David Webster

**Abstract:** Using qualitative methods, the author sought to better understand how philosophical assumptions about technology affect the thinking, and influence the decision making, of educational technology leaders in their professional practice. One of the research questions focused on examining whether assumptions of technological determinism were present in thinking and influenced the decisions that leaders make. The core category that emerged from data analysis, *Keep up with technology (or be left behind)*, was interpreted to be a manifestation of the technological imperative, an assumption associated with the philosophical perspective of technological determinism. The article presents a literature review and critique of philosophical issues surrounding technological determinism. Data analysis led to the conclusion that technology leaders working in K-12 education place weighted priority on the technological imperative, and there is philosophical tension between *Keep up with technology (or be left behind)*, and a concurrently held perspective based on the logic of the instrumental view of technology. The findings suggest that different accounts of technological determinism, including Bimber's three accounts of normative, nomological, and unintended consequences, are significant in the thinking of participants. School technology leaders placed priority on embracing technological change, sometimes adopting technology for its own sake.

**Keywords:** instrumental view of technology, *Keep up with technology (or be left behind)*, philosophy of technology, technological determinism, technological imperative.

## 1. Introduction

In reflecting on what paths philosophy of technology may take in the future, Michelfelder predicted that “the trend toward empirical-based, interdisciplinary research within the philosophy of technology will continue to expand and flourish” (2010, 64). In the spirit of this type of inquiry, the author became interested in conducting an empirical study that investigated educational technology leadership, and how philosophy of technology may be influential in the thinking and decision making of practitioners working in K-12 education. A full treatment of the qualitative research methods employed in this grounded theory study was previously published (Webster 2016). A separate article was published that covered the implications of the research findings for the field of educational technology (Webster 2017). The purpose of this current article is to explore the philosophical implications that arose from the study, with special focus on examining how philosophy of technology assumptions characterized by

technological determinism were discovered to be influential. While the empirical study was open to any philosophy of technology assumptions present in the thinking of participants, the third research question that guided the study focused on questioning whether assumptions of technological determinism were operative in technology leaders' thinking and decision making.

In order not to duplicate previously published work, this article will only summarize the grounded theory methods and analysis that were used in research, while sharing a condensed treatment of the findings, with emphasis on examining the core category that emerged and its relationship to technological determinism. Subjects in the qualitative study involved 31 technology directors and instructional technology specialists from K-12 school districts working in the state of Virginia in the USA. 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 (2008) grounded theory methods and employed purposive and theoretical sampling, open and axial coding, constant comparative analysis, and theoretical saturation of categories.

The core category in grounded theory research involves the concept that emerges during data analysis with the greatest explanatory relevance, which is placed at the center of an axis with other concepts related to it (Corbin and Strauss 2008). The core category and central phenomenon that emerged from the study, *Keep up with technology (or be left behind)*, was interpreted to be a manifestation of the technological imperative (see definition below), an assumption connected with the philosophical perspective of technological determinism.

The author will present a review of literature that critiques philosophical issues and concerns surrounding technological determinism. Included is an examination of the technological imperative, which involves rhetoric and underlying assumptions that technology has a controlling influence (Hofmann 2006) that is inevitable and unstoppable (Chandler 1995, Cukier, Ngwenyama, Bauer, and Middleton 2009, Leonardi 2008) and creates an imperative to keep up with technological developments (Strobel and Tillberg-Webb 2009). The review will emphasize discussion of assumptions regarding the perceived inevitability of technological development. An overview of various theories or accounts of technological determinism will be discussed, including the framework of the categories of hard and soft technological determinism, and the Bimber (1994) conceptual framework for technological determinism.

We will discuss how the research findings suggest that Bimber's three accounts of technological determinism, normative, nomological, and unintended consequences, were significant in the thinking of participants. Important for our investigation will be analyzing pertinent issues surrounding technological determinism including the dilemma regarding human agency and responsibility for technology in a deterministic context, while considering the thought of

philosophers including Ellul, Heidegger, and Hofmann. We will also consider the insights of educational researchers on issues related to technological determinism. Lastly, we'll discuss the researcher's conclusion that assumptions connected with *Keep up with technology (or be left behind)* were of such persuasive force that this philosophical approach to technology was given the greatest weight by technology leaders in making decisions about technology.

## 2. Critique of Technological Determinism

Misa (2009) asserted that technological determinism is a scholarly and practical problem that has merited philosophical reflection and critique for decades. Although technological determinism is often criticized and few serious thinkers seem eager to lay claim to the view (Hofmann 2006), scholars often observe that technological determinist assumptions persist in the popular mindset and common discourse (Best 2009, Burnett, Senker, and Walker 2008, Carr-Chellman 2006, Friesen 2008, Hofmann 2006, Leonardi 2008, Lievrouw 2006, Selwyn 2010b, Wyatt 2008, Yang 2009). Broadly, 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).

### 2.1 The Technological Imperative and Assumptions of the Inevitability of Technology

We will examine different accounts of technological determinism, but a view often associated with technological determinism is the 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 (Strobel and Tillberg-Webb 2009). The logic of following the technological imperative means users should learn to cope with technological developments (Chandler 1995) and cannot help but use technology (Leonardi 2008).

Influenced by assumptions of technological determinism, the technological imperative accepts 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). Scholars have observed that the technological imperative implies the suspension of ethical judgment, with technology exercising a type of control and becoming an end in itself (Chandler 1995, Ellul [1964] 2010, Hofmann 2006, Martin 2008). The technological imperative may consider

the pursuit of technology as an end in itself to such an extent, that we continually adapt our lives to technology (Hofmann 2006). For Ellul ([1964] 2010) 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. If technological development proceeds in such a way that ethical judgments are suspended, and we fail to recognize the human impacts of present and future technologies, does technology then become not only an end in itself, but our master, and we the servant of technology (Ellul [1964] 2010)? 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 (Smith 1994). Although Heidegger saw danger in a domination of technology (Dreyfus 2009), he argued the essence of technology does not equate to a technological imperative (Heidegger [1977] 2009). For Heidegger, technology may be our destiny, but it is not an inevitable fate that compels us to obey it (Dreyfus, 2009, Heidegger [1977] 2009).

From a historical perspective, the technological imperative may seem reasonable. As technological progress has relentlessly marched forward, even technology pioneers have underestimated the pace of technological change (Selwyn 2010a, Selwyn 2010b). Within education, advocates for educational technology may 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 introduction of new technologies has often been accompanied by rhetorical promises and hype that it will transform education (Canole 2007). Scholars have argued that rhetoric characterized by assumptions of technological determinism can be a powerful discursive strategy for advancing interests or marginalizing dissenting opinions (Cukier et al. 2009, Leonardi and Jackson 2004, Leonardi 2008). Selwyn (2010b) held that optimistic rhetoric concerning instructional technology has been a characteristic feature of some educational technology scholarship for decades. Selwyn (2010b) argued that educational technologists, and their academic research influenced by the technological imperative, generally proceed from the assumption that technology will inevitably change education for the better. Discourse characterized by the technological imperative and presenting technological change as inevitable can be employed to persuade others, with the rhetoric creating within a culture an ideological orientation toward technological change (Webster 2013, Webster 2017, Cukier et al. 2009, Leonardi, 2008).

Rhetoric of the inevitability of technological development 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, Hudson, and Steel 2003). Fisher

(2006) observed in the UK a tendency for educational discourse about educational technology to be framed in technological determinist rhetoric that ascribed to technology the power to inevitably cause transformation in schools. Similarly, Clegg et al. (2003) critically examined higher education policy documents in the UK, and found that the dominant discourse was characterized by technological determinism along with a passive acceptance of the premise that globalization is inevitable. Cukier et al. (2009) examined media discourse surrounding a university funded student laptop initiative at an institution in Canada, and found that hyperbole evoking a technological determinist viewpoint was present in both academic and non-academic literature, and rhetoric of the technological imperative was a dominant metaphor in discourse. These researchers argued that such rhetoric can distort discourse by making positive claims for technology that may not be supported by sufficient evidence, or marginalize dissenting opinions by portraying technology initiatives as inevitable (Cukier et al. 2009). Discourse dominated by technological determinism can create anxiety and place pressure on individuals and organizations to uncritically pursue technological change for fear of failing to keep pace with it (Clegg et al. 2003).

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 (Webster 2013, Webster 2016, Webster 2017, Grant, Hall, Wailes, and Wright 2006, Jackson and Philip 2010, Leonardi 2008, Leonardi and Jackson 2004, Prakash and Sinha 2008). Individuals, including those in leadership roles, faced with an uncertain future or pressures to keep pace with technological change may treat technology as if it were inevitable for cognitive relief (Webster 2013, Leonardi 2008). Discourse characterized by technological determinism and the inevitability of technology can become a powerful element of the organizational narrative (Leonardi and Jackson 2004). Managers may rely on technological determinist rhetoric to shield their decisions, suppress controversy and deflect opinions of the opposition, and portray their actions as uncontested and inevitable because of technology, rather than take ownership of their decisions (Leonardi and Jackson 2004). 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. Consequences of technological determinist assumptions 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).

Fisher (2006) examined discourse and rhetoric about educational transformation in the United Kingdom, including advertising, official discourse in

educational policy documents, and public comments by education officials. The researcher observed a tendency for discourse about educational technology to be framed in technological determinist rhetoric that ascribed to technology the power to inevitably cause transformation in schools (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 is that the technological determinist assumptions may influence educators to focus on how schools should adapt to technology, rather than shaping the technology to suit unique educational needs and requirements (Jones and Czerniewicz 2010).

There may be a tendency for technology advocates to eagerly embrace technology trends because of their enthusiasm that new developments will improve education (Kanuka 2008, Mason and Rennie 2010). On the one hand, anticipating technology trends can be a proactive approach to technology leadership (Battistella and De Toni 2011). A strategy oriented toward forecasting technological trends, and aligning decision making with the trends can be proactive and effective for organizations so that they stand ready in advance for the future (Battistella and 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 pursuing 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. 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, or the needs of faculty and students (Jones and Czerniewicz 2010).

## 2.2 Theoretical Interpretations and Accounts 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 typically focuses on whether or not autonomy can be imputed to technology itself, independent of social constraints, or whether technology's supposed agency occurs within a complex interaction of social factors (Marx and Smith 1994, Smith 1994). A common framework for technological determinism involves the categories of hard and soft determinism (Marx and Smith 1994, Strobel and Tillberg-Webb 2009). The perspective of hard technological determinism attributes agency to technology itself (Marx and Smith 1994) and asserts that technology has a dominant autonomy of its own to cause social change, independent of social constraints (Smith 1994, Strobel and Tillberg-Webb 2009). The view of soft technological determinism also asserts that technology can

drive 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 and Smith 1994, Strobel and Tillberg-Webb 2009).

Another theoretical interpretation for technological determinism is Bimber's conceptual framework. Bimber (1994) argued that the term technological determinism had been utilized in the literature in imprecise ways to explain the impact of technology, and 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 essentially 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 advances according to the internal laws of science and technological development independent of the social context (Vermaas, Kroes, van de Poel, Franssen, and Houkes 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 or ethical 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 et al. 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 et al. 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 et al. 2011). Scholars have observed that the implementation of technology can result in unforeseen consequences and risks that were not originally intended (Canole 2007, Jonas [1974] 2009, Vermaas et al. 2011).

With regard to education the unintended consequences account 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 and Haughton 2008). Instructional disparities may widen for students who are without sufficient access to technology at home (Nworie and 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 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. While Bimber may be technically accurate in making his point, his argument seems to beg the question arising from the dilemma of technology being considered to have any autonomy of its own. Beyond the question of strict causality, Slack and Wise (2006) emphasized that regardless of actual cause and effect, our attitudes toward technology make a difference. For Braman (2004), philosophical differences regarding technology are largely differences in attitude toward technology, and these differences matter from a policy and decision making standpoint and affect our perception of risks and opportunities. Slack and Wise considered the question of whether, if we become so dependent on our technology tools, we create a “de facto technological determinism” (2006, 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.

### 2.3 Human Agency and Responsibility for Technology

Even if hard technological determinism is rejected such that technology is not imputed to act as an autonomous agent, the soft technological determinist view, or similar accounts that emphasize that technological power is a secondary change agent, still present a dilemma for human responsibility. If technology operates with any determinative efficacy, driving historical events and society, does this not limit free human agency (Marx and Smith 1994, Kritt and Winegar 2010)? Any claim that we do not control technology, but are controlled by it seems in some way to be a renunciation of human responsibility for technology (Hofmann 2006, Slack and Wise 2006, Wyatt 2008). 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 (Webster 2013, Fisher 2006, Hofmann 2006, Jonas [1974] 2009, Jonas, [1979] 2010, Kritt and Winegar 2010, Slack and Wise 2006, Strobel and



Tillberg-Webb 2009, Wyatt 2008). Wyatt asserted that technological determinism presents a dilemma for human responsibility because perceiving autonomy in technology leaves little room for human decision making, and “absolves us from responsibility for the technologies we make and use” (2008, 169).

Within the field of education, Strobel and Tillberg-Webb (2009) held that if technology is assumed to be driving change and this influences the decision making of educators, it leaves less room for the agency of the human actors involved, who perceive the world as run by technology. Kritt and Winegar (2010) emphasized the importance of human agency and our responsibility to direct the future evolution of educational technology. 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.

For Hofmann, technology as an end in itself results in a type of technological enslavement, and he argues that the deterministic logic of the technological imperative is a reverse adaptation that results in the reduction of human autonomy and responsibility, and undermines ethical accountability (Hofmann 2006). 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). Hofmann held that a proper focus should 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.

### **3. Empirical Findings and Technological Determinism**

The qualitative study was guided by three research questions. Question 1 was designed to capture any philosophy of technology assumptions: “What broad philosophy of technology assumptions are present in the thinking of K-12 technology directors and instructional technology specialists?” Question 2 was designed to link thinking with action: “How do philosophy of technology assumptions influence the decisions that leaders make about educational technology?” Discussion of the implications of the findings for these two research questions was covered previously in other published works (Webster 2016, Webster 2017). This article focuses on the third research question, which was open to assumptions characterized by technological determinism: “What assumptions characterized by technological determinism may be present in leaders’ thinking or decision making?”

Before focusing on how significant technological determinism was found to be present in the research findings, let’s first briefly examine the extent to which many technology leaders viewed technology through the common lens of 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 [1977] 2009). Following from this parent philosophy that views technology as a tool, was the prevalent approach to technology decision making, represented by the category *Educational goals and curriculum should drive technology*. The important point to make is that under the instrumental view of technology, technology is not considered to be an end in itself, but rather a means to achieve purposeful ends (such as educational goals).

In describing their philosophy that *Educational goals and curriculum should drive technology*, several technology leaders asserted that technology should not be pursued for the sake of technology. For example, Technology Director 6 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." Technology Director 4 explained, "I'm not a fan of technology for its own sake, and as a decision maker I like to see reasons for implementing technology." Some technology leaders lamented that technology can be considered by some to be a panacea. Technology Specialist 5 shared that, "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." Participants expressed how there are pressures to keep up with technological change. For example, Technology Specialist 9 explained, "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."

The findings suggest technology leaders place great importance on viewing technology in an instrumental way, as something not adopted for its own sake but as a tool, as a means to end. In making decisions about technology, the category *Educational goals and curriculum should drive technology* follows from this parent philosophy of the instrumental view. However, things got interesting during data analysis because based on coding instances in the data, the viewpoint *Technological change is inevitable* was also found to be prevalent, present in the thinking of 30 out of the 31 participants. The philosophical perspective that technology causes inevitable change in society is an assumption associated with technological determinism (Leonardi 2008; Leonardi 2009).

Despite the logic of the instrumental view of technology being so widespread among participants, the findings show that the perspective *Technological change is inevitable* influenced the thinking of leaders in a compelling way. The philosophy *Keep up with technology (or be left behind)* emerged as something both prevalent and highly significant, with coding instances from 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. *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. This category was closely linked in the data with viewing technological change as inevitable, and a perceived

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imperative within schools to keep up with technological change. *Keep up with technology (or be left behind)* emerged as the core category in the study, with the greatest explanatory relevance (Corbin and Strauss 2008). The following table displays dimensionalized examples from the interviews and written questionnaire transcripts for the category *Keep up with technology (or be left behind)*. The 31 participants included 15 technology directors and 16 instructional technology specialists from Virginia school districts, and the table uses TD to represent technology director, and TS for instructional technology specialist.

Table 1  
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 (or be left behind)	TS2	"The game has changed and research cannot 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 prepare 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."

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After data analysis, the core category was interpreted by the researcher to be a manifestation of the technological imperative (see Section 2.1). Weighted priority is placed by educational technology leaders on keeping up with technological change, and the irony is that the data suggests there is some cognitive dissonance or conflict with the prevalent but competing philosophy of technology, the instrumental view of technology. Technological optimism showed itself to influence technology leaders as they approach technology as a solution for education with an optimistic attitude. This optimism affects their emotional response to dealing with pressures to keep pace with technological change, and dealing with the resistance to technological change often found in schools. Technology leaders, breathing the air of technological optimism, under pressure to keep up with technological change, and influenced by an ideological orientation toward technological change, may place priority on embracing technology, sometimes adopting it for its own sake.

The phenomenon of *Keep up with technology (or be left behind)* emerging as the core category is an empirical example of what Bimber considered to be normative technological determinism. As noted above, the normative 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 considered to have a type of dominance or autonomy of its own (Bimber 1994; Wyatt 2008). If leaders pursue the adoption of a specific technology under pressure to keep up with the pace of technological change,

without its implementation being aligned with educational or business ends, such an adoption of technology for its own sake would arguably be normative technological determinism.

There were also examples in the data whereby the pursuit of technology implementation seemed disconnected from broader ethical criteria and norms of practice. One property of the core category was *technology takes precedence over other values or norms*, for which there were coding instances from 13 of the 31 participants. 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*.

The category *Technology causes social change*, associated with 17 of the 31 participants, involved coding instances when participants held the perspective that technology causes social change. This category was interpreted by the researcher as aligning with the nomological account in Bimber's conceptual framework for technological determinism. Technology Director 9 asserted, "Technology drives change. Education doesn't change technology." During the interview, Technology Specialist 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." Technology Director 3 observed, "Society has changed because of technology," and stated, "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." Properties associated with the category *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*.

The findings also suggest that Bimber's unintended consequences account of technological determinism was present in participants' thinking in a significant way. There were coding instances for the category *Technology causes unintended consequences* from 25 of 31 participants, when participants described that technology can cause consequences that were not anticipated or which are difficult to control. Several participants described how technology may dehumanize a situation with people saying things or behaving in ways that might not occur in person. For example, Technology Director 14 stated, "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." Participants described other unintended consequences of technology including exposing children to inappropriate content on the Internet, increasing the risk of sexual predators, amplifying problems including information security issues, and increased cheating and ease of plagiarism. Technology Specialist 2 stated, "In these days of cut and paste, it seems that every school needs to invest in plagiarism detection subscriptions. Students need

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to know before they get to college that stealing someone else's information is illegal and immoral."

#### **4. Conclusion and Implications for Philosophy of Technology**

In examining the philosophy of technology of school technology leaders, the researcher found that technological determinist assumptions and the technological imperative were alive and well. Our discussion has observed that empirical findings suggest Bimber's three accounts of technological determinism, normative, nomological, and unintended consequences, were all significant in the thinking of participants. Perhaps the most interesting philosophical implication of the research is that the author argues there is philosophical tension in technology leaders' thinking between the instrumental view of technology, and a perceived imperative to keep up with the pace of technological change. On the one hand, participants seemed committed to the principle that technology is a means to an end, an instrumental means to accomplish goals related to the business of education. Thus, technology is a tool and we should not pursue technology for the sake of technology. On the other hand, however, the researcher concluded that technology leaders placed weighted priority on *Keep up with technology (or be left behind)*, which was the core category that emerged in the grounded theory study.

The findings provide evidence that technological determinist assumptions, especially underlying assumptions about the perceived inevitability of technological change, and the imperative to keep up with technological change, can influence the thinking of leaders and their perceived agency in shaping technological change. In seeking to understand why this is the case, the researcher found there is pressure in schools to keep up with technological change, and as discussed elsewhere (Webster 2017), the author has concluded that educational technology leaders have an ideological orientation to technological change. The data also suggests that leaders are concerned about preparing students for what they assume will be a technological future. Leaders expressed a sense of responsibility for exercising 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. For example, Technology Director 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."

In short, we see the technological imperative operative in technology leaders' thinking and decision making. Within the field of educational technology the researcher argues there is a strong ideological orientation to technological change. These reasons, taken together with leaders' concern for preparing students for a technological future, are the key to understanding why technology leaders give technology the benefit of the doubt, even if pursuing it might mean adopting technology for the sake of technology.

## Questioning Technological Determinism through Empirical Research

In conclusion, in questioning technological determinism, the answer that we hear is that technology leaders in a real sense do see technology as having a certain autonomy, as being in charge, technology is considered something that must be given the benefit of the doubt. In pursuing this study, one issue believed by the researcher to be important for inquiry concerned the relationship between human agency and responsibility for technology and its implementation, particularly in an educational context. While proceeding into the research study by attempting to bracket out his prior assumptions as much as possible (Husserl [1935] 1965), it should be confessed that the researcher generally believes that human beings have responsibility for technology in society and education (Hofmann 2006, Kritt and Winegar 2010), especially those charged with leadership decisions. In reflecting on this issue of responsibility for technology, the empirical study found that school technology directors and technology specialists, focused on student concerns, give priority to the technological imperative in their professional response as leaders in the field of education. It can still be argued that to assume that technology determines our choices presents a dilemma for responsible leadership, because “if we really are determined by technology in one way or another, it must mean that we have less responsibility for technology” (Hofmann 2006, 2). Questioning technological determinism through empirical research does seem to leave us on the horns of a dilemma.

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